

# instructions

FOR THE



## 10 METER ACCESSORY

MODEL HWA-104-1



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HEATH COMPANY  
BENTON HARBOR, MICHIGAN 49022

I-597-1476

## INTRODUCTION

The Heathkit Model HWA-104-1, 10 Meter Accessory extends the frequency coverage of the Model HW-104 Single Sideband Transceiver from 29.0 MHz to 29.7 MHz. The components are all installed on the Receiver Front End and the HFO/Premixer circuit boards in special areas provided for them (printed in yellow). The circuit of the Accessory is included on the Schematic Diagrams of these two circuit boards in your HW-104 Manual.

NOTE: If you purchased this Accessory at the same time as you purchased the HW-104 Transceiver, assemble the Transceiver first. You will be directed to this kit at the proper time during the assembly of the Transceiver.

## PARTS LIST

Check each part against the following list. Make a check (✓) in the space provided as you identify each part. Return any part that is packed in an individual envelope with the part number on it back in the envelope after you identify it until it is called for in a step. Do not throw away any packing material until all parts are accounted for.

<u>KEY</u> <u>No.</u>	<u>QTY.</u>	<u>DESCRIPTION</u>	<u>PART</u> <u>No.</u>	<u>CIRCUIT</u> <u>Component No.</u>
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### RESISTORS, 1/2-watt

A1 ( )	1	470 $\Omega$ (yellow-violet-brown)	1-6	R435
A1 ( )	4	1000 $\Omega$ (brown-black-red)	1-9	R431, R436, R468, R469
A1 ( )	1	3300 $\Omega$ (orange-orange-red)	1-14	R434
A1 ( )	3	4700 $\Omega$ (yellow-violet-red)	1-16	R433, R437, R473
A1 ( )	2	100 k $\Omega$ (brown-black-yellow)	1-26	R432, R438



### RESISTOR, 1/4-watt

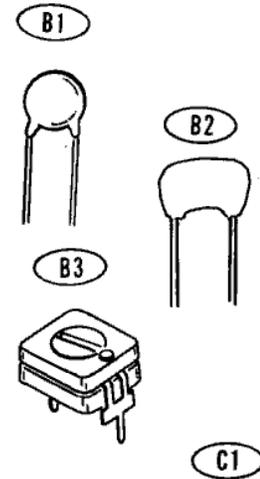
A2 ( )	1	1000 $\Omega$ (brown-black-red)	1-2-12	R710
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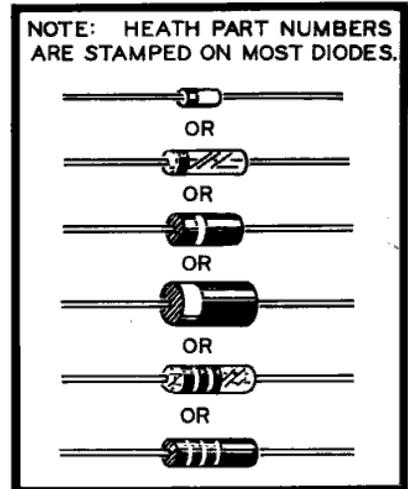
KEY No.	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.
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**CAPACITORS**

B1 ( )	3	5 pF disc	21-78	C428, C474, C476
B1 ( )	2	7.7 pF disc	21-181	C426, C433
B1 ( )	2	10 pF disc	21-3	C429, C431
B1 ( )	5	.01 $\mu$ F disc	21-176	C427, C432, C473, C755, C758
B2 ( )	1	33 pF mica	20-160	C475
B2 ( )	1	150 pF mica	20-149	C756
B3 ( )	3	1-8 pF trimmer	31-68	C754, C757, C759


**DIODES-TRANSISTORS**

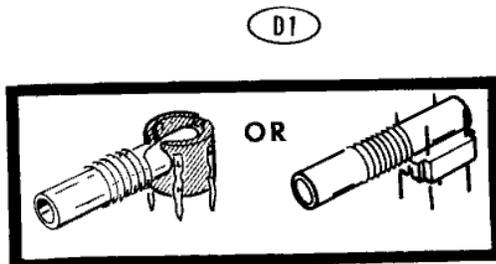
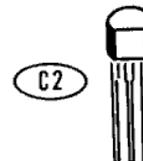
C1 ( )	4	1N458 diode	56-24	D441, D442, D717, D718
C1 ( )	8	1N4149 diode	56-56	D415, D416, D417, D418, D423, D425, D715, D716
C2 ( )	1	MPS6521 transistor	417-172	Q404


