

Assembling and Using Your...

Heathkit

6-METER AMATEUR TRANSCEIVER

MODEL HW-29

HEATH COMPANY

A Subsidiary of Daystrom Inc

BENTON HARBOR, MICHIGAN

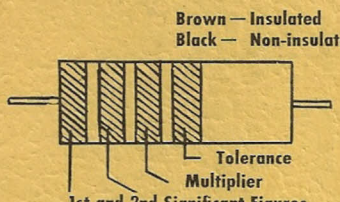
595-320

Copyright 1960
Heath Company

STANDARD COLOR CODE — RESISTORS AND CAPACITORS

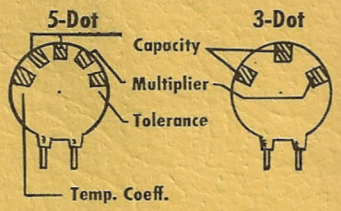
INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	,000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

AXIAL LEAD RESISTOR

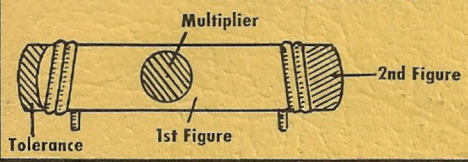


Wire wound resistors have 1st digit band double width

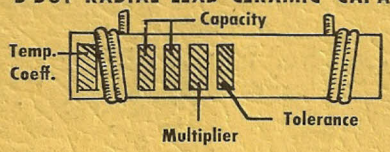
DISC CERAMIC RMA CODE



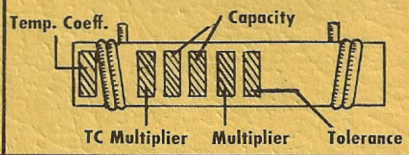
RADIAL LEAD DOT RESISTOR



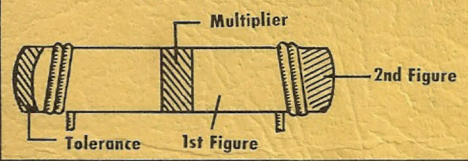
5-DOT RADIAL LEAD CERAMIC CAPACITOR



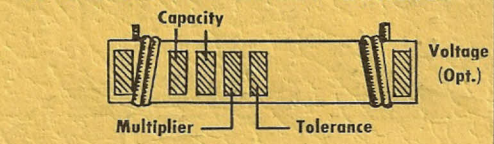
EXTENDED RANGE TC CERAMIC HICAP



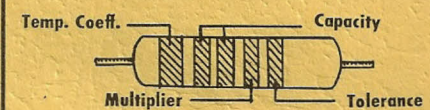
RADIAL LEAD (BAND) RESISTOR



BY-PASS COUPLING CERAMIC CAPACITOR



AXIAL LEAD CERAMIC CAPACITOR

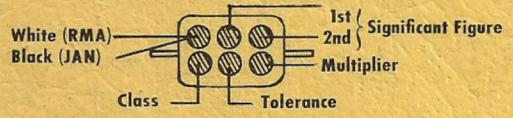


The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

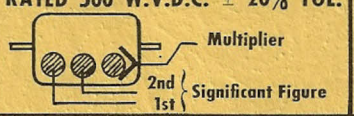
MOLDED MICA TYPE CAPACITORS

CURRENT STANDARD CODE



JAN & 1948 RMA CODE

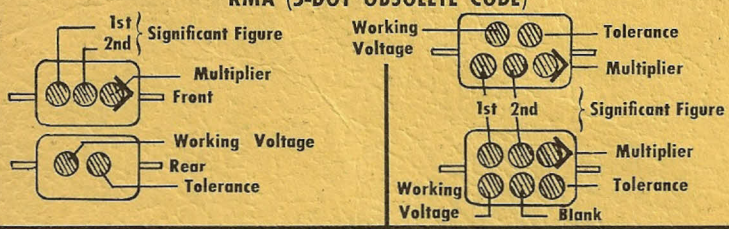
RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.



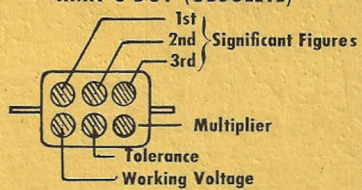
BUTTON SILVER MICA CAPACITOR



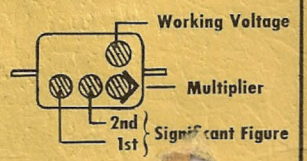
RMA (5-DOT OBSOLETE CODE)



RMA 6-DOT (OBSOLETE)

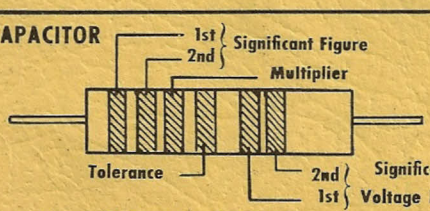


RMA 4-DOT (OBSOLETE)



MOLDED PAPER TYPE CAPACITORS

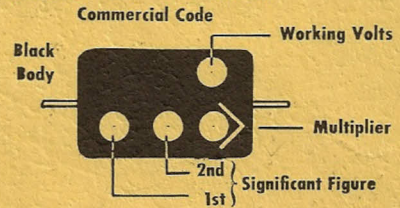
TUBULAR CAPACITOR



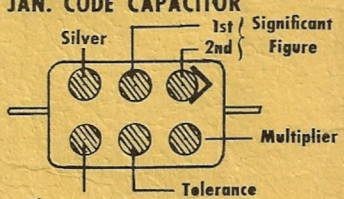
Normally stamped for value

A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

MOLDED FLAT CAPACITOR



JAN. CODE CAPACITOR



The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

ASSEMBLY AND OPERATION OF THE HEATHKIT 6-METER AMATEUR TRANSCEIVER

MODEL HW-29

"THE SIXER"



SPECIFICATIONS

RECEIVER SECTION

Receiver Type:	Superregenerative detector preceded by RF amplifier stage.
Sensitivity:	Usable with signals as low as 1 microvolt at the antenna terminals.
Speaker Size:	3 1/2" (round).
Audio Power Output:	Approximately 1 watt (undistorted).
Tuning Range:	50-54 mc.

TRANSMITTER SECTION

Power Input to Final RF Amplifier:	Approximately 5 watts.
Frequency Control:	5th overtone quartz crystal. Crystal holder type HC-6/U. Pin spacing - .486". Pin Diameter - .050".
Modulation:	AM plate modulation, automatically limited to not more than 100%.
Output Impedance:	50 or 70 Ω.

POWER SUPPLY

Power Rectifier:	2 silicon diodes in full wave voltage doubler circuit.
Power Requirements:	With built-in supply: 105-125 volt 50/60 cycle AC, 35 watts. With external power supply: 6 volt operation - 6 volts at 1.8 amps, 260 volts DC at 60 ma. 12 volt operation - 12 volts at 0.9 amps, 260 volts at 60 ma.

ACCESSORIES

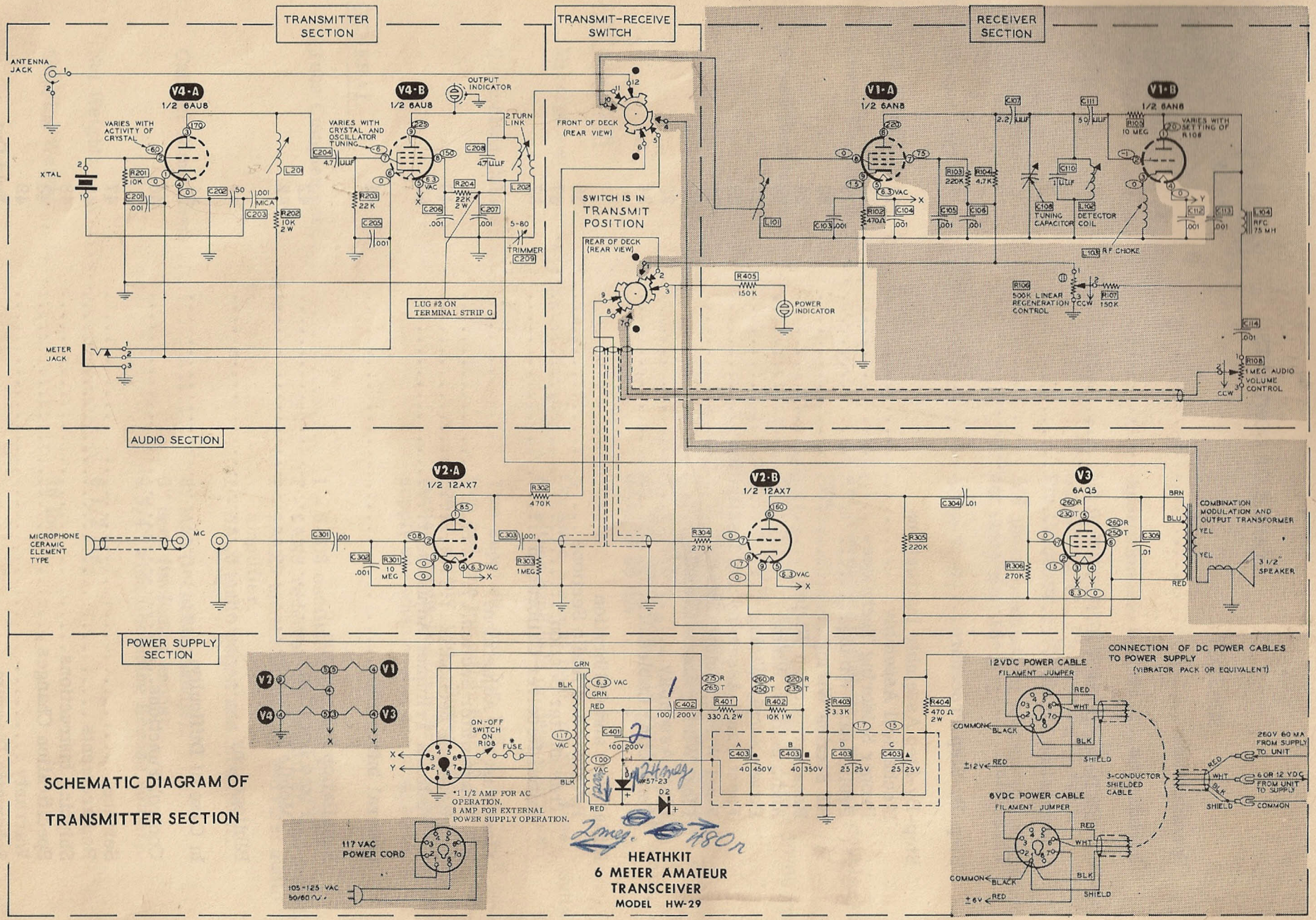
Microphone:	Ceramic element type, plastic case. Suitable for either hand held or desk operation.
Connecting Cables:	Two supplied, one for 105-125 AC volt operation and one for either 6 or 12 volt external DC power supply use. Power circuits are automatically switched for internal or external power supply use when cables are plugged in.

GENERAL

Tube Complement:	1 - 6AU8 oscillator and RF amplifier. 1 - 6AN8 receiver RF amplifier and detector. 1 - 12AX7 speech amplifier and first audio amplifier. 1 - 6AQ5 audio output and modulator.
Cabinet Dimensions:	8" high (including handle). 6" deep (including knobs). 9 3/4" wide (including license holder).
Net Weight:	6 1/2 lbs.
Shipping Weight:	10 lbs.

TABLE OF CONTENTS

SUBJECT	PAGE
Specifications	1
Introduction	5
Circuit Description	5
Construction Notes	7
Parts List	8
Step-By-Step Procedure	11
Step-By-Step Assembly Instructions	
Mechanical Assembly	13
Proper Soldering Techniques	16
Preliminary Wiring	18
RF Section Wiring	22
Receiver Section Wiring	24
Audio Section Wiring	26
Power Supply Wiring	27
Front Panel Assembly and Installation	29
Final Wiring Below Chassis	31
Final Wiring Above Chassis	32
Final Assembly	33
Connecting Cables	34
Initial Test and Calibration	
Receiver and Audio Sections	36
Transmitter Section	37
Initial Receiver Calibration	37
Final Test and Adjustment	
Transmitter Section	38
Receiver Section	40
Antenna Trimmer Adjustment	40
General Information	41
Installation Information	
Fixed Location	42
Mobile Location	42
Bibliography	44
In Case of Difficulty	44
Control Functions	46
Service	47
Replacements	48
Shipping Instructions	48
Specification Changes	48
Warranty	49
Schematic Diagram	Fold Out



SCHEMATIC DIAGRAM OF TRANSMITTER SECTION

HEATHKIT
6 METER AMATEUR TRANSCEIVER
MODEL HW-29

INTRODUCTION

The HEATHKIT Model HW-29 Transceiver is a combination transmitter and receiver for use in 6-meter amateur radiotelephone service.

Extensive proofbuilding and field testing over a period of several months have provided conclusive evidence that the HW-29 Transceiver will provide highly reliable service in its intended application if assembled, wired and adjusted in accordance with the instructions contained herein. It is therefore recommended that you follow the instructions carefully and make full use of the Circuit Description, Schematic Diagrams, General Information, etc., in the interest of acquiring a good understanding of this transceiver and its capabilities.

The HW-29 Transceiver has a self-contained power supply for operation from a 117 volt 50/60 cycle AC power line, and can be operated from either a 6 volt or a 12 volt battery by using external power supplies, such as Models VP-6 or VP-12 offered by the Heath Company.

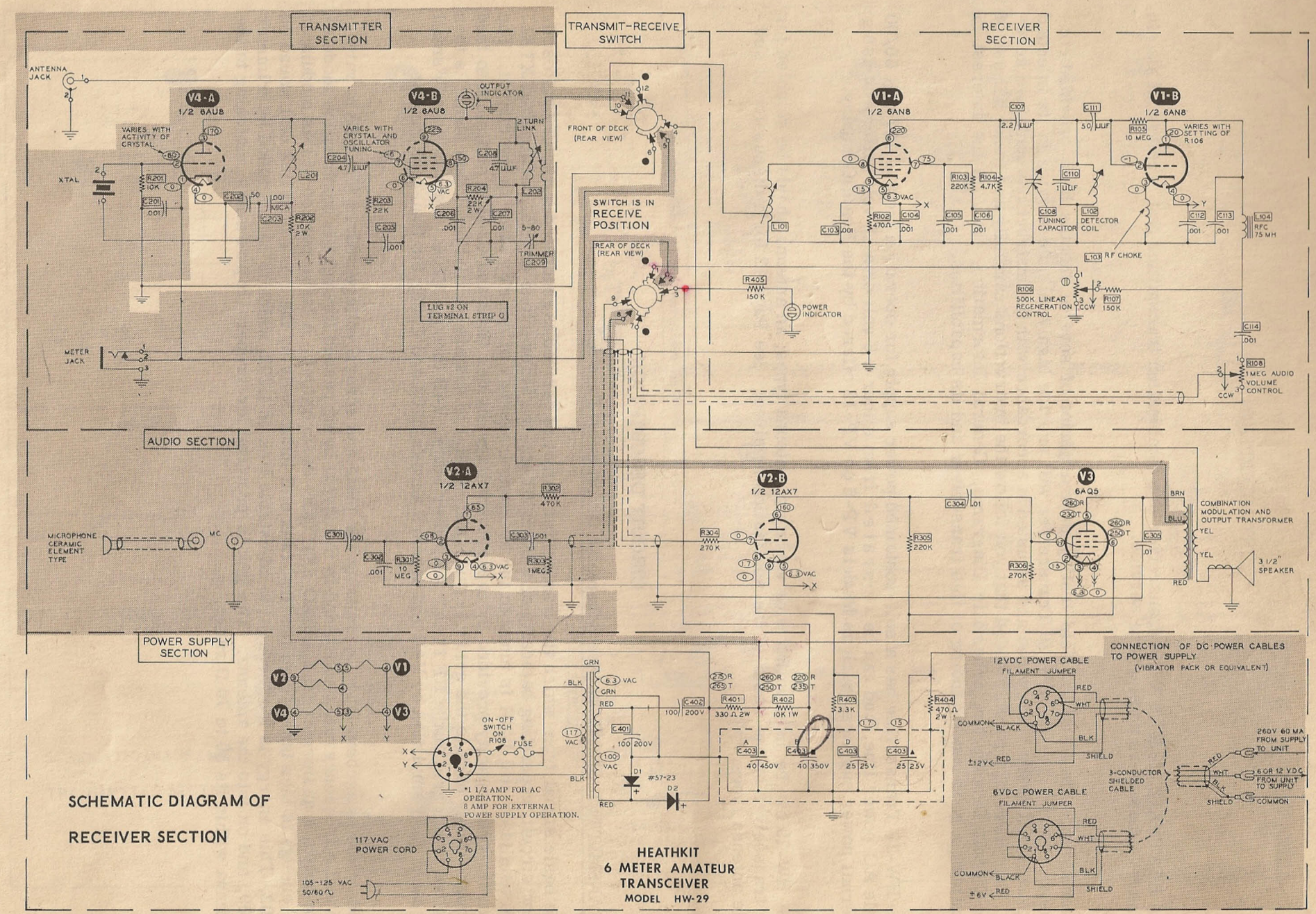
The HW-29 can be used with a wide variety of antenna types; an antenna should be selected for the transceiver on the basis of the application involved. See Page 42 for a discussion of suitable antenna types.

CIRCUIT DESCRIPTION

TRANSMITTER SECTION (See Schematic Diagram on Page 4.)

The basic signal from which the transmitter output is derived is generated in the crystal oscillator circuit, consisting basically of V4A, L201 and the 5th overtone crystal, designated XTAL. The oscillator coil L201 is tuned to the overtone frequency of the crystal in the circuit. The plate-to-grid capacity provided by capacitive voltage divider C202 and C203 is sufficient to feed enough energy back to the grid circuit and crystal to sustain oscillation. This signal is then applied to the grid of the RF final amplifier stage, V4B through C204. This relatively small signal is then amplified by V4B and appears across L202 and C208, the final tank circuit.

Modulation is accomplished by causing the plate and screen voltage source for V4B to vary at the audio frequency rate determined by the signal being passed through the combination modulation-output transformer (see AUDIO SECTION description). A large portion of this modulated RF energy is then taken from the final tank coil inductively by the 1 1/2 turn link coil wound on L202. This energy is fed through the adjustable link on L202, which is series tuned by trimmer C209, and on into the antenna. The link is provided for proper impedance matching to the antenna within its 50 to 70 Ω range.



SCHEMATIC DIAGRAM OF

RECEIVER SECTION

HEATHKIT
6 METER AMATEUR
TRANSCEIVER
MODEL HW-29

RECEIVER SECTION (See Schematic Diagram on Page 6.)

The incoming signal picked up by the antenna is applied to the grid of V1A through the coil tap of L101. Tapped coil L101 forms a broadly tuned circuit which reduces the level of frequencies other than those desired (between 50.0 and 54.0 mc).

The incoming signal, after amplification in V1A, is then applied to the tuned circuit consisting of C108, C110 and L102. C108 is the variable tuning capacitor, and the signal tuned by this circuit is then applied to the grid of the superregenerative detector V1B, through C111.

The superregenerative detector actually goes in and out of oscillation at approximately a 20 kc rate (referred to as "quench" frequency) and the signal detection takes place during the time just before actual oscillation occurs. At this time the gain of V1B is very high, and for this reason, overall sensitivity is quite good. R105 and C111 control the quench frequency rate. L104, in the plate circuit of V1B, presents a high impedance to the quench frequency and a low impedance to audio signal frequencies. C113 bypasses RF present in the detected audio to ground. R106, the REGENERATION control, is used to set the circuit at the maximum sensitivity point by varying the plate voltage.

AUDIO SECTION

In the RECEIVE position, the detected audio signal is applied to the VOLUME control (R108) through C114. Then, a portion of this signal (dependent on the VOLUME control setting) is applied to the grid of V2B through R304. Here the signal is amplified, and this amplified signal is then applied to the grid of V3 through C304. V3 further amplifies the signal and it is then coupled into the speaker by the combination modulation-output transformer.

The operation of the audio section in the TRANSMIT position is very similar, with the following exceptions: The voltage developed by the microphone must be amplified before being applied to V2B, and for this reason, the signal from the microphone passes through V2A. Note that the VOLUME control (R108) is disconnected from the circuit when in the TRANSMIT position. The other exception is that the speaker is disconnected and the audio energy needed to modulate the RF final amplifier stage is taken from a tap on the primary of the combination modulation-output transformer. This tap is so positioned electrically that limiting takes place in V3 before overmodulation can occur.