**INDUCTORS**

D1 ( )	2	Variable inductor	40-687	L408, L409
D2 ( )	2	3.975 $\mu$ H (red dot)	40-1879	L420, L421
D3 ( )	2	4.5 $\mu$ H (red dot)	40-1875	L721, L722
D3 ( )	2	1.7 $\mu$ H (white and green dots)	40-1871	L723, L724
D4 ( )	1	Ferrite bead	475-10	

**CRYSTALS**

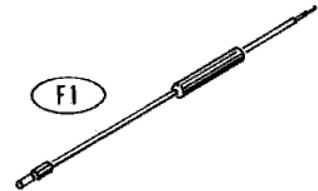
E1 ( )	1	37.895 MHz	404-421	Y408
E1 ( )	1	38.395 MHz	404-422	Y409



<u>KEY</u> <u>No.</u>	<u>QTY.</u> <u>_____</u>	<u>DESCRIPTION</u> <u>_____</u>	<u>PART</u> <u>No.</u>	<u>CIRCUIT</u> <u>Component No.</u>
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**MISCELLANEOUS**

F1	( )	1	Coil alignment tool	490-1
	( )	1	Parts Order Form	597-260
	( )	1	Instruction sheet (see front cover for part number)	
	( )		Solder (Additional 3' lengths of solder, #331-6, can be ordered for 25 cents each)	



The prices shown on the separate "Heath Parts Price List" apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering (Michigan residents add 4% sales tax) to cover insurance, postage, and handling. Outside the U.S.A., parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Customer Service" inside the rear cover of this Manual.

IDENTIFICATION DRAWING

PART NUMBER

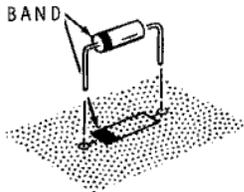


The steps performed in this Pictorial are in this area of the circuit board.

START

( ) Remove the receiver front end circuit board from compartment GG in your Transceiver (if this has not already been done). Then position the circuit board as shown in the identification drawing and perform the following steps.

NOTE: When you install a diode, always match the banded end of the diode with the band mark on the circuit board.

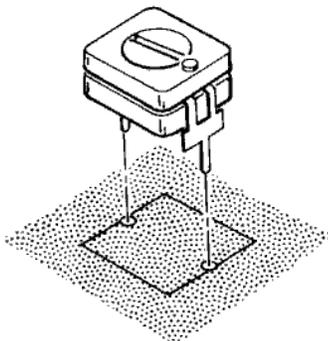


( ) D715 and D716: Two 1N4149 diodes (#56-56).

( ) D718: 1N458 diode (#56-24).

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

NOTE: The square 1-8 pF trimmer capacitors may be installed either way in the circuit board. Solder the lugs to the foils as you install the capacitors.



( ) C759: 1-8 pF trimmer capacitor.

( ) C757: 1-8 pF trimmer capacitor.

( ) C754: 1-8 pF trimmer capacitor.

( ) D717: 1N458 diode (#56-24).

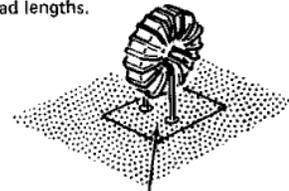
( ) Solder the leads to the foil and cut off the excess lead lengths. Save one cutoff lead for use later.

CONTINUE

( ) C758: .01  $\mu$ F disc.

( ) 1" bare wire. Use the cutoff lead you saved earlier.

NOTE: In the following steps, mount the toroid coils as shown. Put one drop of cement (from the tube of cement supplied with the HW-104, if you still have it) on the bottom of each coil. Then press the coil against the circuit board, solder the leads to the foil, and cut off the excess lead lengths.



( ) L724: Coil #40-1871 (white and green dots).

( ) L723: Coil #40-1871 (white and green dots).

( ) L722: Coil #40-1875 (red dot).

( ) C756: 150 pF mica.

( ) L721: Coil #40-1875 (red dot).

( ) C755: .01  $\mu$ F disc.