POWER SUPPLY SECTION

The internal power supply provides the voltages necessary for proper circuit operation from any 105-125 volt 50/60 cycle source. The B+ voltage is produced in a full-wave voltage doubler circuit consisting of D1, D2, C401 and C402. This DC voltage is then filtered by C403A, C403B, R401 and R402, and then distributed to the proper circuit points.

The power connector on the rear chassis apron permits operation from any external source offering the proper voltages. The wiring is so arranged that the tube filaments are connected for either 6 or 12 volt operation, depending upon which power cable is in use.

CONSTRUCTION NOTES

This manual is supplied to assist you in every way to complete your kit with the least possible chance for error. While the arrangement of components and wires shown is probably not the only satisfactory arrangement, nevertheless it is the result of extensive experimentation and trial. If followed carefully, it will result in a stable unit, operating at a high degree of accuracy and dependability. We suggest that you retain the manual in your files for future reference, both in the use of the Transceiver and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information shown on the inside covers of your manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein, and include all inspection slips in your letter to us. Hardware items are counted by weight and there may be a few more or less than the quantity specified. If a few are missing, please obtain them locally if at all possible.

In order to expedite delivery to you, we are occasionally forced to make minor substitution of parts. Such substitutions are carefully checked before they are approved and parts supplied will work satisfactorily. In checking the Parts List for resistors, for example, you may find that a resistor with a 5% tolerance has been substituted for a resistor with a 10% tolerance, as shown on the Parts List. These changes are self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

Resistors generally have a tolerance rating of 10% unless otherwise stated in the Parts List. Tolerances on capacitors are generally even greater. Limits of +100% and -50% are common for electrolytic capacitors.

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-6	1	470 Ω (yellow-violet-brown) 1/2 watt
1-14	1	3.3 KΩ (orange-orange-red) 1/2 watt
1-16	1	4.7 KΩ (yellow-violet-red) 1/2 watt
1-20	1	10 KΩ (brown-black-orange) 1/2 watt
1-22	1	22 KΩ (red-red-orange) 1/2 watt
1-27	2	150 KΩ (brown-green-yellow) 1/2 watt
1-29	2	220 KΩ (red-red-yellow) 1/2 watt
1-30	2	270 KΩ (red-violet-yellow) 1/2 watt
1-33	1	470 KΩ (yellow-violet-yellow) 1/2 watt
1-35	1	1 megohm (brown-black-green) 1/2 watt
1-40	2	10 megohm (brown-black-blue) 1/2 watt
1A-9	1	10 KΩ 1 watt (brown-black-orange)
1B-3	1	10 KΩ 2 watt (brown-black-orange)
1B-11	1	22 KΩ 2 watt (red-red-orange)
1B-12	1	470 Ω 2 watt (yellow-violet-brown)
1B-16	1	330 Ω 2 watt (orange-orange-brown)
Capacitors		
20-33	1	.001 μfd ±20% mica
20-97	2	50 μμf 5% silver mica
21-14	14	.001 μfd 20% disc ceramic
21-29	2	4.7 μμf 10% tubular ceramic
23-41	2	.01 μfd 600 V paper tubular
25-57	2	100 μfd 200 V tubular electrolytic
25-86	1	40-40-25-25 μfd at 450-350-25-25 V twist prong electrolytic
26-65	1	2.5 μμf variable tuning
28-1	1	2.2 μμf 10% tubular phenolic (red-red-white)
28-2	1	1.0 μμf tubular phenolic (brown-black-white)
31-20	1	5-80 μμf mica trimmer w/mounting foot

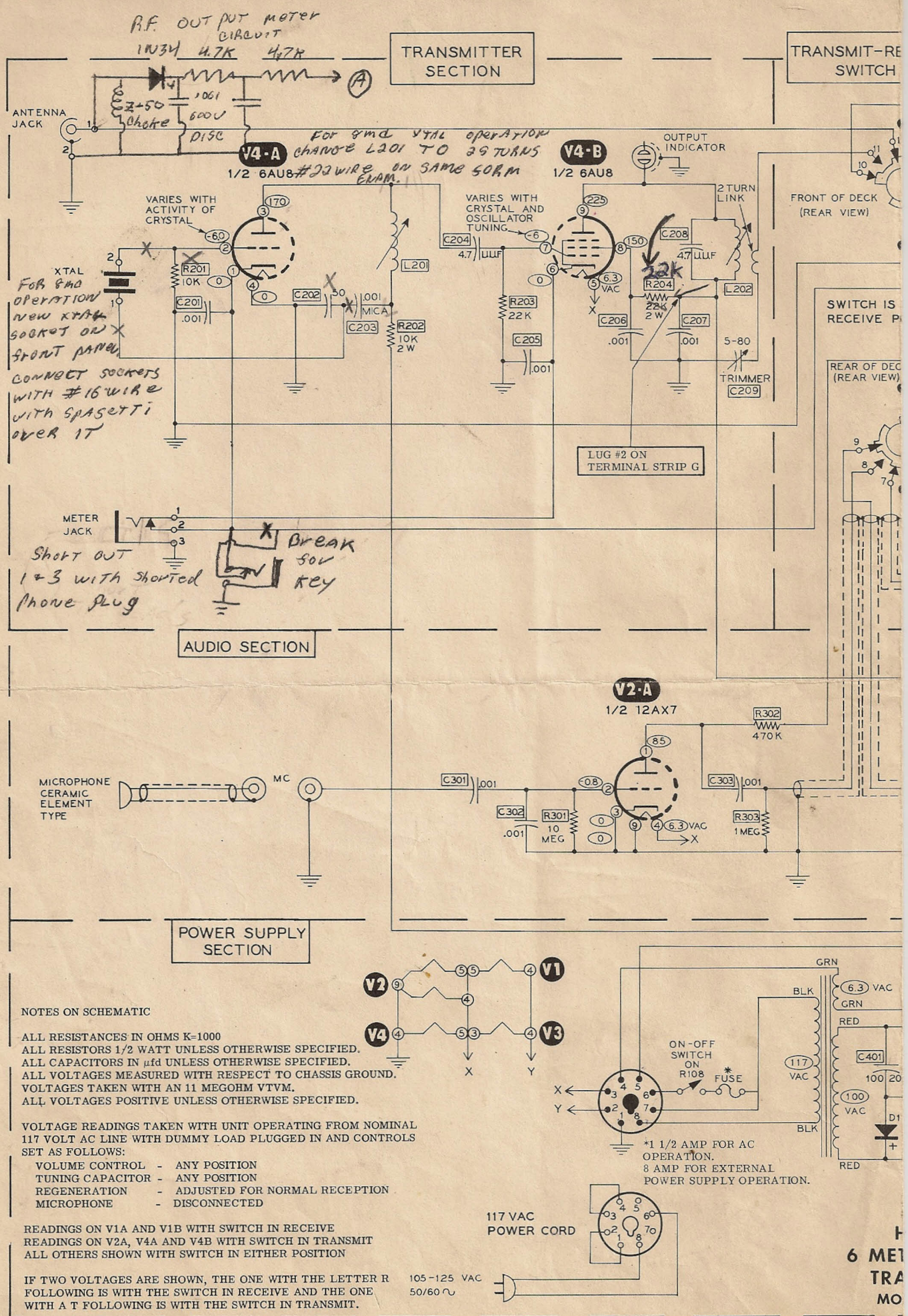
SEE FOLD-IN FOR ILLUSTRATION OF PARTS.

PART No.	PARTS Per Kit	DESCRIPTION
Transformers-Coils		
51-43	1	Combination modulation and output transformer
54-87	1	Power transformer
141-6	1	Coil set, consisting of:
40-304	1	Oscillator coil
40-305	1	RF tank coil
40-306	1	RF input coil
40-307	1	Detector coil
45-36	1	RF choke
45-48	1	RF choke
Terminal Strips-Sockets-Plugs		
431-2	3	2-lug terminal strip (no ground)
431-10	2	3-lug terminal strip (center ground)
431-12	1	4-lug terminal strip (1 ground)
431-40	2	4-lug terminal strip (1 ground)
432-1	1	Microphone connector (cable)
432-3	1	Microphone connector (chassis)
434-4	2	Octal socket
434-15	1	7-pin miniature wafer socket
434-42	1	Phono socket
434-74	1	Crystal socket, ceramic
434-75	1	9-pin ceramic socket
434-77	2	9-pin miniature wafer socket w/center ground
435-1	1	Octal socket ring
436-4	1	Phone jack
438-3	1	Phone plug
438-4	2	Phono plug
438-22	1	Octal plug
Controls-Switches		
10-60	1	500 KΩ linear tab mounting control
19-27	1	1 megohm audio taper control w/SPST switch
63-210	1	3-position, 4-circuit transmit-receive switch
Diodes-Tubes-Lamps		
57-23	2	Silicon diode
411-26	1	12AX7 tube
411-60	1	6AQ5 tube
411-68	1	6AN8 tube
411-114	1	6AU8 tube
412-1	1	#47 pilot lamp
412-12	1	Neon pilot lamp (clear)
412-13	1	Neon pilot lamp (red)
Metal Parts		
90-111	1	Cabinet
209-25	1	Speaker grille
200-M219F297	1	Chassis
203-M181F328	1	Front panel
205-M167F	1	Speaker baffle plate

SEE FOLD-IN FOR ILLUSTRATION OF PARTS.

PART No.	PARTS Per Kit	DESCRIPTION
Wire		
340-3	1	Length #16 bare wire
340-8	1	Length #22 bare wire
343-3	1	Length shielded lead
344-1	1	Length #22 hookup wire
344-2	1	Length #18 stranded wire, black
344-3	1	Length #18 stranded wire, red
346-1	1	Length #15 sleeving
347-9	1	Length 3-conductor shielded cable
Hardware		
250-3	3	4-40 x 3/16" RHMS
250-29	1	6-32 x 3/4" RHMS
250-49	8	3-48 x 1/4" BHMS
250-56	13	6-32 x 1/4" BHMS
250-83	2	#10 x 1/2" self-tapping screw
250-89	12	6-32 x 3/8" BHMS
250-133	1	3-48 x 7/16" BHMS
252-1	9	3-48 nut
252-3	22	6-32 nut
252-7	3	3/8-32 control nut
252-22	4	#6 speednut
252-23	1	6-32 knurled thumb nut
252-32	2	Speednut for pilot lamp
253-10	4	3/8" x 5/8" control flat washer
253-21	6	5/32" x 9/16" flat washer
254-1	29	#6 lockwasher
254-4	4	3/8" control lockwasher
254-7	12	#3 lockwasher
254-9	3	#4 lockwasher
259-1	3	#6 solder lug
259-11	3	#6 spade terminal
Miscellaneous		
73-1	3	3/8" rubber grommet
89-1	1	Line cord
211-16	1	Plastic handle
261-1	4	Rubber foot
391-5	1	HEATHKIT logotype
401-21	1	Speaker
421-1	2	1 1/2 amp 3 AG fuse (1 spare)
421-4	2	8 amp fuse (1 spare)
423-1	1	Fuse holder
440-1	2	Octal plug cap
446-M17	1	Plastic window
462-85	2	Knob w/gold insert and indicator dot
462-86	1	Knob lever type w/gold insert and indicator line
480-8	1	Microphone
481-1	1	4-prong capacitor mounting wafer
595-318	1	Construction manual

SEE FOLD-IN FOR ILLUSTRATION OF PARTS.



NOTES ON SCHEMATIC

ALL RESISTANCES IN OHMS K=1000
ALL RESISTORS 1/2 WATT UNLESS OTHERWISE SPECIFIED.
ALL CAPACITORS IN μfd UNLESS OTHERWISE SPECIFIED.
ALL VOLTAGES MEASURED WITH RESPECT TO CHASSIS GROUND.
VOLTAGES TAKEN WITH AN 11 MEGOHM VTVM.
ALL VOLTAGES POSITIVE UNLESS OTHERWISE SPECIFIED.

VOLTAGE READINGS TAKEN WITH UNIT OPERATING FROM NOMINAL 117 VOLT AC LINE WITH DUMMY LOAD PLUGGED IN AND CONTROLS SET AS FOLLOWS:

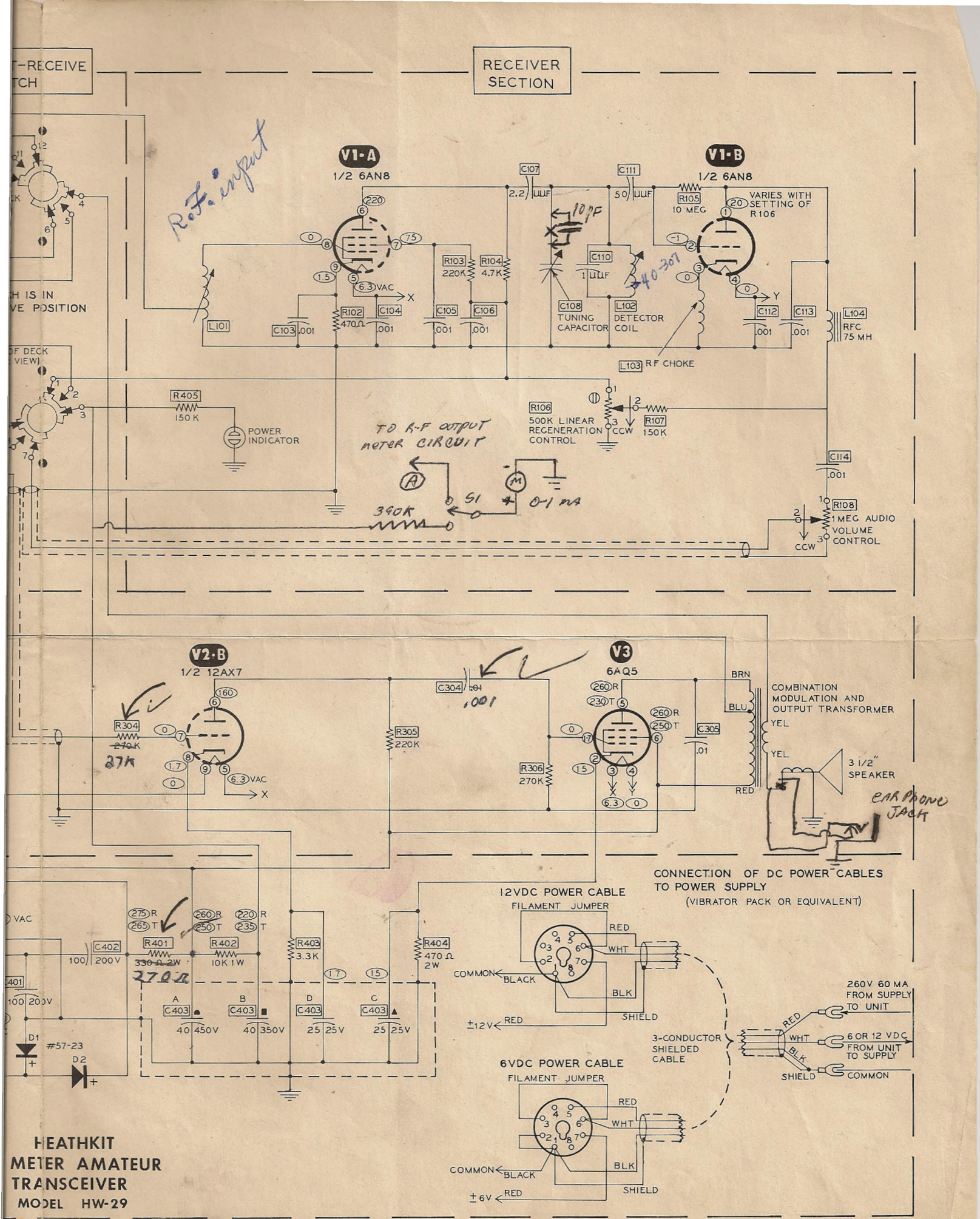
VOLUME CONTROL	-	ANY POSITION
TUNING CAPACITOR	-	ANY POSITION
REGENERATION	-	ADJUSTED FOR NORMAL RECEPTION
MICROPHONE	-	DISCONNECTED

READINGS ON V1A AND V1B WITH SWITCH IN RECEIVE
READINGS ON V2A, V4A AND V4B WITH SWITCH IN TRANSMIT
ALL OTHERS SHOWN WITH SWITCH IN EITHER POSITION

IF TWO VOLTAGES ARE SHOWN, THE ONE WITH THE LETTER R FOLLOWING IS WITH THE SWITCH IN RECEIVE AND THE ONE WITH A T FOLLOWING IS WITH THE SWITCH IN TRANSMIT.

T-RECEIVE
TCH

RECEIVER SECTION



HEATHKIT
METER AMATEUR TRANSCEIVER
MODEL HW-29

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

MECHANICAL ASSEMBLY

In the following steps, refer to Pictorial 1. Securely tighten all mounting hardware unless instructed otherwise. It may be helpful to mark the socket and terminal strip designations on the chassis with a grease pencil or soft lead pencil before the following steps are begun.

( ) Orient the chassis as shown, with the flanges upward. NOTE: As the construction progresses, you may find it desirable to re-orient the chassis to obtain better access when tightening mounting hardware. If this is done, be sure to return the chassis to its original position before beginning another step, to prevent possible errors in component location.

(✓) Mount the ceramic crystal socket (#434-74) on the top side of the chassis, at location X. Use the 3-48 x 7/16" BHMS (this is the longest 3-48 screw supplied with your kit), lockwasher and nut. Do not overtighten.

(✓) Install the 9-pin ceramic tube socket (#434-75) at V4, using 3-48 screws, lockwashers and nuts. The blank space between lugs 1 and 9 (indicated by the arrow) should be toward the front apron, as shown. (Bend the ground lugs down). Note that this, and the following three sockets, mount on the inside of the chassis with 3-48 hardware.

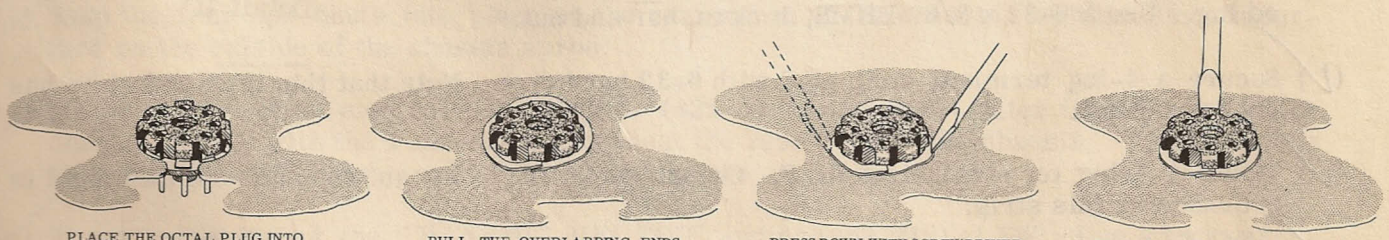
(✓) Now mount a 9-pin wafer socket (#434-77) at V1, with the blank space between pins 1 and 9 toward the rear, as shown.

(✓) Mount the other 9-pin wafer socket at V2, with the blank space between pins 1 and 9 toward the right hand edge of the chassis, as shown.

(✓) Now mount the 7-pin wafer socket (#434-15) at V3. Orient with the blank space between pins 1 and 7 toward the right hand edge of the chassis.

(✓) Install the three rubber grommets at GA, GB and GC.

(✓) Locate the octal plug (#438-22) and the retaining ring (#435-1) which will be used to secure it to the chassis. Mount the plug at location PC on the rear chassis apron, with the locating "key" toward the bottom edge of the flange. Refer to Detail 1A for further instructions.



PLACE THE OCTAL PLUG INTO THE CHASSIS HOLE AS SPECIFIED IN THE STEP.

PULL THE OVERLAPPING ENDS OF THE RING APART AND PLACE THEM INTO THE GROOVE OF THE OCTAL PLUG.

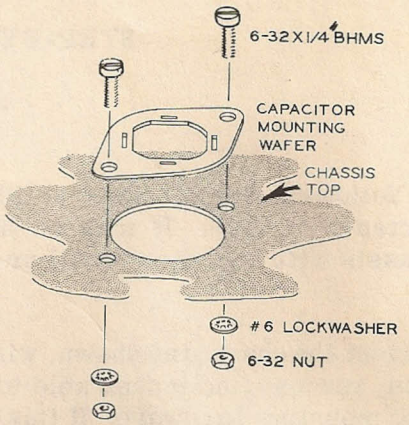
PRESS DOWN WITH SCREWDRIVER IN THE TWO LOCATIONS SHOWN TO ASSURE PROPER SEATING IN THE FRONT HALF OF THE OCTAL PLUG.

PRESS BACK OF RING DOWN INTO GROOVE AND THEN ALL THE WAY AROUND, TO BE SURE IT IS SEATED PROPERLY.

Detail 1A

NOTE: In the following steps, #6 mounting hardware will be used, unless otherwise specified. In all steps calling for #6 mounting hardware, use a 6-32 x 1/4" BHMS, lockwasher and nut, unless otherwise stated. Set eight of the 6-32 x 3/8" BHMS aside, as they will be used later in the construction.

( ) Install the electrolytic capacitor mounting wafer at location FC, using 6-32 hardware. Note that the wafer mounts on the top side of the chassis, as shown. Refer to Detail 1B.



Detail 1B

NOTE: In the following steps involving terminal strips, be sure that the terminal strip you install is the one called for, as several types are similar in appearance.

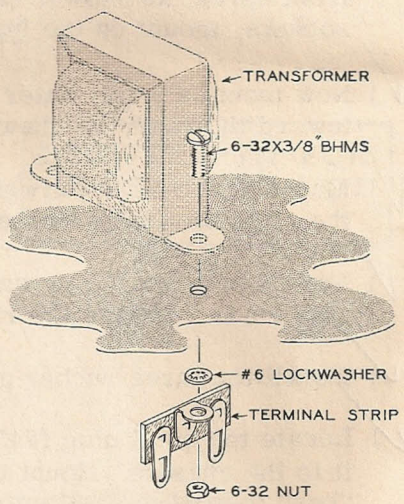
( ) Mount the power transformer (#54-87) and 2-lug terminal strip A next. Orient the transformer with the red and green leads nearest grommet GA, pass a 6-32 x 3/8" screw through the transformer mounting foot and then on through the chassis. Slip a #6 lockwasher and the 2-lug terminal strip A over the screw and secure the assembly with a #6 nut. Refer to Detail 1C for further clarification. Note that terminal strip A has no grounded lug.

( ) Now secure the remaining power transformer mounting foot with a 6-32 x 3/8" screw, lockwasher, terminal strip B, and nut. This time use a 4-lug terminal strip (#431-12) with lug 3 grounded, as shown.

( ) Mount a 3-lug terminal strip at location C. Note that the center lug (2) is grounded on this terminal strip.

( ) Mount the combination modulation-output transformer (#51-43) next, with the two yellow leads nearest grommet GB. Secure the mounting foot nearest grommet GB with a 6-32 x 3/8" BHMS, lockwasher and nut.

( ) Now secure the other mounting foot with 2-lug terminal strip D on the underside of the chassis, as shown in Pictorial 1. Note that this terminal strip has no grounded lug. Use a 6-32 x 3/8" BHMS, lockwasher and nut.



Detail 1C

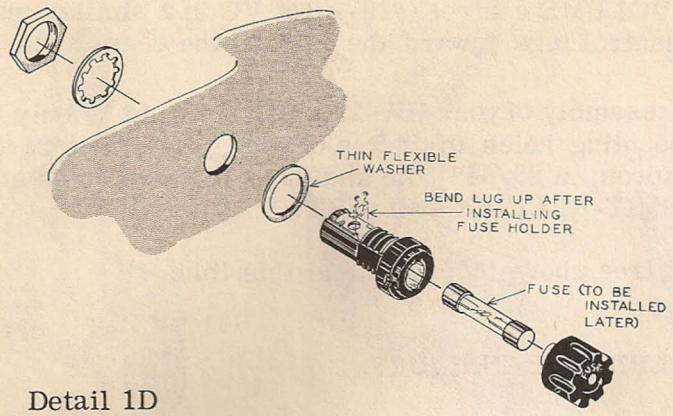
( ) Secure a 4-lug terminal strip at E with 6-32 hardware. Note that this terminal strip has lug 3 grounded.

( ) Mount a 4-lug terminal strip at F. Orient on an angle as shown, and note that lug 3 is grounded on this strip.

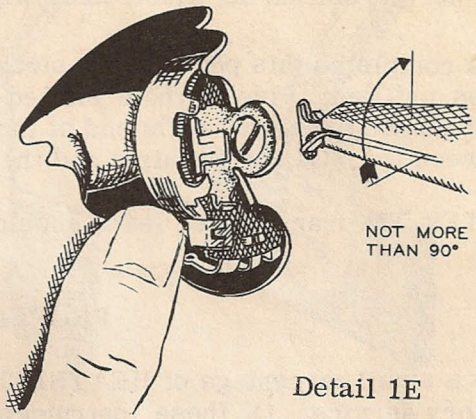
( ) Now mount a 2-lug terminal strip at G. Note that this strip has no grounded lug.

( ) Mount a 3-lug terminal strip at H, on the top side of the chassis, with a #6 lockwasher between the strip mounting foot and the chassis. Secure with a lockwasher and nut beneath the chassis. See Pictorial 9 on Page 32 and position as shown.

( ) Secure two #6 ground lugs at location GR, as shown. No lockwasher is required at this location.



Detail 1D



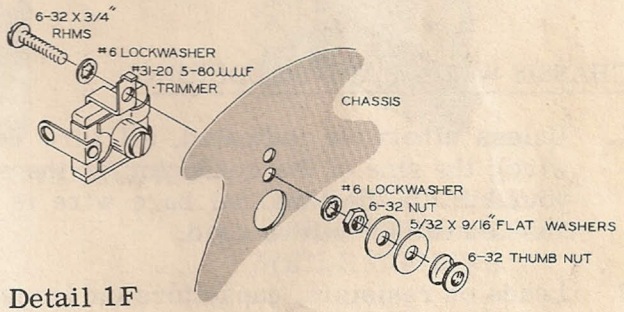
Detail 1E

( ) Install the fuse holder (#423-1) at FH next. Orient with the lugs in the location shown before tightening. See Detail 1D.

( ) Mount the 500 KΩ linear tab mounting control (#10-60) at location RC, as shown. Refer to Detail 1E for mounting details.

( ) Mount the phono socket type antenna jack at location AJ next. Be sure the lugs are oriented as shown, and tighten securely to assure a good ground connection

( ) The antenna trimmer mounts at location TR as follows: Pass the 6-32 x 3/4" RHMS (this is the longest #6 screw supplied) through a #6 lockwasher, through the trimmer mounting bracket, and then on through the chassis (see Detail 1F). Secure with a #6 lockwasher and nut. Tighten securely. Slip two 5/32" x 9/16" washers on the stud; install the thumb nut and secure tightly enough to keep it and the washers in place during later assembly.



Detail 1F

( ) Now mount the phone jack at location MJ. Orient with the lugs as shown. Bend lug 2 up so it points straight back from the chassis skirt. Use a 3/8" lockwasher between the jack and the inside of the chassis; secure with a 3/8" control washer and 3/8 - 32 nut. Again, tighten securely.

( ) Snap the four speednuts into place on the rear apron of the chassis, with the smooth surface on the outside of the chassis apron.

( ) Mount the 4-section electrolytic capacitor (#25-86) on the metal wafer from the top of the chassis at FC, with the ▲ marked lug nearest the rear edge of the chassis. Twist the four tabs approximately one-quarter turn to secure the can to the wafer.

( ) Temporarily mount the TRANSMIT-RECEIVE switch (#63-210) at SW. Use a lockwasher between the switch and the chassis and a control nut outside. The switch assembly studs should be positioned as shown and the "flat" side of the switch shaft should be toward the group of three dimples.

NOTE: Make sure that this switch is positioned with the "flat" as indicated in the previous step, before any wiring is started as it would be difficult to correct at a later time. Check, also, to be sure this switch is in its center position before proceeding.

( ) Also, temporarily mount the 1 megohm VOLUME control (#19-27) at VC in a similar manner. Position as illustrated, with the control lugs toward the edge of the chassis flange.

This completes this phase of the mechanical assembly of your HW-29. There should be only ten holes unfilled: Five keyhole shaped coil mounting holes in the top of the chassis; one 25/64" hole at MC, near the right end of the front apron; a 25/64" hole and three dimpled holes at T, between the VOLUME control and the TRANSMIT-RECEIVE switch SW.

NOTE: The transformer leads should be left free above the chassis at this time.

PROPER SOLDERING TECHNIQUES

Only a small percentage of HEATHKIT purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest proportion of malfunctions are due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half-hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory a lower wattage iron than this may not heat the connection enough to flow the solder smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

CHASSIS WIRING AND SOLDERING

1. Unless otherwise indicated, all wire used is the type with the colored insulation (hookup wire); the size of the conductor is the same for all colors of hookup wires furnished with your kit. In the case that bare wire is to be covered with insulating sleeving, the phrase "use sleeving" will be used.

2. Leads on resistors, capacitors and transformers are generally much longer than they need to be to make the indicated connections. In these cases, the excess leads should be cut off before the connection is made. In general, the leads should be just long enough to reach their terminating points. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving.

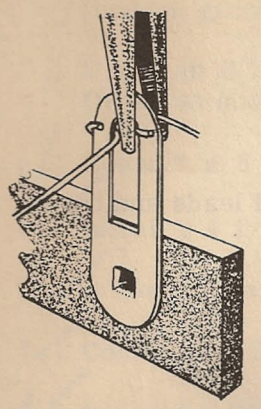
3. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the wire is too large to allow bending, position the wire so that a good solder connection can still be made.

4. Position the work, if possible, so that gravity will help to keep the solder where you want it.

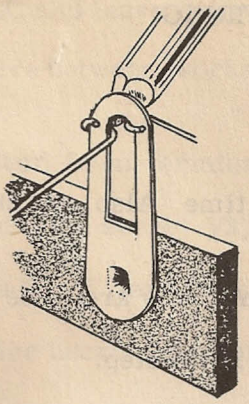
5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.

6. Then place the solder against the heated terminal and it will immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.

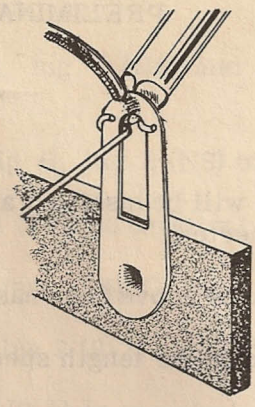
7. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.



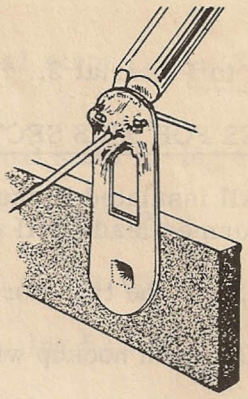
CRIMP WIRES



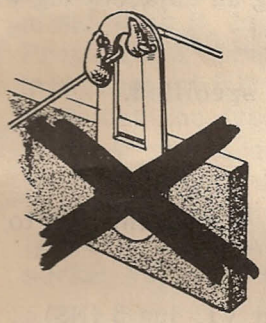
HEAT CONNECTION



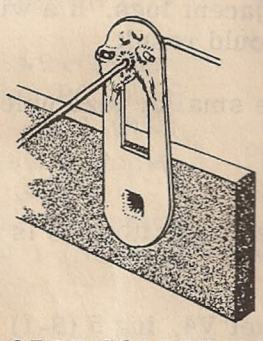
APPLY SOLDER



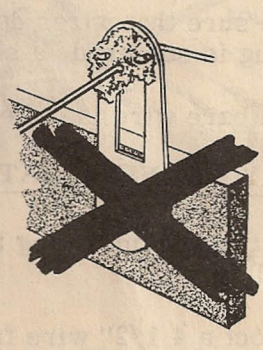
ALLOW SOLDER TO FLOW



COLD SOLDER JOINT
CONNECTION INSUFFICIENTLY
HEATED



PROPER SOLDER CONNECTION



COLD SOLDER JOINT
CONNECTION MOVED
WHILE COOLING

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth, bright appearance.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

The abbreviation "NS" indicates that a connection should not be soldered as yet for other wires may need to be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in question before it is soldered. For example, if the instruction reads, "Connect one lead of a 47 KΩ resistor to lug 1 (S-2)." it will be understood that there will be two leads connected to the terminal at the time it is soldered. This additional check will help avoid errors.

Some kit builders have also found it helpful to mark each lead in colored pencil on the pictorial as it is added.

PRELIMINARY WIRING

Refer to Pictorial 2.

NOTES FOR THIS SECTION

1. All insulated hookup wire will be installed at this time. Also, the shielded leads and transformer leads will be connected.

2. Leave the transformer leads above the chassis until they are to be used.

3. Cut each hookup wire lead to the length specified in its step.

4. Strip 1/4" of insulation from each end unless stated otherwise.

5. All the leads should be dressed tightly against the chassis following the pictorial closely for direction. Details will be shown where necessary.

6. The leads should be crimped tightly enough to the lugs to keep them in place until soldered.

7. Make sure that wires do not touch adjacent lugs. If a wire is touching an adjacent lug when the lug is soldered, a short circuit could result.

8. When bare wire is called for, use the smaller size unless otherwise specified.

HOOKUP WIRE INSTALLATION

( ) Note that one mounting tab of the filter capacitor FC is not punched. Solder this tab to the metal wafer.

( ) Connect a 4 1/2" wire from tube socket V4, lug 5 (S-1) to tube socket V1, lug 5 (NS).

( ) Run a 7" wire from socket V1, lug 5 (NS) to terminal strip C (on the rear apron), lug 1 (NS).

( ) Cut two 5 3/4" lengths of wire and connect one between socket V4, lug 1 (NS) and the meter jack MJ, lug 2 (S-1).

( ) Connect the other lead between socket V4, lug 6 (NS) and meter jack MJ, lug 1 (S-1).

( ) Connect a 6" lead from terminal strip A, lug 1 (NS) to the ◓ marked lug (NS) of filter capacitor FC.

( ) Connect an 11 1/4" wire to switch SW, lug 2 (S-1). Dress this lead across the front of the chassis and connect the other end to terminal strip F, lug 2 (NS).

( ) Connect a 10" lead from switch SW, lug 4 (S-1) to terminal strip D, lug 2 (NS). Dress as shown.

( ) Install a 6" lead between switch SW, lug 1 (S-1) and terminal strip G, lug 1 (NS).

( ) Now, run a 7" lead from terminal strip G, lug 1 (NS) to control RC, lug 1 (S-1). Dress as shown.

( ) Connect an 8 1/2" wire between switch SW, lug 3 (NS) and the ■ marked lug of filter capacitor FC (NS).

( ) Connect one end of a 3 1/2" lead to switch SW, lug 3 (S-2). Pass the other end of this lead through grommet GC and leave it free at this time.

( ) Place an 8 1/2" wire between socket V1, lug 4 (NS) and terminal strip C, lug 3 (NS). Dress as shown.

( ) Connect a 6 1/2" lead from terminal strip G, lug 2 (NS) to terminal strip E, lug 4 (NS).

( ) Install a 4 1/2" lead from socket V3, lug 4 (S-1) to terminal strip C, lug 3 (NS).

( ) In like manner, run a 3 1/2" lead from terminal strip C, lug 1 (NS) to socket V3, lug 3 (NS).

( ) Connect a 2 3/4" wire between socket V3, lug 3 (S-2) and socket V2, lug 5 (NS).

( ) Connect a 5" lead from control RC, lug 2 (S-1) to terminal strip D, lug 1 (NS). Dress as shown.

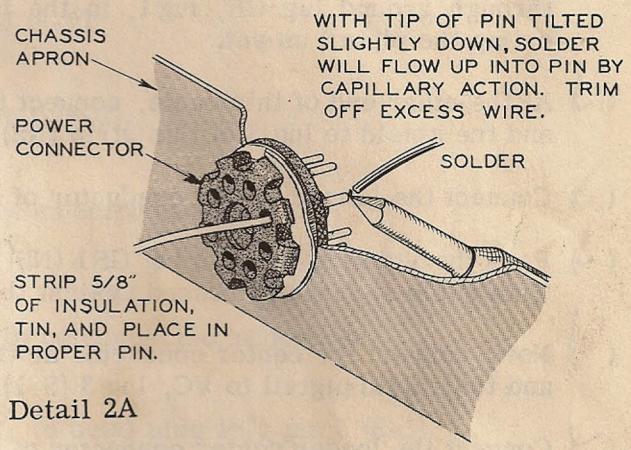
( ) Strip one end of a 6 1/2" length of hookup wire 5/8" and the other end 1/4". Connect the end stripped 5/8" to the octal plug PC, pin 5 (S-1). Refer to Detail 2A.

( ) Connect the other end of this lead to terminal strip B, lug 2 (NS).

( ) Prepare a 3" length of hookup wire as before, connect it between octal plug PC, pin 7 (S-1) and the fuse holder FH, lug 1 (NS).

( ) Run a 4" wire from filter capacitor, lug ● (NS) to terminal strip E, lug 1 (NS).

( ) Another 4" lead should now be connected between terminal strip E, lug 1 (NS) and socket V3, lug 6 (NS).



Detail 2A

( ) Install a 4 1/2" wire from filter capacitor FC, lug ▲ (NS) to socket V3, lug 2 (S-1).

( ) Similarly, run a 5 1/4" wire from FC, unmarked lug (NS) to socket V2, lug 8 (S-1).

PREPARATION AND INSTALLATION OF SHIELDED CABLE

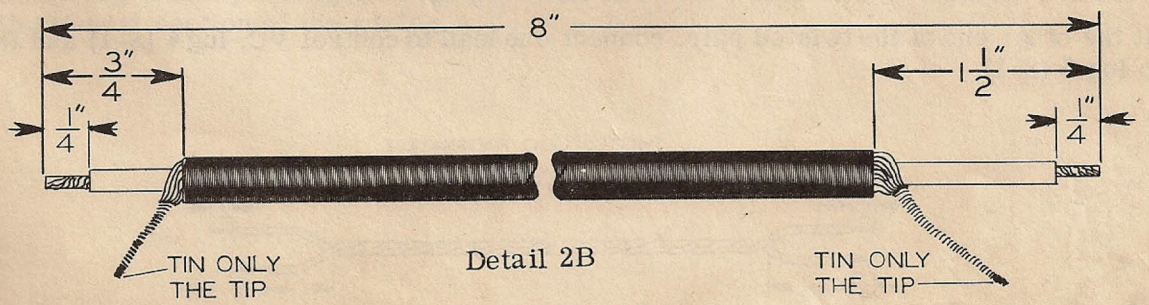
( ) Cut three lengths of shielded cable, each 8" long, and prepare as shown in Detail 2B and the following steps.

( ) At one end of each cable, strip the outer insulation 3/4". Use care to avoid cutting the shield wires.

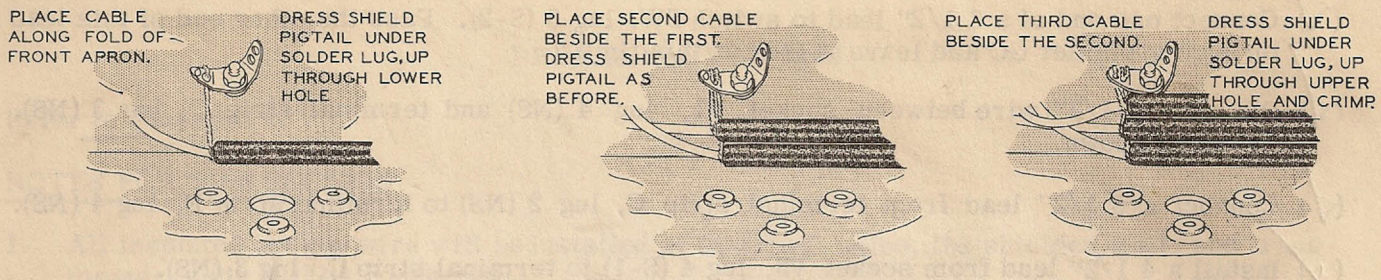
( ) At the opposite end of each cable, strip the outer insulation 1 1/2".

( ) Twist all the shields to form pigtails, as shown. Tin (coat with solder) the tip of each pigtail to keep the strands from fraying.

( ) Strip each center conductor 1/4" and tin.



Detail 2B



Detail 2C

See Detail 2C and connect the cables as follows:

( ) On one cable, connect the longer center conductor to switch SW, lug 8 (S-1).

( ) With this cable lying against the chassis in the bend of the front apron, pass the pigtail up through ground lug GR, lug 1, in the hole nearest the mounting bolt (NS). Do not trim or crimp the pigtail as yet.

( ) At the other end of this cable, connect the center conductor to terminal strip F, lug 4 (NS) and the shield to lug 3 of this strip (NS). Crimp and cut off excess pigtail.

( ) Connect the longer center conductor of another cable to switch SW, lug 7 (S-1).

( ) Pass the pigtail up through lug GR1 (NS) in the same hole as the pigtail previously installed. This cable should be dressed against the chassis touching the other cable.

( ) Now, connect the center conductor at the other end of this cable to control VC, lug 2 (S-1) and the shield pigtail to VC, lug 3 (S-1). As before, cut off excess pigtail.

( ) Connect the longer center conductor of the remaining cable to switch SW, lug 9 (S-1).