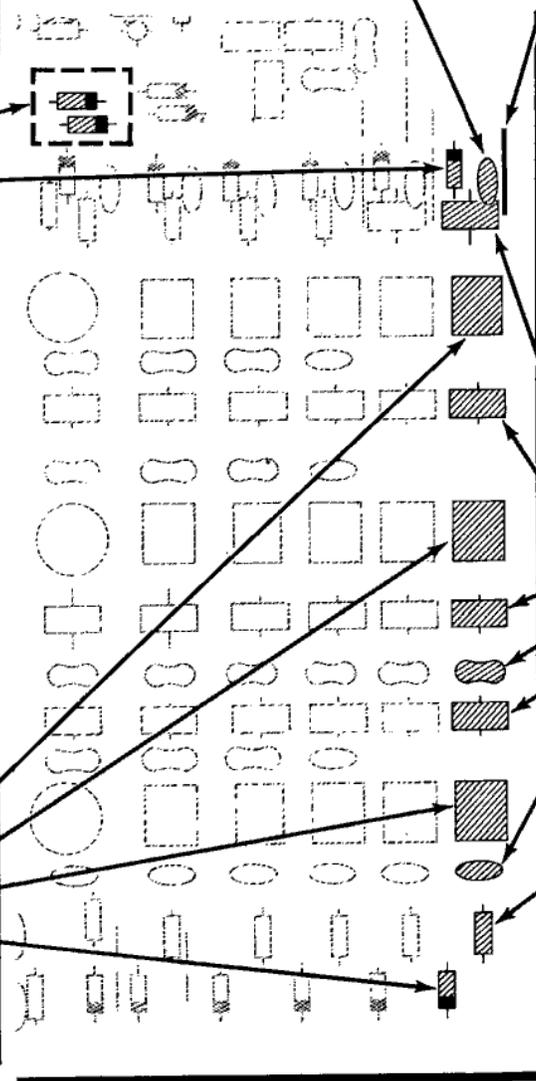
NOTE: Be sure to use the 1/4-watt (smaller) resistor in the next step.

( ) R710: 1000  $\Omega$ , 1/4-watt (brown-black-red).

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

NOTE: There may be several unused holes in the circuit board.

Set this circuit board aside until it is called for.



PICTORIAL 1-1

IDENTIFICATION  
DRAWING

The steps performed in this Pictorial are in this area of the circuit board.



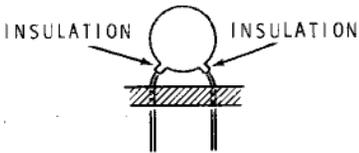
PART  
NUMBER

**START** ↙

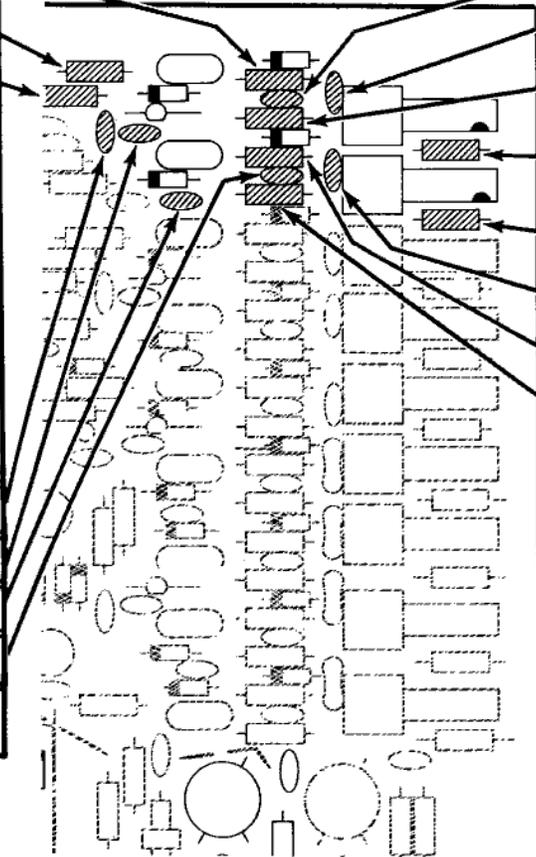
Remove the HFO/premixer circuit board from compartment DD in your Transceiver (if this has not already been done). Then position the circuit board as shown in the identification drawing and perform the steps in the following Pictorials.