( ) Run the shield pigtail of this cable up through the remaining hole in lug GR1. Press all the cables against the chassis between lug GR and the front apron. Crimp the three pigtails to GR1 and cut off excess lead but do not solder yet.

( ) At the other end of this cable, connect the center conductor to terminal strip E, lug 2 (NS) and the shield to lug 3 (NS).

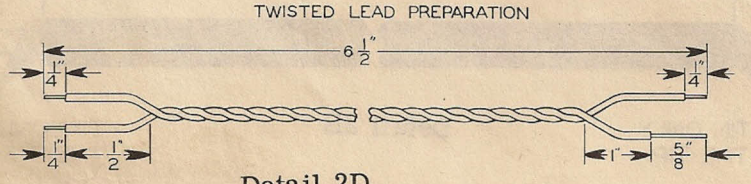
INSTALLATION OF TWISTED PAIR

( ) Twist together two unstripped 8" lengths of wire; then cut off a 6 1/2" length of this twisted pair and prepare as follows. See Detail 2D.

( ) Strip one lead 5/8" at one end.
( ) Strip the rest of the leads 1/4".

( ) Connect the long stripped lead to octal plug PC, pin 6 (S-1). The other lead at this end should connect to fuse holder FH, lug 2 (S-1).

( ) At the other end of the twisted pair, connect one lead to control VC, lug 4 (S-1) and the other to lug 5 (S-1).



Detail 2D

CONNECTION OF TRANSFORMER LEADS

( ) Feed the red, blue and brown leads and the shorter yellow lead of the modulation-output transformer through grommet GB. Feed all the power transformer leads through grommet GA.

The leads from the modulation-output transformer (at GB) are to be connected as follows:

( ) Connect the red lead to socket V3, lug 6 (S-2).

( ) Connect the brown lead to socket V3, lug 5 (NS).

( ) Connect the blue lead to terminal strip E, lug 4 (S-2).

( ) Connect the yellow lead to terminal strip D, lug 2 (S-2).

The yellow lead remaining above the chassis is not connected at this time.

The leads from the power transformer (at GA) are to be connected as follows:

( ) Connect one black lead, after stripping to 5/8", to octal plug PC, pin 8 (S-1).

( ) Connect the other black lead to fuse holder FH, lug 1 (S-2).

( ) Connect the long green lead, after stripping to 5/8", to PC, pin 4 (S-1).

( ) Connect the short green lead to the filter capacitor FC, ground lug 2 (S-1), as shown.

( ) Connect the short red lead to terminal strip B, lug 4 (NS).

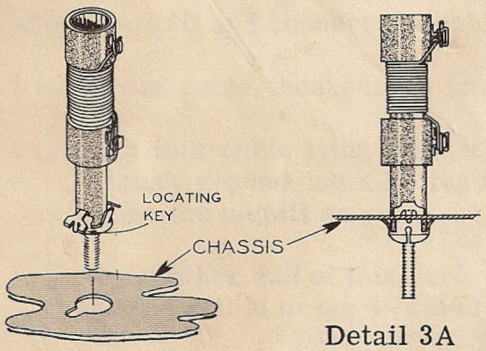
( ) Connect the long red lead to terminal strip A, lug 2 (NS).

The installation of the hookup wire, shielded wire and transformer leads is now completed. Check the wiring to this point against the pictorial to be sure that no error exists and then proceed with the next section of the wiring.

RF SECTION WIRING

Refer to Pictorial 3.

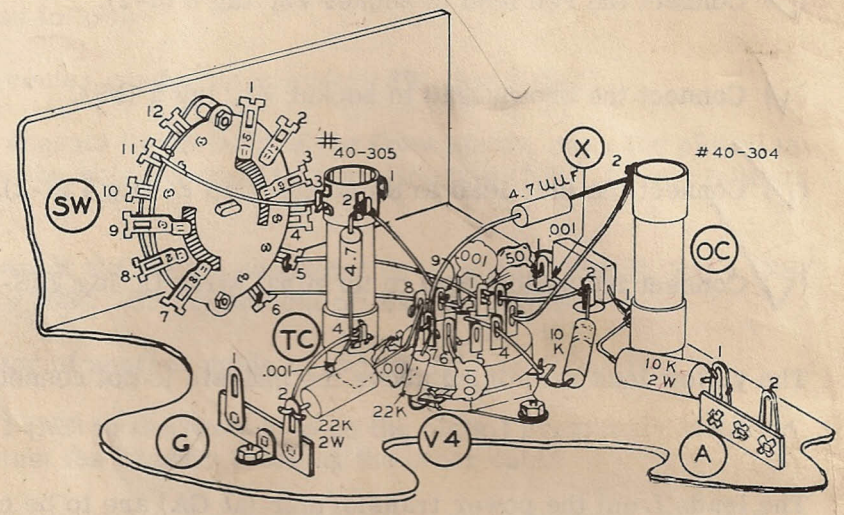
NOTE: To mount a coil, position the coil so the locating key is in line with the keyway and the coil mounting hole. Press the coil into the hole until it snaps into place. See Detail 3A.



Detail 3A

(✓) Mount the RF tank coil (#40-305) at hole TC. This coil is the one with four lugs and a link winding.

(✓) Connect a bare lead from tank coil TC, lug 3 (S-1) to switch SW, lug 11 (S-1).



Pictorial 3

(✓) Connect a bare lead between terminal strip G, lug 2 (NS) and TC, lug 4 (NS). Dress this lead as shown to leave room for a resistor to be installed later.

(✓) Connect a .001 μfd disc capacitor from TC, lug 4 (NS) to the socket ground lug near pin 9 of V4 (NS). Keep the leads short and dress as shown.

(✓) Now connect a 4.7 μμf 10% tubular ceramic capacitor (4.7 or yellow-violet-white) from TC, lug 4 (S-3) to TC, lug 2 (NS). Position this capacitor tightly against the coil.

(✓) Connect another .001 μfd disc capacitor from the socket ground lug near pin 9 of V4 (S-2) to V4, pin 8 (NS).

(✓) Connect a 22 KΩ 2 watt (red-red-orange) (large body) resistor between terminal strip G, lug 2 (S-3) and V4, lug 8 (S-2). Use care to avoid breaking a lug with the large leads of this part.

(✓) Connect a bare wire from TC, lug 2 (S-2) to V4, lug 9 (NS).

(✓) Connect a 22 KΩ 1/2 watt (red-red-orange) (small body) resistor from the V4 ground lug near pin 6 (NS) to V4, lug 7 (NS). Dress as illustrated.

(✓) Connect a .001 μfd disc capacitor from the same ground lug (S-2) to V4, pin 6 (S-2).

(✓) Run a bare lead from V4, lug 4 (NS) to the adjacent socket ground lug (NS).

( ) Connect another bare lead between V4, lug 4 (S-2) and the V4 center post (S-1).

( ) Mount the oscillator coil (#40-304) at hole OC. This coil has a single layer winding of eleven turns with two lugs.

( ) Connect a .001 μfd ±20% mica capacitor between crystal socket X, lug 1 (NS) and oscillator coil OC, lug 1 (NS).

( ) Connect a 50 μμf 5% silver mica capacitor from crystal socket X, lug 1 (S-2) to the V4 socket ground lug near pin 1 (NS).

( ) Connect a .001 μfd disc capacitor from the same ground lug (NS) to V4, lug 1 (NS).

( ) Now connect a bare wire from the same ground lug (S-3) to switch SW, lug 6 (S-1).

( ) Connect a bare wire between V4, lug 1 (S-3) and SW, lug 5 (S-1).

( ) Connect another bare wire between crystal socket X, lug 2 (NS) and V4, lug 2 (S-1).

( ) Connect a 10 KΩ 1/2 watt resistor (brown-black-orange) from the socket ground lug near V4, lug 4 (S-2) to crystal socket X, lug 2 (S-2).

( ) Using care to avoid damage to the coil lug, connect a 10 KΩ 2 watt (brown-black-orange) (large body) resistor from OC, lug 1 (S-2) to terminal strip A, lug 1 (S-2). Do not crimp the lead at the coil terminal. Feed the resistor lead through the coil lug, solder the joint, and clip off excess lead after soldering.

( ) Connect a bare wire from OC, lug 2 (NS) to V4, lug 3 (S-1).

( ) Connect a 4.7 μμf 10% tubular ceramic capacitor (4.7 or yellow-violet-white) from OC, lug 2 (S-2) to V4, lug 7 (S-2).

Recheck your wiring to this point, making sure there are no short circuits, connections to improper lugs, loose wire clippings, etc. All lugs in this section should be soldered at this time, except the following:

1. On switch SW, lugs 10 and 12 have no connection.
2. On terminal strip A, lug 2 should have one lead connected but not soldered.
3. On terminal strip G, lug 1 should have two leads connected but not soldered.
4. On socket V4, lug 9 should have one lead connected but not soldered.

RECEIVER SECTION WIRING

Refer to Pictorial 4.

( ) Connect a .001 μfd disc capacitor from ground lug GR1 (S-4) to terminal strip G, lug 1 (NS).

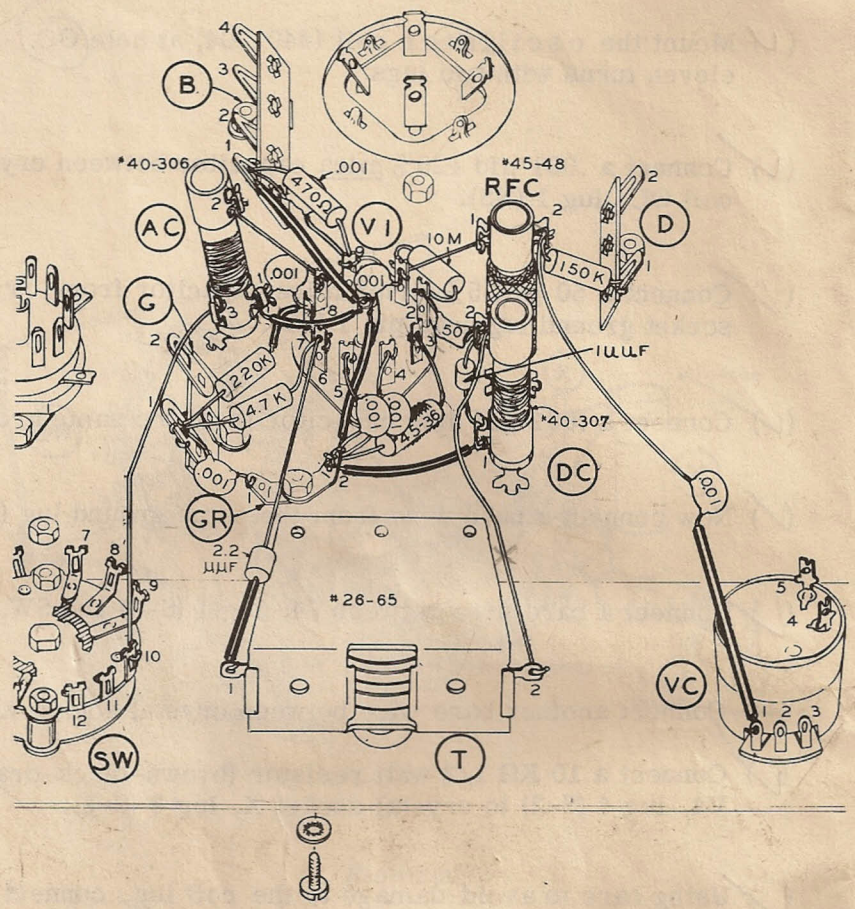
( ) Using a 1" length of sleeving. connect a bare wire from terminal strip B, lug 1 (NS) to the center post of socket V1 (NS).

( ) Connect another bare wire covered with 1" of sleeving between the V1 center post (NS) and ground lug GR2 (NS).

( ) Install a #45-36 RF choke from socket V1, lug 3 (S-1) to ground lug GR2 (NS). Position the body of the choke not less than 1/16" from the chassis. This is important.

( ) Connect a .001 μfd disc capacitor from V1, lug 4 (S-2) to GR2 (NS).

( ) Connect another .001 μfd disc capacitor from V1, lug 5 (S-3) to GR2 (NS).



Pictorial 4

( ) Mount RF input coil (#40-306) at AC.

( ) Mount detector coil (#40-307) at DC.

( ) Connect a bare wire between coil AC, lug 1 (NS) and the V1 center post (NS); cover the lead with 3/4" of sleeving.

( ) Similarly, connect a bare lead (covered with 1" of sleeving) from detector coil DC, lug 1 (NS) to ground lug GR2 (S-5).

( ) Connect a .001 μfd disc capacitor from AC, lug 1 (S-2) to socket V1, lug 7 (NS).

( ) Slip a 1/2" of sleeving on one lead of a 220 KΩ 1/2 watt (red-red-yellow) resistor and connect this lead to V1, lug 7 (S-2). Connect the other end to terminal strip G, lug 1 (NS).

( ) Connect a 4.7 KΩ 1/2 watt (yellow-violet-red) resistor from G, lug 1 (S-5) to V1, lug 6 (NS).

( ) Mount the tuning capacitor at T with the three 4-40 RHMS, using #4 lockwashers under the heads. Tighten until the lockwashers are pulled completely into the dimple. Keep the capacitor rotor plates meshed while mounting to avoid damage.

( ) Connect a 2.2 μμf tubular phenolic capacitor (red-red-white) from V1, lug 6 (S-2) to tuning capacitor T, lug 1 (S-1). Use 3/4" of sleeving on the lead to T1.

( ) Connect a bare wire from switch SW, lug 10 (S-1) to coil AC, lug 3 (S-1).

( ) Connect a bare wire from AC, lug 2 (S-1) to V1, pin 8 (S-1).

( ) Connect a .001 μfd disc capacitor from V1, pin 9 (NS) to terminal strip B, lug 1 (NS).

( ) Connect a 470 Ω 1/2 watt (yellow-violet-brown) (small body) resistor between V1, lug 9 (S-2) and terminal strip B, lug 1 (S-3).

( ) Install a 10 megohm (brown-black-blue) resistor between V1, lug 1 (NS) and V1, lug 2 (NS).

( ) Connect a 1 μμf tubular phenolic capacitor (1 or brown-black-white) between detector coil DC, lugs 1 (S-2) and 2 (NS).

( ) Connect a 50 μμf ±5% silver mica capacitor from V1, lug 2 (S-2) to DC, lug 2 (NS).

( ) Connect a bare wire between DC, lug 2 (S-3) and tuning capacitor T, lug 2 (S-1).

( ) Connect a .001 μfd disc capacitor between V1, lug 1 (NS) and the V1 center post (S-4), keeping the leads short.

( ) Mount the #45-48 RF choke at RFC.

( ) Connect a 150 KΩ 1/2 watt (brown-green-yellow) resistor from terminal strip D, lug 1 (S-2) to RFC, lug 2 (NS).

( ) Connect a .001 μfd disc capacitor from RFC, lug 2 (S-2) to volume control VC, lug 1 (S-1) with 1" of sleeving on the VC1 end.

( ) Connect a bare wire between RFC, lug 1 (S-1) and V1, lug 1 (S-3).

At this time, check the wiring just installed. By now all terminals of V1, VC, AC, DC, RFC, GR1 and GR2 and terminal strips D and G should be soldered. Terminal strip B, lug 1, should also be soldered. If any discrepancy exists, carefully recheck wiring for error.

AUDIO SECTION WIRING

Refer to Pictorial 5.

( ) Slip a 1/2" length of sleeving on the lead shown of a .01 μfd 600 volt plastic tubular capacitor and connect this lead to socket V3, pin 7 (S-1). Connect the other end to socket V2, pin 6 (NS). Dress as shown.

( ) Slip a 1 1/2" length of sleeving on another .01 μfd 600 volt plastic tubular capacitor as shown and connect this lead to V3, lug 5 (S-2). Connect the other end to V2, lug 9 (NS), and dress as shown.

( ) Connect a 270 KΩ 1/2 watt (red-violet-yellow) resistor from terminal strip E, lug 3 (S-2) to V3, lug 1 (S-1).

( ) Install a 220 KΩ 1/2 watt (red-red-yellow resistor from terminal strip E, lug 1 (S-3) to V2, pin 6 (S-2).

( ) Connect a 270 KΩ 1/2 watt (red-violet-yellow) resistor between terminal strip E, lug 2 (S-2) and V2, lug 7 (S-1).

( ) Connect a bare lead from V2, lug 5 (S-2) to V2, lug 4 (S-1).

( ) Feed a bare wire through 5/8" of sleeving and connect between terminal strip F, lug 3 (NS) and V2, pin 9 (NS).

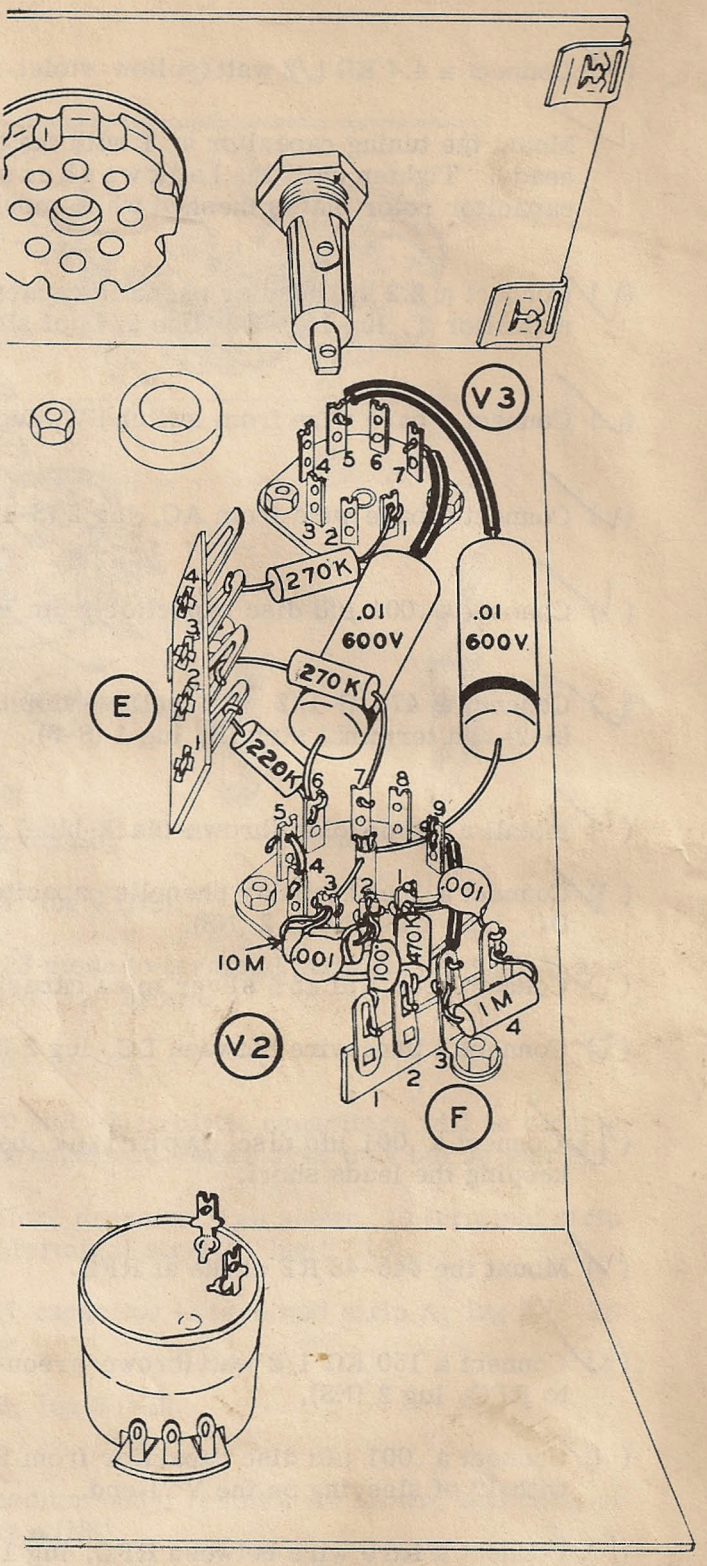
( ) Connect another bare wire from V2, pin 9 (S-3) to the V2 center post (NS).

( ) Connect a bare lead from the center post of V2 (S-2) to V2, pin 3 (NS).

( ) Connect the remaining 10 megohm (brown-black-blue) resistor from V2, lug 2 (NS) to V2, lug 3 (NS). Dress this resistor close to the chassis.

( ) Connect a .001 μfd disc capacitor from V2, lug 3 (S-3) to V2, lug 2 (NS).

( ) Connect a 1 megohm 1/2 watt (brown-black-green) resistor between terminal strip F, lugs 4 (NS) and 3 (S-3).



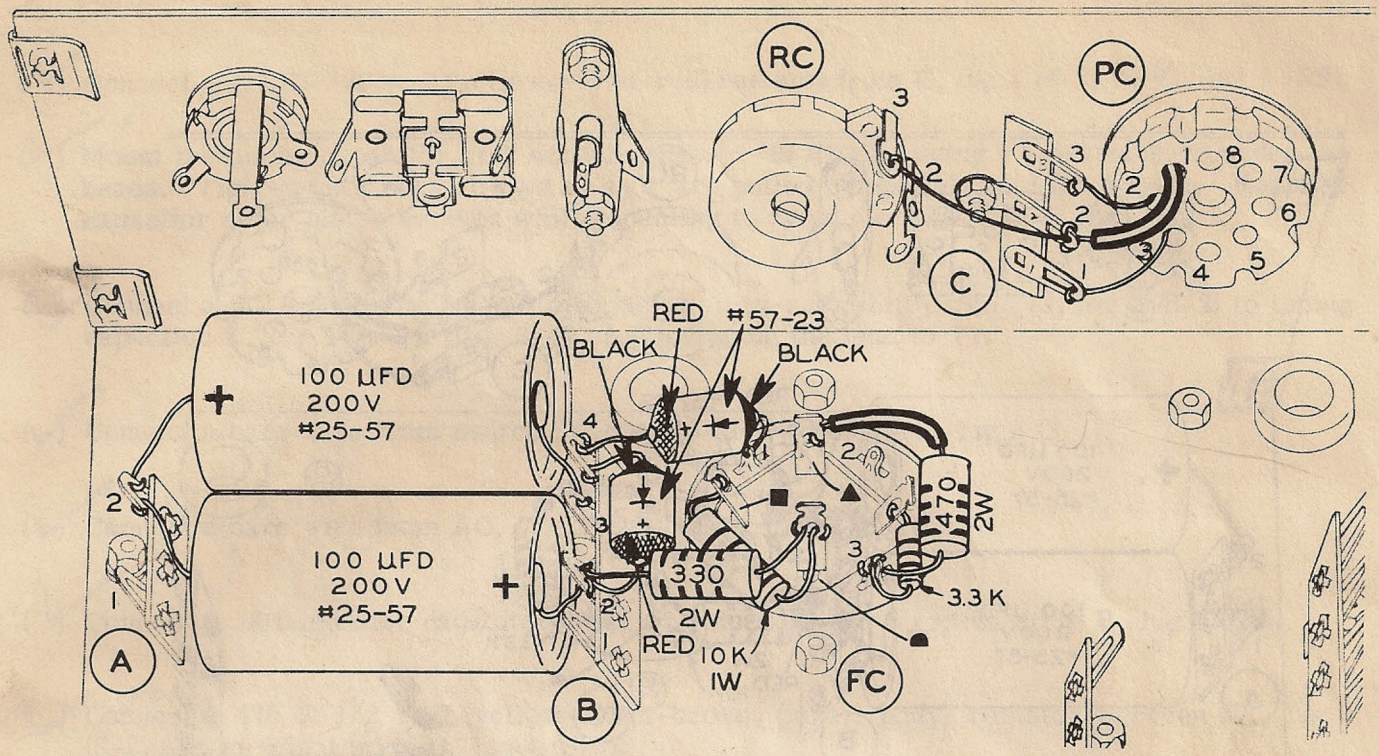
Pictorial 5

( ) Now connect a 470 KΩ 1/2 watt (yellow-violet-yellow) resistor from terminal strip F, lug 2 (S-2) to V2, lug 1 (NS).

( ) Connect a .001 μfd disc capacitor from V2, lug 1 (S-2) to terminal strip F, lug 4 (S-3).

( ) Connect another .001 μfd disc capacitor from V2, lug 2 (S-3) to terminal strip F, lug 1 (NS).

Check the wiring to this point. In the Audio Section, only lug 1 on terminal strip F should not be soldered at this time.



Pictorial 6

POWER SUPPLY WIRING

Refer to Pictorial 6.

( ) Pass a bare wire through pin 3 of the power connector PC from the outside of the chassis. Connect this lead to terminal strip C, lug 1 (S-3). Now solder the wire to pin 3 and trim the lead flush with the tip of the pin.

( ) In like manner, connect a bare wire to terminal strip C, lug 3 (S-3) with a lead through PC, pin 2 (S-1).

( ) Pass a bare wire through pin 1 of PC. Slip a 1 1/4" length of sleeving over the lead and connect it to terminal strip C, lug 2 (NS). Now solder pin 1 and trim the wire.

( ) Connect another bare lead from terminal strip C, lug 2 (S-2) to control RC, lug 3 (S-1).

( ) Connect the 3.3 KΩ 1/2 watt (orange-orange-red) resistor from the unmarked lug of the filter capacitor FC (S-2) to ground lug 3 (NS). Dress as shown.

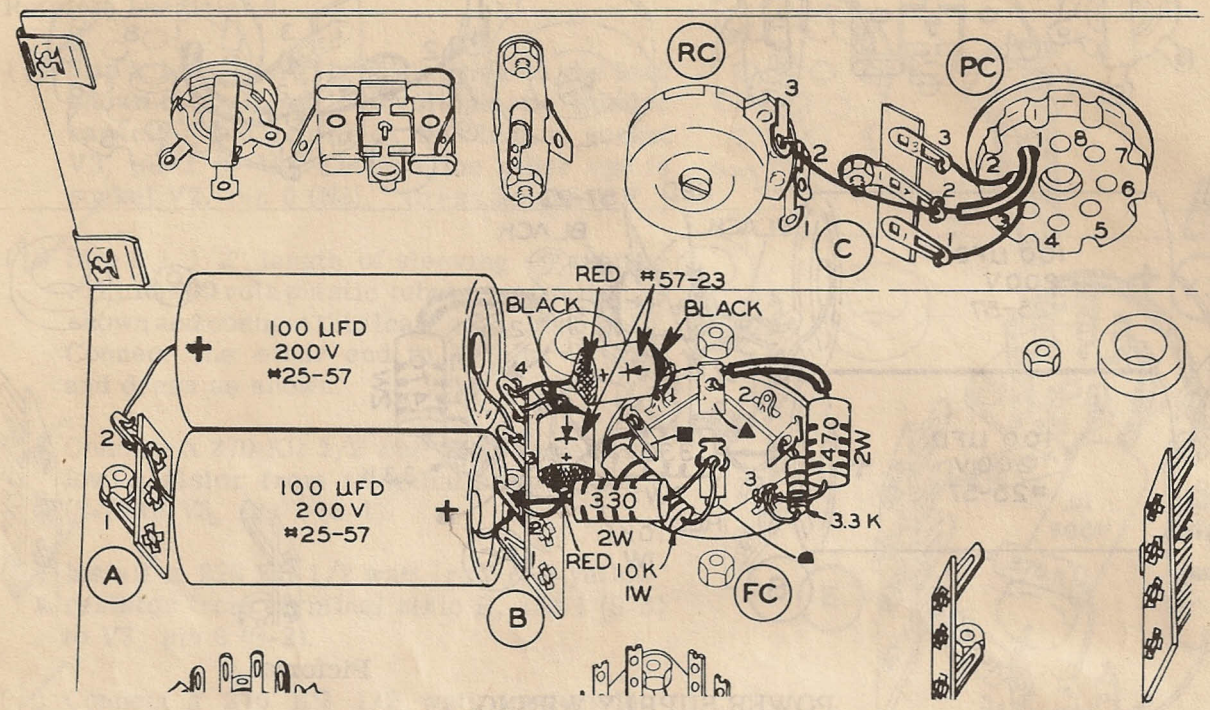
( ) Connect the 470 Ω 2 watt (yellow-violet-brown) (large body) resistor, dressing as illustrated with a 1/2" length of sleeving on the ungrounded end, between the ground lug mentioned in the preceding step (S-2) and FC, lug ▲ (S-2).

NOTE: The polarity of the next four components is very important. If not properly installed, damage to them or other components is likely. Follow the instructions closely to avoid any possible error.

INSTALLATION OF SILICON DIODES

NOTE: The positive (+) end of the diodes will be marked with red and the negative (-) end will be marked with black.

( ) Dressing as shown, connect the negative (-) end of a #57-23 diode to ground lug 1 (S-1) on filter capacitor FC.



POWER SUPPLY WIRING Pictorial 6

( ) Connect the positive (+) end to terminal strip B, lug 4 (NS).

( ) Connect the negative (-) end of the other #57-23 diode to terminal strip B, lug 4 (S-3) and the positive (+) end to terminal strip B, lug 2 (NS), as shown.

INSTALLATION OF ELECTROLYTIC CAPACITORS

NOTE: The positive (+) end of the #25-57 100 µfd 200 volt electrolytic capacitors will be clearly marked with a plus (+) sign or the word "Positive". The negative (-) end may or may not be marked.

( ) Connect the negative (-) end of a #25-57 capacitor, dressing it as shown, to terminal strip B, lug 3 (S-1). Connect the positive (+) end to terminal strip A, lug 2 (NS).

( ) Connect the negative (-) end of the other #25-57 capacitor to terminal strip A, lug 2 (S-3). Dress as illustrated against the other capacitor.

( ) Connect the positive (+) end to terminal strip B, lug 2 (NS).

( ) Dress a 10 KΩ 1 watt (brown-black-orange) (medium body) resistor as shown, and connect between filter capacitor FC, lug ■ (S-2) and lug ◓ (NS).

( ) Connect the 330 Ω 2 watt (orange-orange-brown) (large body) resistor from terminal strip B, lug 2 (S-4) to FC, lug ◓ (S-4).

Carefully recheck the wiring to this point. Only lug 1 on terminal strip F and pin 9 of socket V4 should be free of solder at this time. Each one of these lugs will have one lead connected to it.

FRONT PANEL ASSEMBLY AND INSTALLATION

Refer to Pictorials 7, 8 and 9.

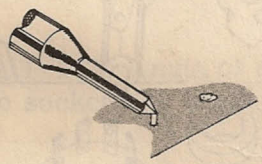
NOTE: It is recommended that you cover the work surface with a soft cloth to prevent scratching the panel during the following operations.

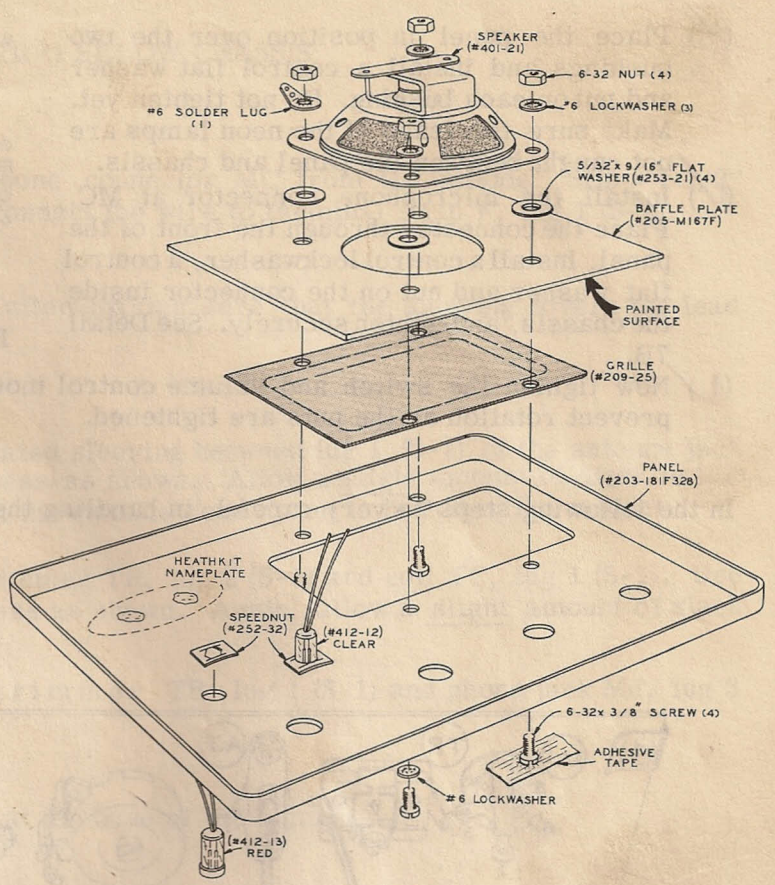
ASSEMBLY

( ) Mount the clear neon pilot lamp (#412-12) at the hole marked POWER, using one of the large speednuts (#252-32).

( ) Similarly, mount the red pilot lamp (#412-13) at OUTPUT.

( ) Tighten the speednuts on the lamps. Place the panel face down on the work surface and press the speednuts down tight with a screwdriver.





Pictorial 7

( ) Mount the HEATHKIT nameplate at the two holes above the words THE "SIXER". Melt the pins of the logotype and press against the back of the panel with your soldering iron. See Detail 7A.

( ) Locate the four 6-32 x 3/8" screws which are to be used for mounting the speaker. Place a #6 lockwasher over <u>one</u> of these screws. Insert each screw through a speaker mounting hole and temporarily fasten it there with adhesive tape over the head.

Again place the panel face down on the work surface and assemble the speaker to the panel as follows:

( ) Place the grille over the screws so that it protrudes through the front panel, with the openings in the mesh facing the bottom edge of the panel.

( ) Place the baffle over the screws with the black surface toward the grille.

( ) Place one of the 5/32" x 9/16" washers over each screw.

( ) Install the speaker now, positioning as shown.

( ) Place a solder lug and nut on the upper left hand screw.

( ) Place a lockwasher and nut on each of the other screws. Carefully center the speaker grille in the opening, and tighten all of the nuts.

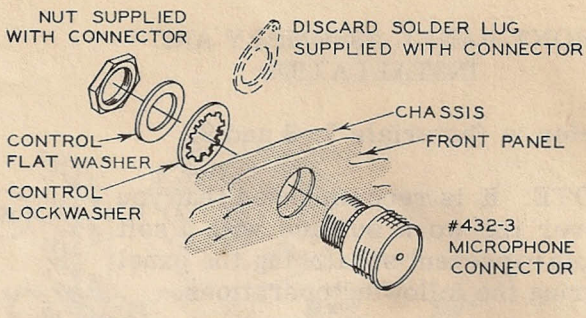
INSTALLATION

( ) Place the chassis on the rear apron so it rests on the apron, the power transformer and the filter capacitor.

( ) Remove the nuts from the switch SW and control VC.

(M) Place the panel in position over the two bushings and install a control flat washer and nut on each bushing. Do not tighten yet. Make sure the leads of the neon lamps are not caught between the panel and chassis.

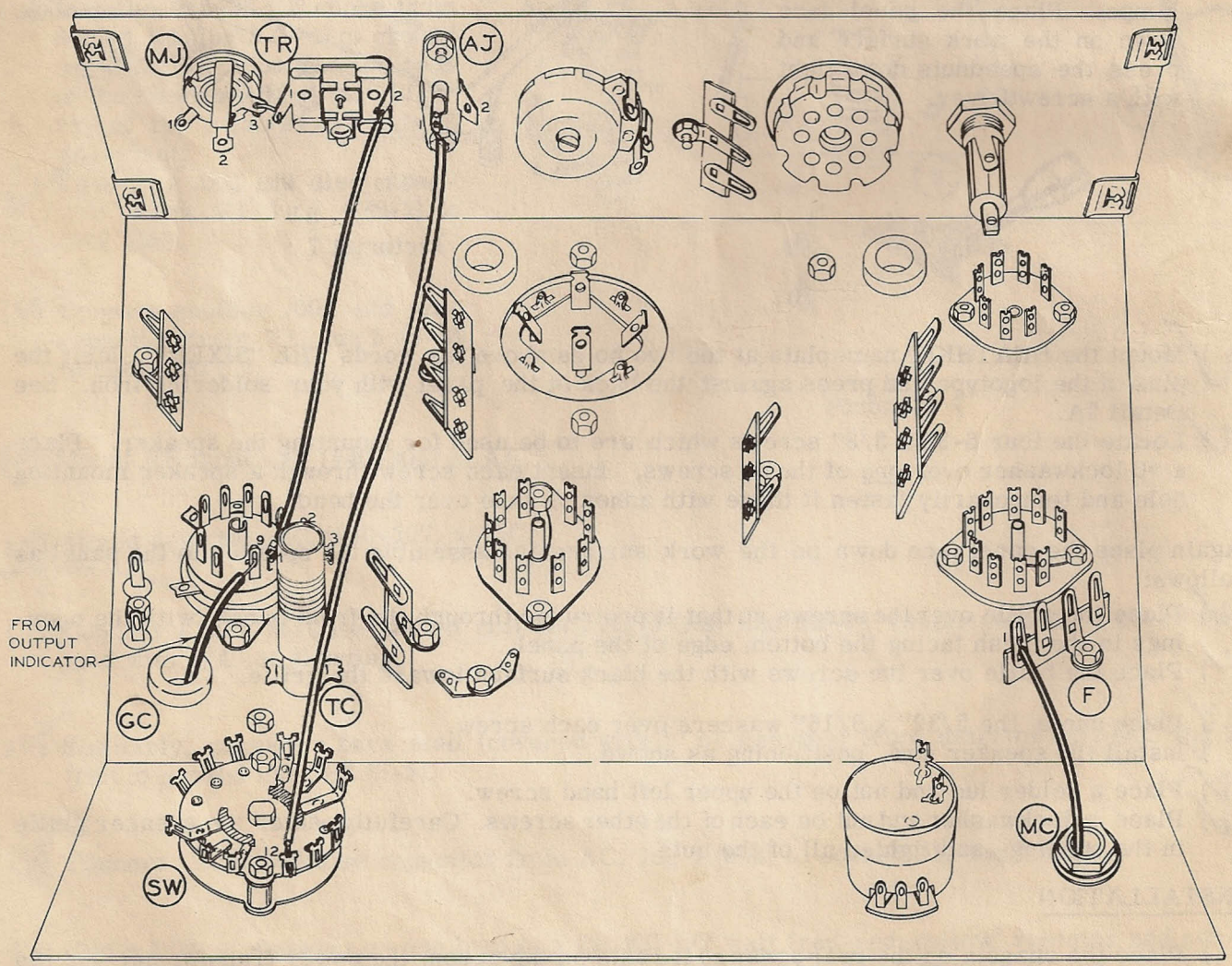
(S) Install the microphone connector at MC. Place the connector through the front of the panel. Install a control lockwasher, a control flat washer and nut on the connector inside the chassis, and tighten securely. See Detail 7B.



Detail 7B

(N) Now tighten the switch and volume control mounting nuts. Hold the switch and control to prevent rotation as the nuts are tightened.

In the following steps be very careful in handling the unit to avoid scratching the panel.



Pictorial 8

FINAL WIRING BELOW CHASSIS

Refer to Pictorial 8.

( ) Feed a bare lead through the microphone connector MC from the outside. Slip a 1 1/2" length of sleeving over this wire and connect the wire to terminal strip F, lug 1 (S-2).

( ) Solder the wire to the eyelet of MC, after making sure that the sleeving covers the lead fully. Clip off the excess wire.

( ) Connect a heavy bare wire using insulated sleeving between lug 1 (S-1) of the antenna jack AJ and lug 12 of switch SW (S-1). Dress as shown. Allow a slight amount of slack in this lead to prevent damage to switch when the chassis rear apron is bolted to the cabinet.