- ( ) R437: 4700  $\Omega$  (yellow-violet-red).
- ( ) R434: 3300  $\Omega$  (orange-orange-red).
- ( ) R435: 470  $\Omega$  (yellow-violet-brown).

NOTE: When you install disc capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



- ( ) C429: 10 pF disc.
- ( ) C428: 5 pF disc.
- ( ) C431: 10 pF disc.
- ( ) C427: .01  $\mu$ F disc.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



**CONTINUE** ↘

- ( ) C432: .01  $\mu$ F disc.
- ( ) C433: 7.7 pF disc.
- ( ) R438: 100 k $\Omega$  (brown-black-yellow).
- ( ) R436: 1000  $\Omega$ , 1/2-watt (brown-black-red).
- ( ) R431: 1000  $\Omega$ , 1/2-watt (brown-black-red).
- ( ) C426: 7.7 pF disc.
- ( ) R433: 4700  $\Omega$  (yellow-violet-red).
- ( ) R432: 100 k $\Omega$  (brown-black-yellow).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-1

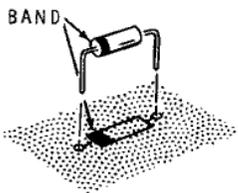
The steps performed in this Pictorial are in this area of the circuit board.

IDENTIFICATION DRAWING

PART NUMBER

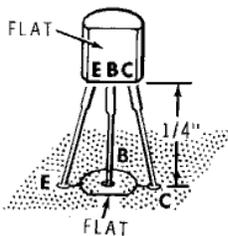
**START**

NOTE: When you install a diode, always match the banded end on the diode with the band mark on the circuit board.



( ) D416: 1N4149 diode (#56-56).

( ) Q404: MPS6521 transistor (#417-172). First line up the flat of the transistor with the outline of the flat on the circuit board. Insert the transistor leads into their correct holes indicated by E, B, and C. Solder each lead to the foil and cut off the excess lead length.



( ) D415: 1N4149 diode (#56-56).

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

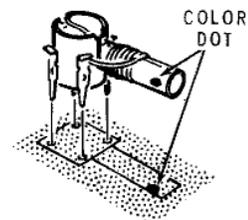
**CONTINUE**

( ) D418: 1N4149 diode (#56-56).

( ) D417: 1N4149 diode (#56-56).

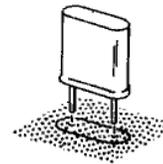
( ) Solder the leads to the foil and cut off the excess lead lengths.

Position each coil over its outline and insert all four pins through their holes. Make sure no terminals of adjacent coils touch each other. Then solder the coil pins to the foil.



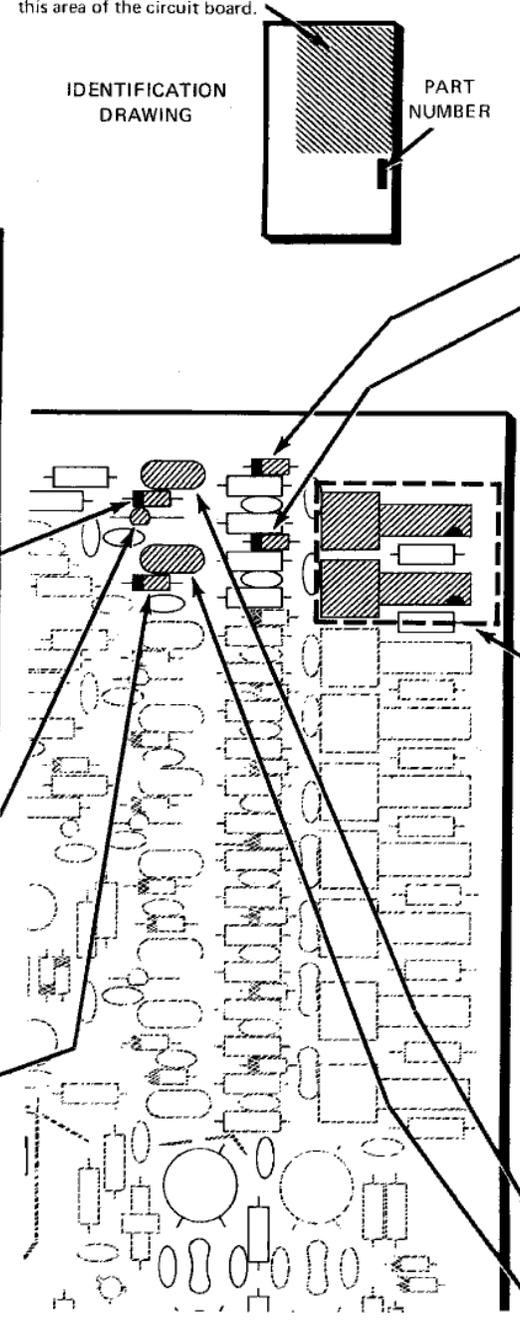
( ) L408 and L409: Two coils (#40-687 green dot).