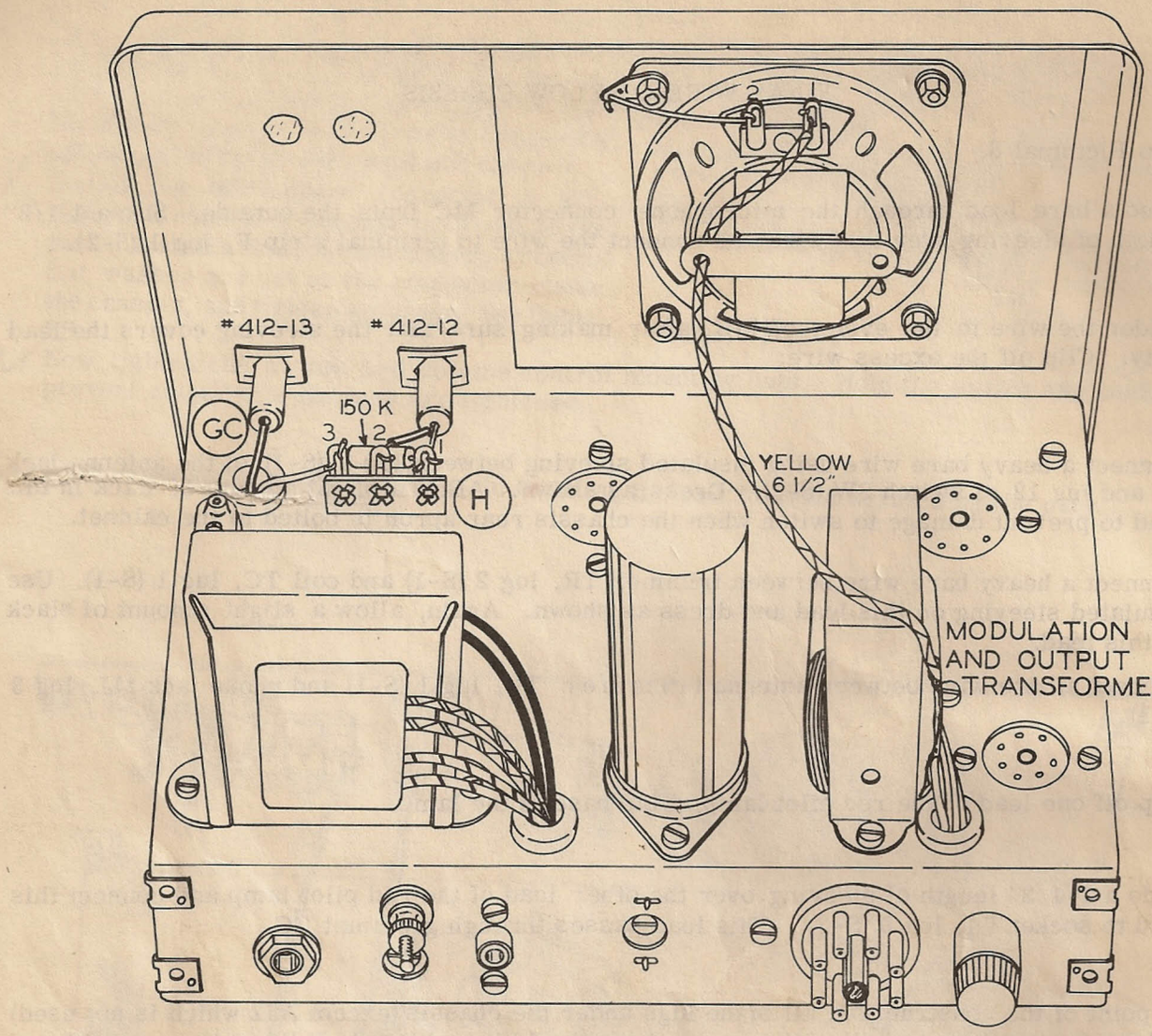
( ) Connect a heavy bare wire between trimmer TR, lug 2 (S-1) and coil TC, lug 1 (S-1). Use insulated sleeving on this lead and dress as shown. Again, allow a slight amount of slack in this lead.

( ) Connect a bare wire between antenna trimmer TR, lug 1 (S-1) and phone jack MJ, lug 3 (S-1).

( ) Clip off one lead of the red pilot lamp at the base of the lamp.

( ) Slide a 1 1/2" length of sleeving over the other lead of the red pilot lamp and connect this lead to socket V4, lug 9 (S-2). This lead passes through grommet GC.

At this point of the construction, all of the lugs under the chassis (except AJ2 which is not used) should have connections and all of the connections should be soldered. If there is an unsoldered joint or an empty lug under the chassis at this time, carefully recheck your wiring to find the error in construction.



Pictorial 9

FINAL WIRING ABOVE CHASSIS

Refer to Pictorial 9.

( ) Cut the free yellow output transformer lead to 6 1/2" and strip 5/16". Feed this lead through the hole in the speaker bracket nearest lug 2 and connect to terminal 1 (S-1).

( ) Connect a bare wire between speaker lug 2 (S-1) and the ground lug near this terminal (S-1).

( ) Connect the lead appearing at grommet GC to terminal strip H, lug 3 (NS).

( ) Connect a 150 KΩ 1/2 watt (brown-green-yellow) resistor from terminal strip H, lug 3 (S-2) to H, lug 1 (NS).

( ) Run one lead of the clear pilot lamp to terminal strip H, lug 1 (S-2).

( ) Cover the other lead with sleeving and connect it to terminal strip H, lug 2 (S-1).

( ) Install the lever knob on the TRANSMIT-RECEIVE switch.

( ) Install the other knobs on the TUNING shaft and the VOLUME control shaft.

Set this assembly aside for the moment and proceed with the assembly of the cabinet and cables.

FINAL ASSEMBLY

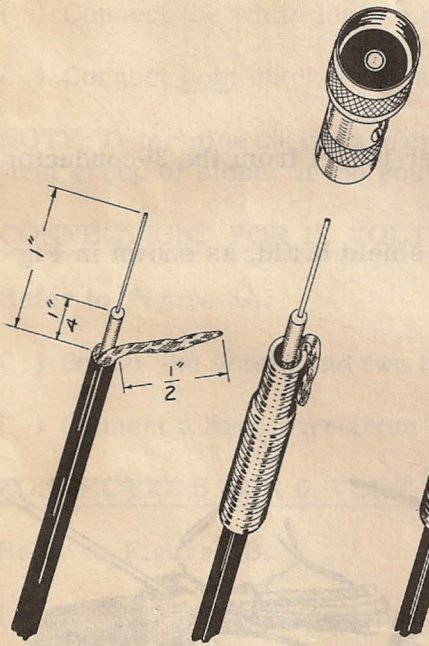
CABINET

( ) Assemble the handle to the cabinet with the two large self-tapping screws.

( ) Mount the four rubber feet from the outside of the cabinet in the four holes in the cabinet bottom.

MICROPHONE CABLE

( ) Using Figure 1, install the microphone connector (#432-1) on the microphone cable.



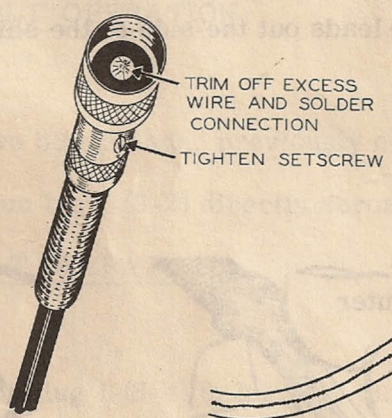


Figure 1

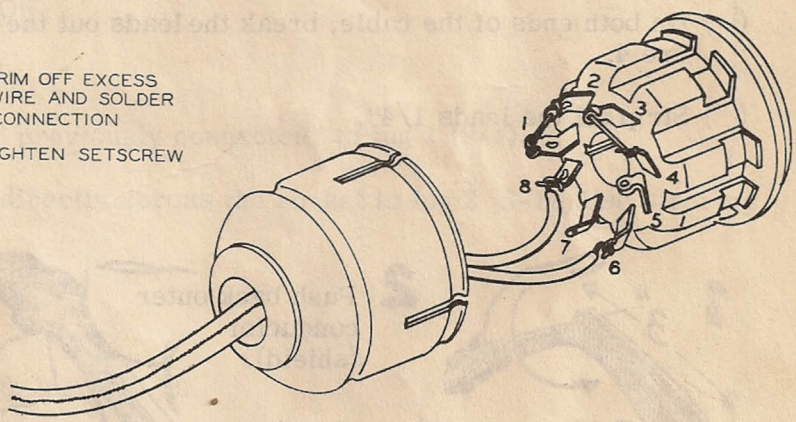


Figure 2

AC POWER CORD

Refer to Figure 2.

( ) Slide an octal plug cap (#440-1) over the line cord, grommet end first.
( ) Tie a large double knot in the cord to act as a strain relief.
( ) Connect one lead of the line cord to an octal socket (#434-4), lug 8 (S-1). Connect the other lead to lug 6 (S-1).

( ) Connect a bare lead from lug 4 (S-1) to lug 3 (S-1).

( ) Connect another bare lead from lug 2 (S-1) to lug 1 (S-1).

( ) Snap the cap over the socket.

( ) Check the line cord and socket pins with an ohmmeter to be sure no connections exist between socket pins other than those shown.

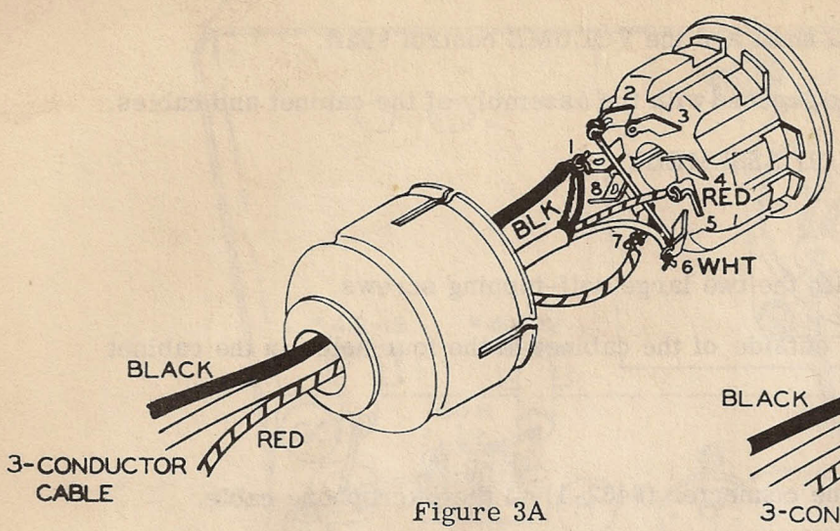


Figure 3A

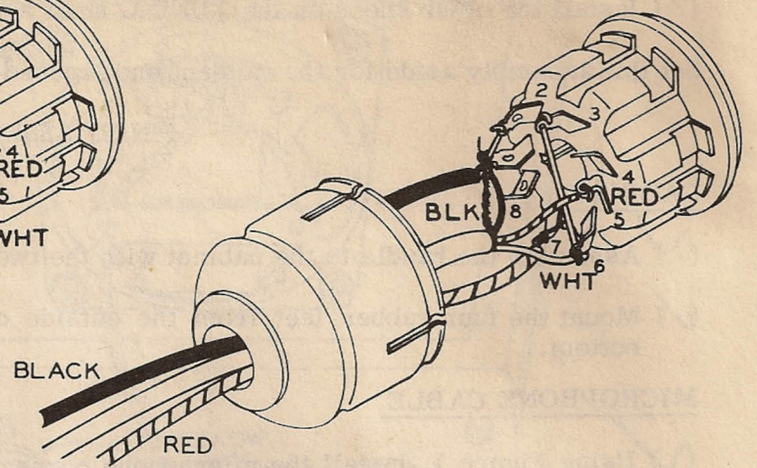


Figure 3B

EXTERNAL POWER SUPPLY CABLE

Refer to Figure 3A or 3B.

( ) Using care to not cut the shield wires, remove 3" of the outer jacket from the 3-conductor shielded cable. Strip 3/4" of the jacket from the other end.

( ) On both ends of the cable, break the leads out the side of the shield braid, as shown in Figure 4.

( ) Strip all the leads 1/4".

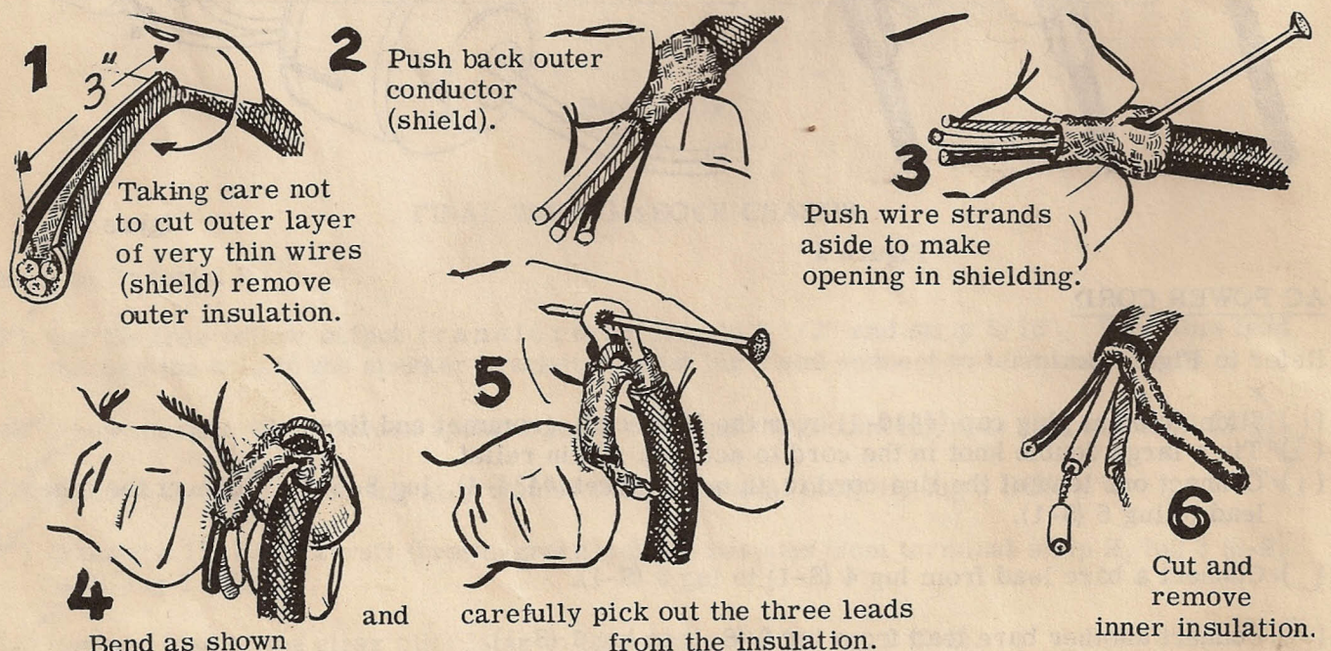


Figure 4

( ) Pull the slack out of the shield braid pigtails and cut them to the same length as the black leads at both ends of the cable.

( ) Refer to Figure 5 and at the 3" stripped end of the cable install a spade terminal on the red and white leads. Install both the black lead and the shield pigtail to the remaining spade terminal in similar manner.

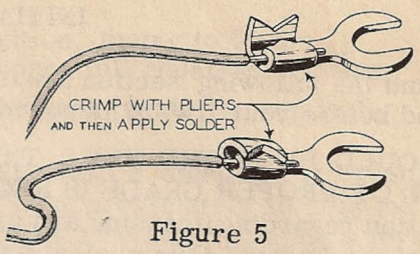


Figure 5

( ) Feed the other end of the cable through the octal plug cap from the grommet side.

( ) Strip the heavy red and black leads 5/8" on one end and 1/4" on the other. Tin the leads. The ends stripped 1/4" are used in the following steps. The ends stripped 5/8" are for connection to the power source.

( ) Connect the heavy red lead to lug 7 of the #434-4 octal socket (S-1).

( ) Connect the small red lead from the shielded cable to pin 5 of the socket (S-1).

( ) Connect the white lead to pin 6 (NS).

( ) Connect both black leads and the shield pigtail to lug 1 (NS).

NOTE: Determine the voltage on which this cable is to operate. If the source is 12 volts, use the first group of steps; if the source is 6 volts, use the second group of steps following this note.

CONNECTIONS FOR 12 VOLT OPERATION

Refer to Figure 3A.

( ) Solder the shield and two black leads, previously connected, to lug 1 (S-3).

( ) Connect a bare wire from lug 6 (S-2) directly across the socket to lug 2 (S-1). Use sleeving.

CONNECTIONS FOR 6 VOLT OPERATION

Refer to Figure 3B.

( ) Connect a bare wire from lug 1 (S-4) to lug 2 (S-1).

( ) Connect a bare wire from lug 6 (S-2) directly across the socket to lug 3 (S-1). Use sleeving.

Check the connections just completed on the socket and when you are sure no shorts exist, snap the cap over the socket (if in doubt, tape connections). It might be wise to put a piece of tape on the outside of the shell with the operating voltage of the cable plainly marked for future reference.

DUMMY LOAD

( ) Construct the dummy load by carefully following Figure 6.

NOTE: Use care in soldering to the solder blob at the tip of the #47 lamp to avoid damaging the lamp.

DUMMY LOAD CONSTRUCTION

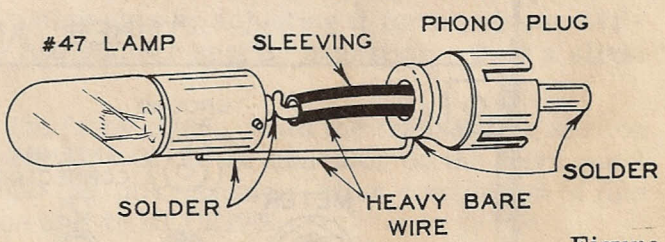


Figure 6

It might be wise to now recheck the HW-29 wiring once more against the Pictorials to be sure that everything is correct. Shake out any wire clippings or solder splashes which might be in the chassis. Now proceed with the test and calibration of the unit, as stated in the following pages of the manual.

INITIAL TEST AND CALIBRATION

This and the following section are concerned with adjustments and tests which should be performed before your HW-29 is put into use.

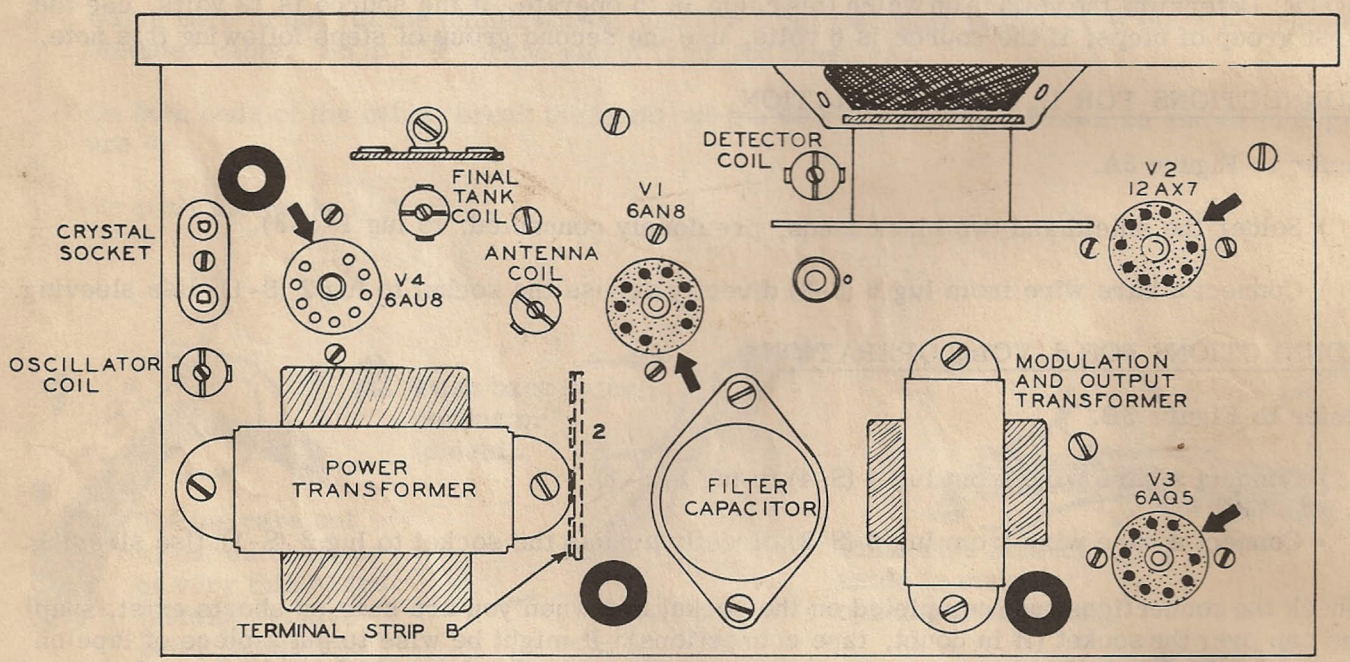
IT SHOULD BE NOTED HERE THAT AN AMATEUR RADIO OPERATOR AND STATION LICENSE OF PROPER GRADE IS REQUIRED TO PLACE THIS TRANSCEIVER ON THE AIR. Information regarding licensing and amateur frequency allocations may be obtained from publications of the Federal Communications Commission or the American Radio Relay League.

RECEIVER AND AUDIO SECTIONS

( ) Begin by checking the power supply for short circuits. An ohmmeter, with positive probe on pin 5 on the power connector and negative probe on the chassis, should read 240 KΩ or above, within one minute after allowing the filter capacitors to charge.

( ) The power supply output voltage will be checked next. Install one of the 1 1/2 ampere fuses and connect the 117 V power cord to the power connector. Plug the cord into a source of 105-125 V 50/60 cycle AC only, and turn the power switch ON. Measure the DC voltage developed between lug 2 on terminal strip B and ground. This voltage should be between 290 and 320 V DC. After making this measurement, check the clear neon "power" lamp for illumination to determine its proper functioning, then turn the unit OFF.