NOTE: Each crystal frequency is screened on the circuit board. The component numbers are also screened. Be sure you mount each crystal in its correct location. Use a minimum amount of heat and solder the leads to the foil.



( ) Y409: 38.395 MHz crystal (#404-422).

( ) Y408: 37.895 MHz crystal (#404-421).



PICTORIAL 2-2

IDENTIFICATION  
DRAWING

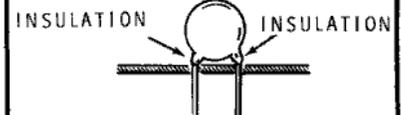


PART  
NUMBER

The steps performed in this Pictorial are in this area of the circuit board.

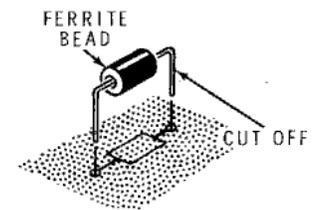
CONTINUE

NOTE: When you install disc capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



- ( ) C476: 5 pF disc.
- ( ) C473: .01  $\mu$ F disc.
- ( ) C475: 33 pF mica.
- ( ) R468: 1000  $\Omega$ , 1/2-watt (brown-black-red).
- ( ) C474: 5 pF disc.
- ( ) R469: 1000  $\Omega$ , 1/2-watt (brown-black-red).

NOTE: When you install a ferrite bead, use a cutoff lead to mount the bead to the circuit board.



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

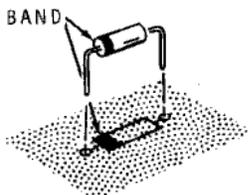
Set the circuit board aside until it is called for in a step.

FINISH

START

- ( ) R473: 4700  $\Omega$  (yellow-violet-red).

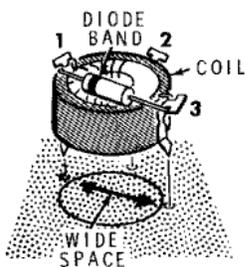
NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board.



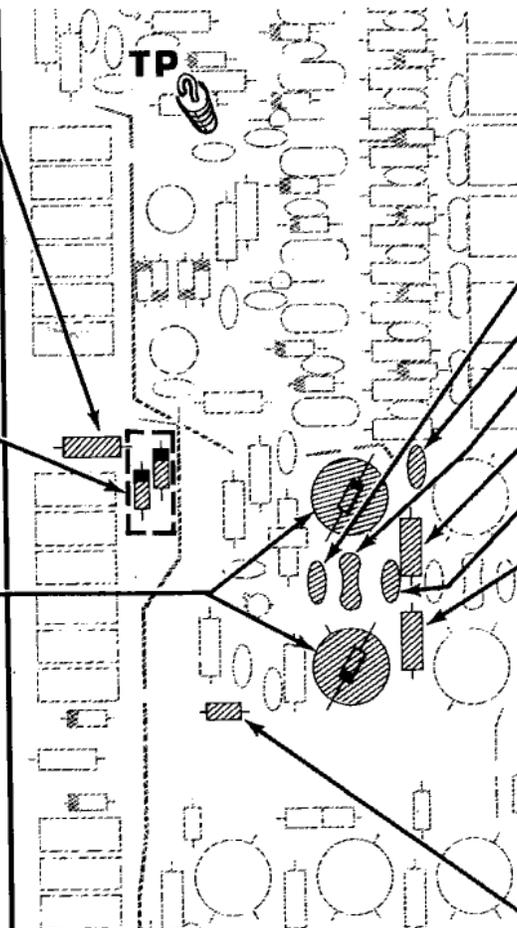
- ( ) D423 and D425: Two 1N4149 diodes (#56-56).