( ) Now install tubes V1 (6AN8), V2 (12AX7) and V3 (6AQ5). See Figure 7.



LOCATION GUIDE FOR COILS, TUBES AND CONTROLS

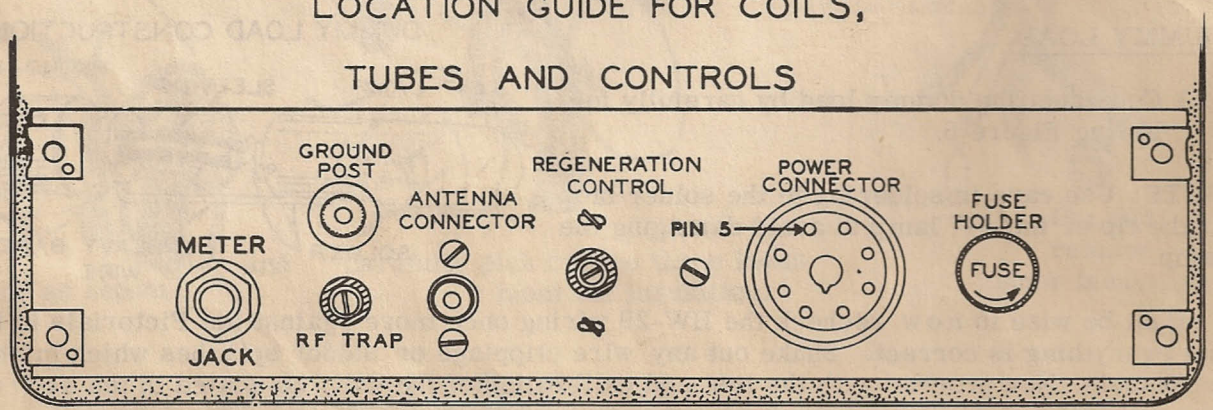


Figure 7

( ) Set the TRANSMIT-RECEIVE switch to the RECEIVE position, tuning to 50 mc.
( ) Rotate the REGENERATION control on the rear chassis apron full counterclockwise.
( ) Turn the unit on and advance the VOLUME control until the knob pointer is vertical.

( ) Now, slowly advance the REGENERATION control clockwise until a "hissing" or "rushing" sound is heard in the speaker. The correct setting will be approximately 15^{O} beyond the point where the noise becomes audible and is evidenced by a relatively uniform level of background noise over the entire receiver tuning range.
( ) If the above steps have all produced the desired effects, turn the transceiver OFF and go on to the following section. If any difficulty was encountered in the foregoing tests, refer to the IN CASE OF DIFFICULTY section on Page 44.

TRANSMITTER SECTION

( ) Install tube V4 (6AU8) and the crystal. Plug the dummy load into the antenna connector on the rear chassis apron. Loosen the adjustable ANT. TRIMMER adjustment marked "RF TRAP" approximately two turns from the "snugly closed" position.
( ) Set the TRANSMIT-RECEIVE switch to the TRANSMIT position, and rotate the oscillator coil slug until the screw extends approximately 3/8" above the top of the coil form. Rotate the final tank coil slug until the screw extends approximately 3/8" above the coil form. Turn the transceiver ON and, after allowing a half minute or so for warmup, slowly turn the oscillator coil adjustment screw outward (counterclockwise) and observe the dummy load lamp. It may glow with some setting of the oscillator coil slug, indicating operation of the oscillator. If the dummy load does not glow, turn the final tank coil adjustment screw counterclockwise one turn, return the oscillator coil slug to the 3/8" setting and repeat the step. Continue this process until the dummy load lamp glows.

NOTE: As an alternate method of oscillator coil adjustment, a VTVM with RF probe, may be connected between V4, pin 7 and the chassis. As the oscillator slug is adjusted the meter will abruptly give an indication of 4-5 volts negative, indicating that the oscillator is functioning.

( ) The RF final tank coil will be adjusted next, by observing the dummy load lamp as the coil slug is adjusted. Tune for maximum dummy load lamp brilliance. NOTE: It will be impossible to perform this step unless the previous step regarding oscillator coil adjustment has been successful. If difficulty is encountered in this step, it is suggested that you go back and recheck the preceding step.

( ) Next, slowly turn the crystal oscillator slug clockwise (into the coil) until the dummy load lamp goes out. Then slowly turn the slug back out of the coil (counterclockwise) and at the same time repeatedly switch between TRANSMIT and RECEIVE until the lamp comes on each time the switch is thrown into TRANSMIT. Repeat this step until you are sure the slug is just at the point which permits the oscillator to oscillate. Then turn the slug out of the coil (CCW) an additional half turn. At this setting the dummy load lamp should light each time the unit is switched to TRANSMIT. NOTE: This step must be followed carefully to insure maximum frequency stability.

( ) Recheck the adjustment of the final tank coil tuning slug by adjusting it for maximum brilliance of the dummy load lamp bulb, with the transmitter section operating. Only a slight adjustment should be required.

( ) Connect the microphone to the connector on the front panel. With the transmitter section operating, both the dummy load lamp bulb and the neon OUTPUT indicator on the front panel should increase in brilliance as you speak into the microphone. After completion of this test, disconnect the microphone and switch the unit to RECEIVE.

NOTE: Changing antennas may call for readjustment of both oscillator and final tank coil slugs.

INITIAL RECEIVER CALIBRATION

( ) Switch the unit OFF and insert the phone plug into the METER JACK on the rear chassis apron. Do not make any connections to the phone plug at this time.

( ) Now, temporarily connect a short length of hookup wire between V4, pin 1 and the ground post on the rear chassis apron.

( ) Turn the unit ON, and set the TUNING knob to the approximate position for your crystal frequency. Adjust the VOLUME control until the background "hiss" is audible and slowly adjust the receiver detector coil through its range until a definite "quiet spot" or absence of background noise is located. Leave the coil set to this spot. After completion of this test, turn the unit OFF, and remove the jumper wire and phone plug.

NOTE: Receiver adjustments inherently interact with each other, therefore receiver calibration should be rechecked after adjustment of the regeneration control and/or RF stage coil slug. It should also be pointed out that in receiver adjustments any tendency toward the appearance of multiple tuning points at any frequency within the tuning range of the receiver is a definite indication that the regeneration control is not sufficiently advanced in the clockwise direction. Speaking generally, if the regeneration control is set at the end of the tuning range where the background "hiss" is lowest, such "multiple tuning" will not be encountered and the noise level will be reasonably uniform over the entire tuning range.

If an accurate frequency standard is available, the 50 mc band edge may be set at the approximate center of the 50 mc marker; the upper band edge should then fall within the 54 mc marker.

( ) If all the adjustments and tests made thus far have been successful, go on with the final adjustments to follow. If difficulty has been encountered, refer to the IN CASE OF DIFFICULTY section, as before.

FINAL TEST AND ADJUSTMENT

NOTE: Due to the circuitry used to permit operation from 6 or 12 volt power sources, under NO circumstances can this unit be operated on external 12 volt DC power supplies with one or more tubes removed. Failure to heed this warning will result in one or more burned out tubes.

TRANSMITTER SECTION

( ) Connect the unit to the power source to be used (either 105-125 V 50/60 cycle AC or a vibrator pack type supply) using the appropriate power cord.

NOTE: The fuse size will have to be increased if a vibrator or similar type supply is used. An 8 ampere fuse is supplied with your kit for this purpose. The supply should have a nominal DC output voltage or 260 V at 60 ma current drain. The HEATHKIT vibrator power supplies meet this requirement.

If an external power supply is to be used, connect the external power supply cable to the power supply as follows:

( ) Connect the BLACK lead and shield to the ground or common terminal.

( ) Connect the RED lead to the B+ output terminal.

( ) Connect the WHITE lead to the terminal marked "A" input, BATT (battery), etc.

Connect the heavy RED and BLACK leads to the power source as follows:

( ) Connect the heavy BLACK lead to a convenient COMMON point of the power system. The chassis or any well grounded part of a car or truck is good. Use the COMMON power connection in a boat or other installation.

( ) Connect the heavy RED lead to the "HOT" side of the power system. It might be wise to connect it to a point that is switched by the ignition switch in a vehicle or boat to avoid running the battery down if the power switch of the HW-29 is accidentally left on when you finish using the mobile unit.

NOTE: In most cases, power source polarity will not be important but this is dependent upon the power supply used. A transistorized power supply is critical on this point. In a supply using a synchronous vibrator, be sure the unit is correctly connected for the polarity employed. The most common type of vibrator supply, that using a non-synchronous vibrator, usually works properly with either polarity.

( ) Turn the unit ON, plug in the dummy load and switch to TRANSMIT. Now measure the DC voltage present at lug 2 on terminal strip G with respect to ground (between 210 V and 250 V). Carefully record this reading for future use. If you are using a vibrator pack power supply, be sure the engine is running at a fast idle during this test, as the battery voltage will vary with engine speed. (The previous statement applies only to those applications where a generator is used to keep the storage battery charged.) 235v

( ) Turn the unit OFF and insert the phone plug into the METER JACK on the rear chassis apron. Refer to Figure 8 and connect a DC milliammeter capable of reading 30 ma (milliamperes) DC to the phone plug. Short lengths of hookup wire may be used, if your meter has no leads.

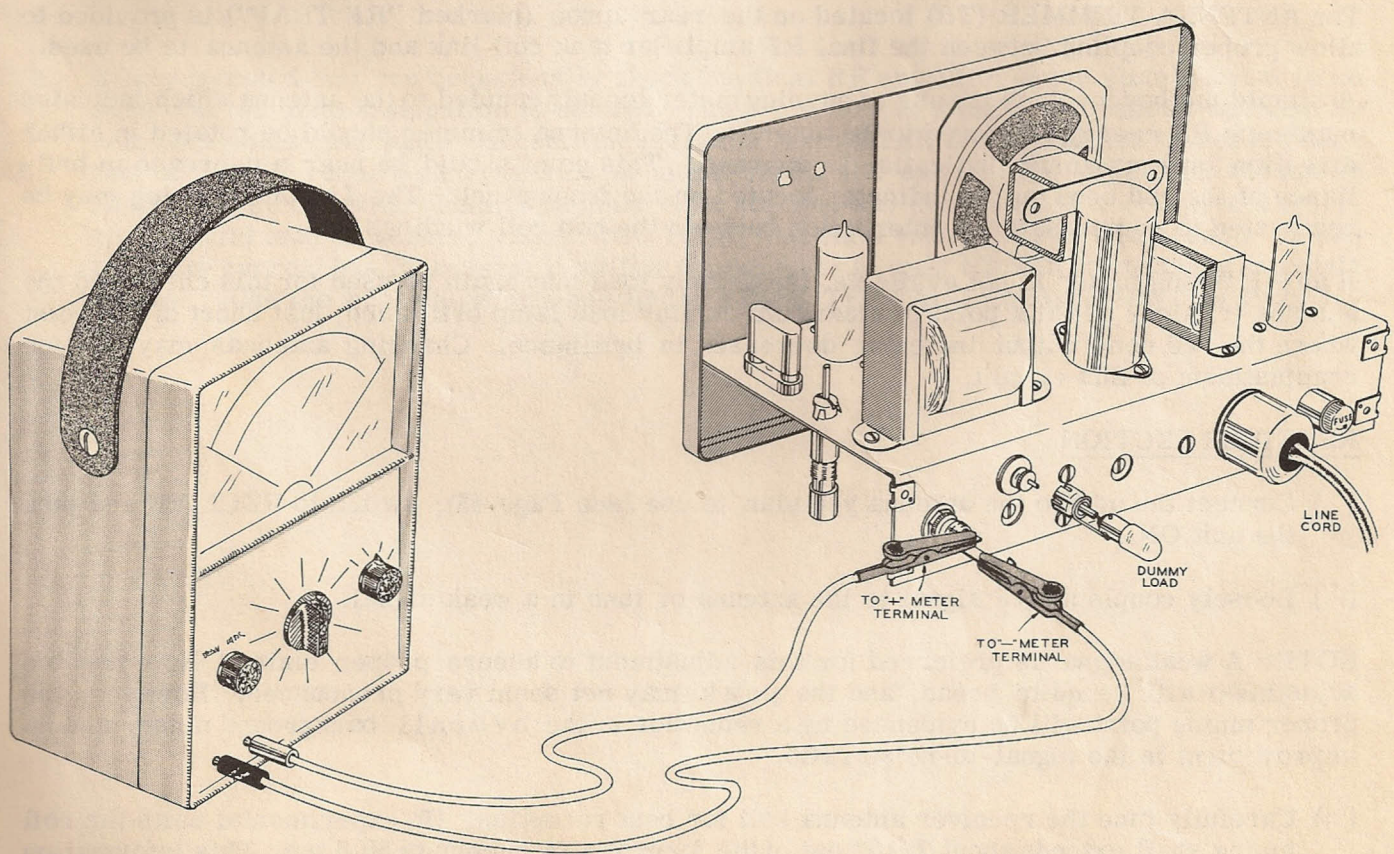


Figure 8

( ) Switch the unit to the TRANSMIT position and turn the power switch ON. As the unit warms up, the current meter reading will slowly climb and should stop in the vicinity of 16-22 ma. Record this reading also, and turn the unit OFF. Now remove the phone plug.

16 ma

( ) The input power to the final RF amplifier will be calculated next. NOTE that this measurement and calculation includes the total plate and screen power input to the RF amplifier stage, including that dissipated in the screen dropping resistor. The formula for calculating the input power in watts is:

(volts) x I (milliamperes) x 0.001 (conversion factor milliamperes to amperes) = W (watts)

To apply this formula, it is only necessary to multiply the voltage previously recorded by the current recorded in the preceding step. For example, a typical unit might check out as follows: Voltage at terminal strip G, lug 2, 230 volts; current measured at the METER JACK, 20 ma. When these figures are multiplied together, the product multiplied by 0.001 will be the input power to the final amplifier in watts. Substituting the values obtained above in the formula, we have:

230

230 volts x 20 milliamperes x 0.001 = 4.600 watts

23
235
.016
1410
235
3.760

235
.022
1470
470
5.170

Solution:

230 volts
x 20 milliamperes
4600
x 0.001
4.600 watts

If the power obtained is over 5 watts or less than 3.5 watts, turn the unit OFF and refer to the IN CASE OF DIFFICULTY section.

ANTENNA TRIMMER ADJUSTMENT

The ANTENNA TRIMMER (TR) located on the rear apron (marked "RF TRAP") is provided to allow proper coupling between the final RF amplifier tank coil link and the antenna to be used.

A simple method involves the use of a tuning meter loosely coupled to the antenna which indicates maximum RF energy delivered to the antenna. The antenna trimmer should be rotated in either direction until maximum indication is reached. This point should be near a decrease in brilliance of the red neon output indicator located on the front panel. The final coil slug may be readjusted to compensate for interaction between the two coil windings.

If an RF tuning meter is not available, the dummy load may again be used for this check and the antenna trimmer set at a point of maximum dummy load lamp brilliance, just short of the point where the red neon output indicator decreases in brilliance. Changing antennas may call for readjustment of this circuit.

RECEIVER SECTION

( ) Connect the unit to the antenna you plan to use (see Page 43), switch to RECEIVE and turn the unit ON.

( ) Loosely couple an RF signal to the antenna or tune in a weak signal.

NOTE: A weak signal is preferred for this adjustment to assure proper tuning. Note that the adjustment will be quite broad, and the peak may not seem very pronounced. However, the proper tuning point will be evidenced by a reduction in the overall background noise, and an improvement in the signal-to-noise ratio.

( ) Carefully tune the receiver antenna coil for best reception. (In experimental units the coil tuning shaft extends about 7/16" out of the form at a frequency of 50.5 mc. This information is given as a reference point only.)

( ) The receiver dial calibration may be rechecked at this time.

( ) Your HW-29 is now ready for installation in the cabinet. Slip the cabinet into place and secure with four 6-32 x 3/8" BHMS.

NOTE: The small card holder on the side of the cabinet may be used to display your license or a copy thereof if you prefer. It may also be used to display an identification card showing ownership and operating frequency, your station call, etc.

( ) Slip the license or card into the holder.

( ) Slip the clear plastic protective window over the license and slightly bend the upper corners of the frame to secure.

GENERAL

1. After becoming familiar with the overall operation of the receiver section of your HW-29, it is suggested that you experiment with the REGENERATION control setting. Although this control is not especially critical as to its setting, there is a setting at which the receiver will operate with maximum sensitivity and the best signal-to-noise ratio. This setting is best found experimentally by utilizing the type of signals normally received. Adjust the control while tuned in on a fairly weak station, and listen to the background noise. The proper setting will be the one at which the lowest background noise is heard. Do not expect the noise to disappear completely, and also note that some shift in receiver calibration may occur as the result of REGENERATION control adjustment. Also, note that some hiss should be heard at all positions of the tuning control with the antenna disconnected. As stated previously, a good indication of proper REGENERATION control adjustment is an essentially uniform hiss level across the entire tuning range.

2. It is suggested that you occasionally check the final RF amplifier stage plate current to be sure that the plate dissipation is normal. The procedure is simple; the cabinet need not be removed unless the plate current (measured at the METER JACK MJ) has increased over that originally recorded at the time of initial check and calibration. The plate voltage in this type of circuit will normally be quite constant, and any changes due to component aging, etc., would tend to reduce, rather than raise, the plate voltage. For this reason, unless the plate current has increased, it will be unnecessary to open the unit to measure the plate voltage. Use the procedure outlined under FINAL TEST AND ADJUSTMENT on Page 38.

INSTALLATION AT A FIXED LOCATION

Various factors should be considered before your HW-29 is installed at a fixed station. Several of these factors are listed below.

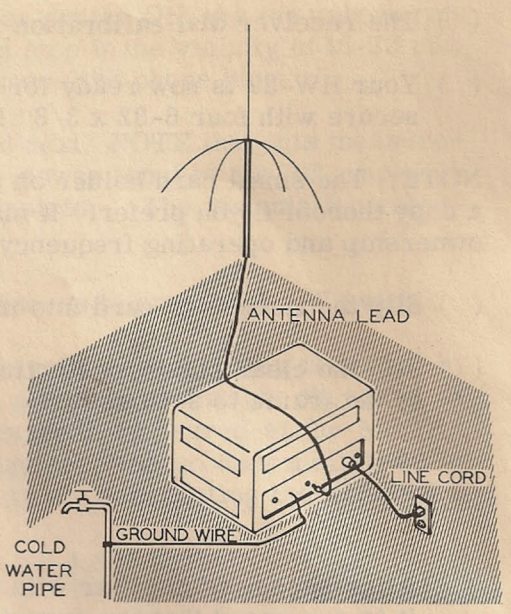


Figure 9

Choose an antenna type suitable for the type of performance your situation requires. For short range communication (1-3 miles), one of the small, relatively inexpensive base loaded type antennas should suffice. For greater, more reliable coverage, an antenna of the "ground plane" type is a good choice. Also, the matters of directivity and polarization in your antenna installation should be considered. Both types of antennas described thus far are essentially non-directional and are vertically polarized. A non-directional antenna system is ideal for applications involving fixed-to-mobile unit operation where the mobile units' locations are not predictable.

For point-to-point communication over an unusually long range or under adverse operating conditions, a directional "beam" type of antenna may be the solution. This type of antenna is more efficient and usually somewhat more expensive than the types previously discussed, and may also be somewhat more difficult to install. However, it does not lend itself to applications where several mobile units in different locations are to be contacted, due to its relatively high directional characteristics.

In general, a high antenna location is always preferable. For this reason it is strongly recommended that you locate your antenna, regardless of the type chosen, as high as possible.

Be sure the location chosen for the Transceiver is favorable to your antenna location. Avoid excessively long antenna lead-in lengths, if at all possible. However, lengths up to 100 feet or so may be advantageous if they permit a better antenna location.

Try to locate your HW-29 near a good earth ground, such as a water pipe going directly underground. Although the use of an earth ground is not essential for proper operation of your HW-29, in some instances improved performance will result, and it is considered good practice to have the system grounded.

INSTALLATION AT A MOBILE LOCATION

The section to follow will deal specifically with installation in an automobile or light truck, but the majority of this information is also applicable to other mobile installations (boats, etc.). See Figures 10A and 10B.

In a mobile installation, the antenna system chosen is of great importance. Any mobile system is at a decided disadvantage, due to the lack of a good earth ground, the only ground being the capacitive coupling between the vehicle body and the earth below.

With few exceptions, the antenna best suited for mobile service will be either some sort of vertically polarized whip antenna or the current "halo" antenna for horizontal polarization. It is suggested that you contact hams in your area to determine the type of polarization used in your locality since some areas prefer one over the other and it becomes very difficult to maintain communications under cross-polarization conditions at this frequency. The "shortened" or base loaded type whip antenna will normally suffice for short range (1-3 mile) communication. Greater range and more reliable operation can be obtained through the use of a full length one-quarter wave whip antenna. Both of these antenna types use the metal vehicle body as their "ground plane" and for this reason are normally somewhat directional when installed in any practical location, such as the rear of the vehicle. No specific information about the actual directional characteristics of any given installation can be given here due to variables in antenna location, but a typical installation might be expected to yield a radiation pattern similar to that shown in Figure 11.

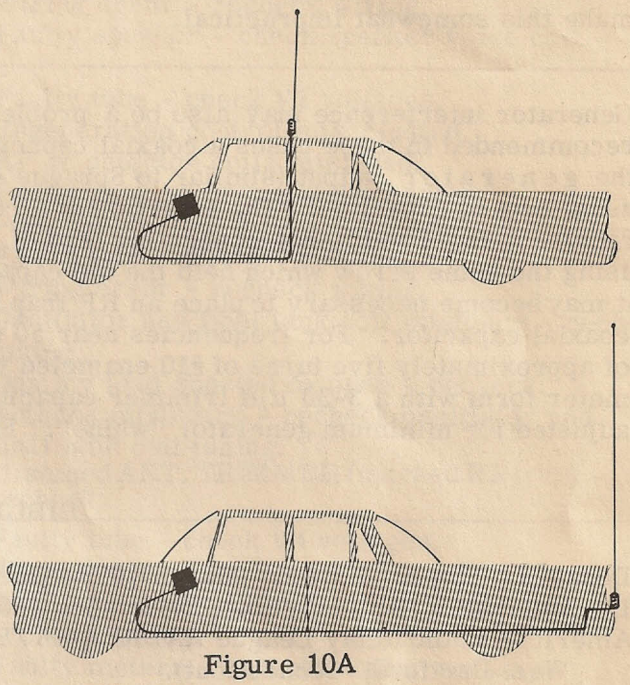


Figure 10A

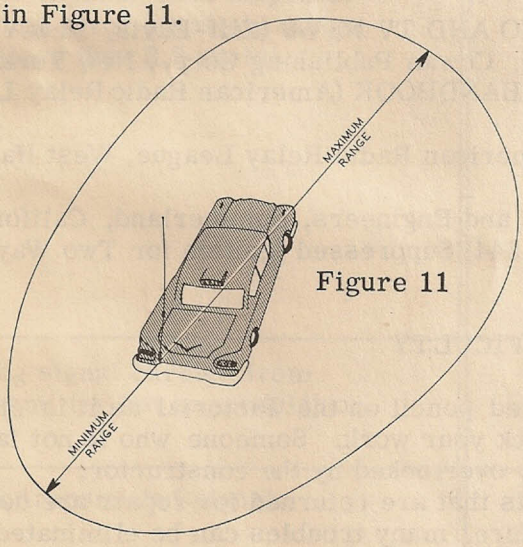


Figure 11

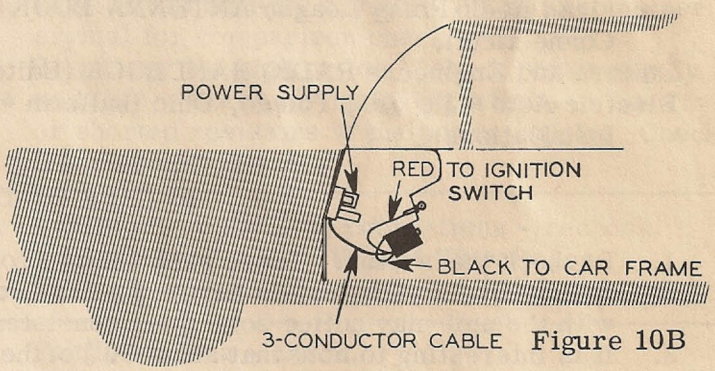


Figure 10B

This directional characteristic normally causes no serious difficulty, but you should be aware of its existence.

In nearly all mobile installations, the ambient noise level will be higher than at a fixed location. For this reason, serious consideration should be given to the physical position of the unit with respect to the operator. Obviously, only those locations within easy reach of the operator should be considered, but usually in any given situation more than one such location exists. Try to pick the location which offers the best compromise of these requirements.

After this location has been chosen, the unit should be securely fastened to some solid surface. Simple sheet metal brackets, fashioned to fit your particular requirements, should suffice.

Engine ignition interference may be a problem, but this is usually relatively easy to correct. Actual field tests in a variety of vehicles have indicated no suppression is required (in the average vehicle) beyond that normally provided for a vehicle with a "factory equipped" standard broadcast band radio receiver. If an ignition interference problem is present nearly any radio service shop, skilled in auto radio repair, should be able to help you locate and correct the difficulty. One possible cause of such interference can be the exhaust system. The muffler and tail pipe are frequently mounted with rubber insulated mounting clamps to reduce vibration, and thus the

muffler and tail pipe are electrically grounded at the engine end only. This problem is more likely to be present if a bumper mount type antenna is employed, and can usually be solved by electrically grounding the tail pipe to the vehicle frame at one or more points. Many other possibilities could be mentioned here, but the many variables between vehicles and installations make this somewhat impractical.

Generator interference may also be a problem as evidenced by a generator "whine". It is recommended in these cases a coaxial capacitor of .5 μfd value with a current rating exceeding the generator output (similar to Sprague 48P18 rated at 40 amperes) be used to replace the usual bypass capacitor. The insertion of a coaxial capacitor in the armature winding lead will require a short additional connecting lead of #10 gauge wire. The capacitor case is grounded using the same screw which held the old capacitor in place. If generator "whine" still persists, it may become necessary to place an RF trap in series with the armature lead in addition to the coaxial capacitor. For frequencies near 50 to 54 megacycles, such a trap may be constructed of approximately five turns of #10 enameled wire, space wound to 1 1/2" in length, on a 1" diameter form with a 3-30 μμf trimmer capacitor in parallel. The trimmer capacitor can then be adjusted for minimum generator "whine". For further information refer to BIBLIOGRAPHY.

BIBLIOGRAPHY

Donald L. Stoner, Article, March 1959 issue RADIO AND TV NEWS (Ziff-Davis, New York).

Lee Aurick, W2QEX, Article, November 1959, CQ, Cowan Publishing Corp., New York, N. Y.

American Radio Relay League RADIO AMATEUR'S HANDBOOK (American Radio Relay League, West Hartford, Connecticut).

American Radio Relay League ANTENNA BOOK (American Radio Relay League, West Hartford, Connecticut).

Editors and Engineers RADIO HANDBOOK (Editors and Engineers, Summerland, California).

Electric Auto-Lite Co., Toledo, Ohio (bulletin #M1544) Suppressed Ignition for Two Way Radio Installations.

IN CASE OF DIFFICULTY

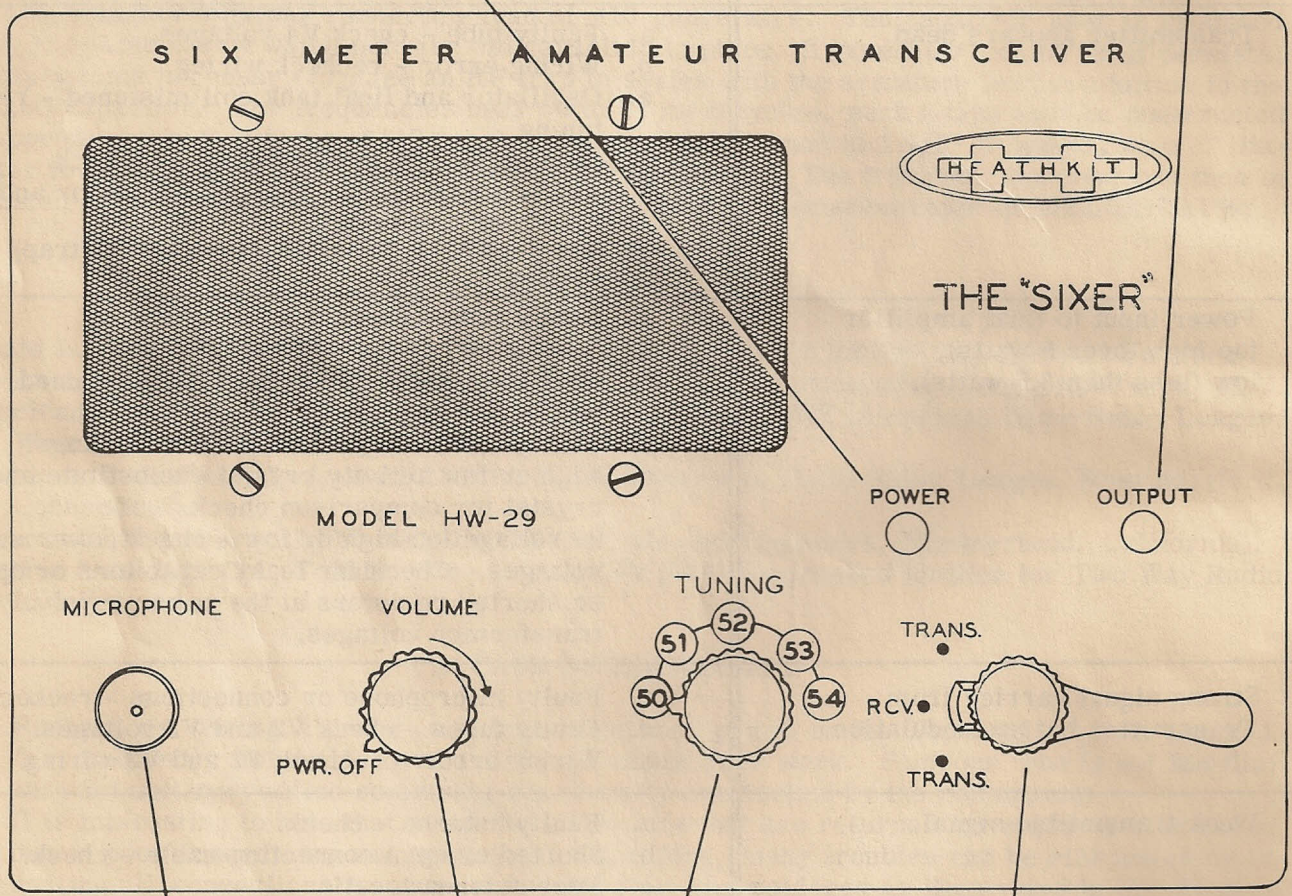
1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair are defective due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as illustrated in the Figures found in the SOLDERING TECHNIQUES section of this manual.
3. Check tube locations to be sure that all tubes are in their proper locations. Make sure that all tubes light up properly and test OK in a reliable tube checker.
4. Check the values of the component parts. Be sure that the proper parts have been wired into the circuit, as shown in the Pictorial Diagram 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 beneath the chassis.
6. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those found on the Schematic Diagram.
7. A review of the circuit description and associated schematic diagrams will prove helpful in indicating where to look for trouble.
8. Listed on the following page are some possible difficulties which might arise in the construction and operation of your HW-29 Transceiver. The suggested corrective measures given definitely DO NOT RULE OUT all other possibilities, but are given primarily to direct your attention to the areas most likely to be faulty.

DIFFICULTY	POSSIBLE CAUSE AND CORRECTION
1. Receiver section dead.	a. Faulty tubes - check V1, V2 and V3 voltages. b. Wiring error - recheck wiring. c. Faulty speaker - check speaker voice coil.
2. Receiver section weak.	a. Faulty tube - check V1 voltages. b. Regeneration control misadjusted. c. RF or detector coils mistuned. d. Faulty antenna or connecting cable.
3. Transmitter appears dead.	a. Faulty tube - check V4 voltages. b. Wiring error - recheck wiring. c. Oscillator and final tank coil mistuned - recheck tuning. d. Dummy load shorted or open - recheck. e. Antenna mismatch - recheck oscillator and final tank coil tuning. f. Mistuned ANT. TRIMMER (marked RF trap) - recheck.
4. Power input to final amplifier too high (over 5 watts), or too low (less than 3.5 watts).	a. Faulty tube - check V4 voltages. b. Wiring error - recheck wiring. c. Oscillator and/or final tank coil mistuned - recheck tuning. d. Faulty meters - recheck meter readings. e. High or low activity crystal - substitute another crystal for comparison check. f. B+ voltage too high or low - check power supply voltages. Check for leaky capacitors or open or shorted resistors at the power supply. Check transformer voltages.
5. Strong signal carrier from Transmitter but no modulation.	a. Faulty microphone or connections - recheck. b. Faulty tubes - check V2 and V3 voltages. c. Wiring error - recheck V2 and V3 wiring.
6. Weak transmitted signal.	a. Faulty antenna - check. b. Shorted or open connecting cable - check. c. Poor antenna location.
7. Interference consistently encountered either during transmission or reception.	a. Change transmitting frequency to more advantageous location in band - check for a frequency with minimum interference.
8. Low power supply voltages.	a. Low line voltage - check. b. Leaky filter capacitors - check. c. Error in dropping resistor values or wiring - check. d. Faulty transformer - check voltages.
9. Modulation hum.	a. Power supply filter capacitor ground connection ungrounded - resolder. b. Faulty tubes - check V2 and V3. c. Open grid circuit connection - check wiring and soldering to V2 and V3.

CONTROL FUNCTIONS

Power Indicator. Informs the operator when power is applied to the unit.

Output Indicator. Informs the operator that the unit is on transmit by indicating the presence of RF in the transmitter section. Also gives an indication that the speech amplifier and modulator circuitry is operating properly by "flickering" or changing in intensity as the operator speaks into the microphone.



Microphone Connector. The electrical connections between the microphone and unit are made via this connector, to permit removal of the microphone as desired.

VOLUME Control. Permits varying the sound output from the speaker to suit your individual desire. A switch at the counterclockwise end of rotation disconnects the unit from its power source.

TUNING Control. Permits the receiver to be tuned at will. Note that this control has NO effect on transmitter frequency.

TRANSMIT-RECEIVE Switch. The middle, or RECEIVE position actuates the receiver section of the HW-29. Pushing the knob down permits short transmissions of an intermittent nature, and is comparable to a similar function provided in many intercoms. Lifting up allows continuous transmission for longer periods of time without continuous pressure. This position would normally be used primarily for mobile operation. Both TRANSMIT positions perform the same functions electrically.

SERVICE

If, after applying the information contained in this manual and your best efforts on the HW-29, you are still unable to obtain proper performance from the instrument, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for the purpose of providing Heath customers with a personalized technical consultation service; this service is available to you without charge. The technical consultants are thoroughly familiar with all details of the Transceiver and can usually localize the trouble from a suitable description of the difficulty encountered. It is, of course, necessary that you provide full and complete information concerning your problem when writing to the Technical Consultation Department for assistance. For instance, clearly identify the kit involved, giving the purchase date and, if possible, the invoice number; describe in detail the difficulty that you have encountered; state what you have attempted to do to rectify the trouble, what results have been achieved, and include any information or clues that you feel could possibly be of value to the consultant who handles your problem. Failure to provide complete descriptive details may lead to incorrect assumptions on the part of the consultant and needless delay in the solution to your problem. Quite frequently, when the information given the consultants is complete, concise and reliable, a diagnosis of the difficulty can be made with confidence and specific instructions given for its correction. If replacement of a component is involved in the correction, the component will be shipped to you, subject to the terms and conditions of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a fixed fee of $ 6.00, plus the price of any additional parts or material required. However, if the instrument is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase and give invoice number, if possible.

Local Service by Authorized HEATHKIT dealers is also available and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although you may find charges for local service somewhat higher than those listed in HEATHKIT manuals (for factory service), the amount of increase is usually offset by the transportation charges you will pay if you elect to return your kit to the Heath Company.

HEATHKIT dealers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company. It will be necessary that you verify the purchase date of your kit by presenting your copy of the Heath Company invoice to the authorized dealer involved.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if your local dealer assists you in locating a defective part (or parts) in your HEATHKIT equipment, or installs a replacement part for you, he may charge you for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the WARRANTY.

THESE SERVICE POLICIES APPLY ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned NOT repaired.

For information regarding modifications of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic outlet stores. Although the Heath Company welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder, according to information which will be much more readily available from some local source.

REPLACEMENTS

Material supplied with HEATHKIT equipment has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

ATTACH A TAG TO THE INSTRUMENT BEARING YOUR NAME, COMPLETE ADDRESS, INVOICE NUMBER ON WHICH THE INSTRUMENT WAS PURCHASED, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the Instrument in heavy paper, exercising care to prevent damage. Place the wrapped instrument in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the instrument and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Mich.

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit, if in HIS OPINION, the article is inadequately packed for shipment. Your instrument will be returned by express collect.

SPECIFICATION CHANGES

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

WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY

HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

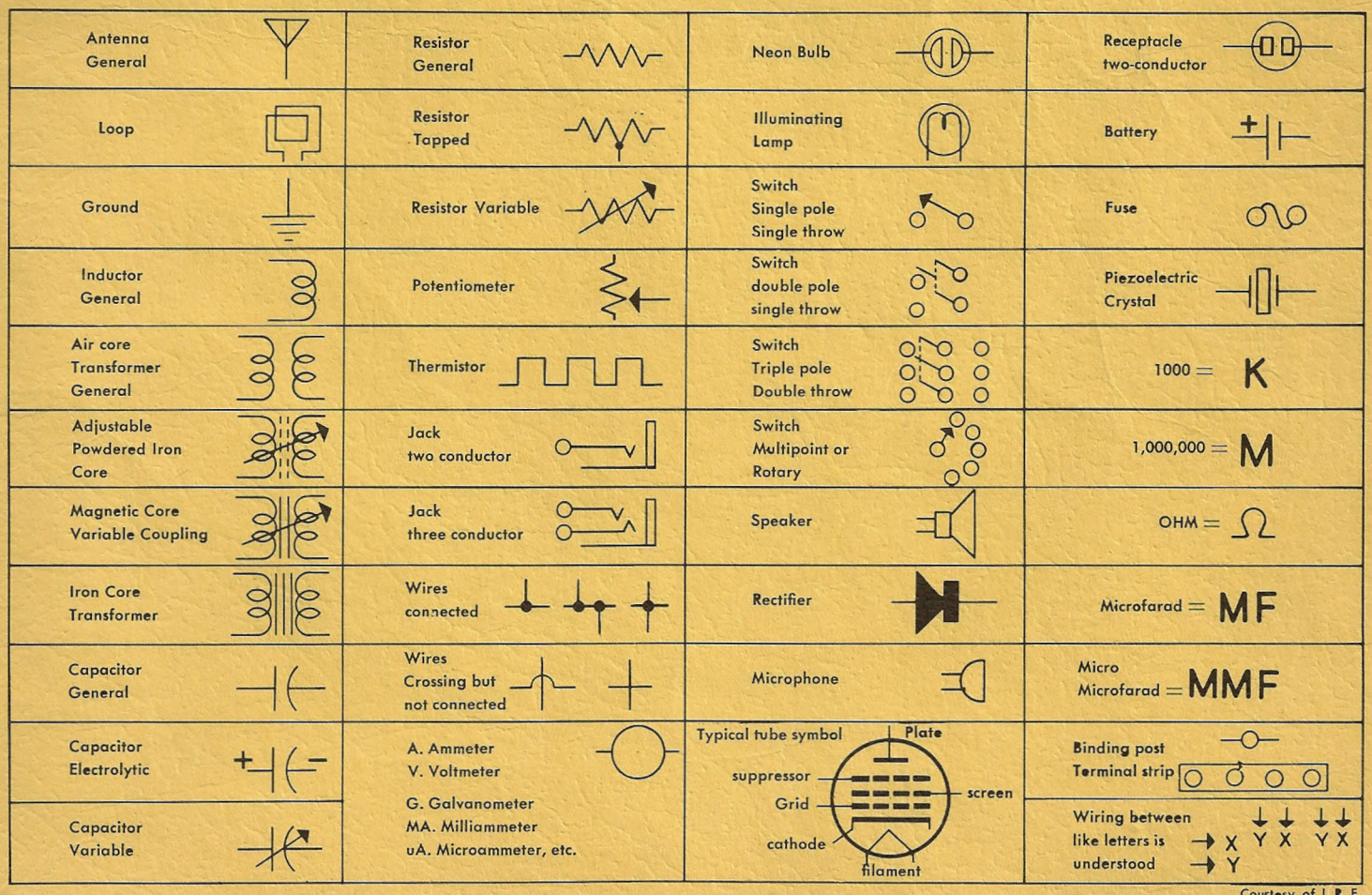
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



Courtesy of I. R. E.

K6-4292

HEATH COMPANY

A Subsidiary of Daystrom Inc.

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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