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

- ( ) L420 and L421: Two coils #40-1879 (red dot). Solder the lugs to the foil.

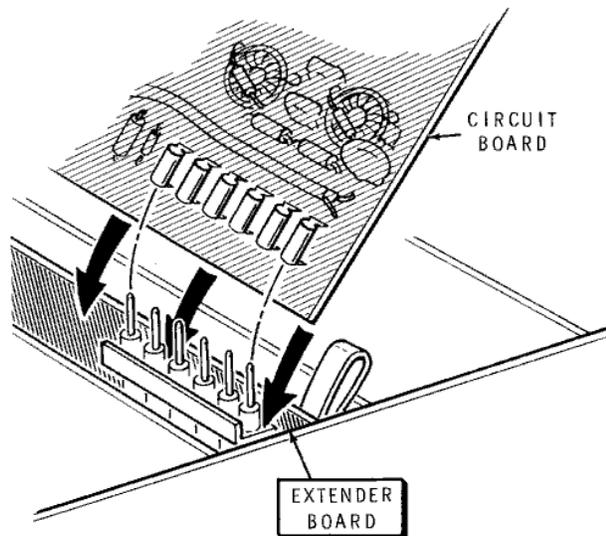


- ( ) D441 and D442: Connect a 1N458 diode (#56-24) between lugs 1 and 3 of each coil. Be sure you position the banded end of each diode as shown.



PICTORIAL 2-3

## ADJUSTMENTS



**Figure 3-1**

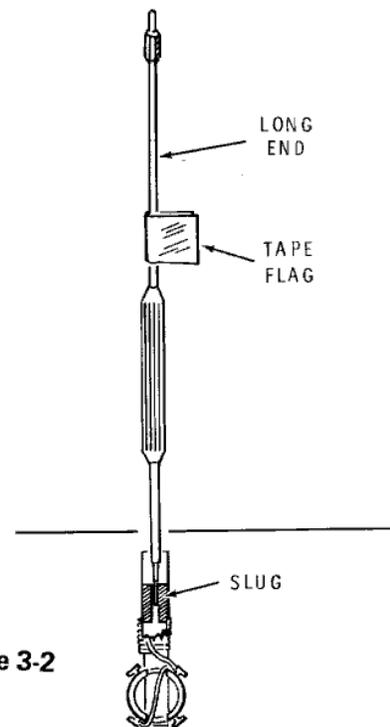
**NOTE:** If you are assembling this Accessory at the same time that you are building the HW-104 Transceiver, proceed directly to the "Tests and Adjustments" section of that Manual and skip the following steps. If you are assembling this Accessory in a properly operating HW-104 Transceiver, complete the following steps.

### HFO COIL ADJUSTMENT

- ( ) Remove the top cover from your Transceiver, if this has not already been done.
- ( ) Plug the extender board (supplied with the Transceiver) into compartment DD in your Transceiver.

**NOTE:** Refer to Figure 3-1 for the method of plugging circuit boards into the extender board.

- ( ) Plug circuit board D into the extender board. First, remove the set of extender board pins on the left for which there are no sockets on board D.



**Figure 3-2**

**NOTE:** You will adjust the high frequency oscillator (HFO) coils in the following steps. Refer to Figure 3-2 for the method of inserting the alignment tool into the coils. Also, make a "flag" out of tape for the alignment tool, as shown, so you can count the number of turns it makes. Rotate the tool for each adjustment until the voltage peaks on the meter scale, and then rotate it clockwise, as shown in the chart.

- ( ) Set your voltmeter to its lowest +DC scale. Connect the meter common lead to the chassis and connect the other lead to the free lead of the 2200  $\Omega$  vertical resistor marked TP (near Q402).
- ( ) Depress the ON button.

Adjust each HFO coil as described in the following chart. Before you adjust each coil for the peak voltage, turn the slug counterclockwise two full turns. Then rotate it further counterclockwise, if necessary, to 0 volts. Then rotate the slug clockwise for the peak voltage, which will be typically 0.2 VDC to 0.5 VDC.

BAND SWITCH	COIL NUMBER	ROTATE SLUG FOR <u>PEAK</u> VOLTAGE. THEN ROTATE SLUG AS DESCRIBED.
( ) 29.0	L408	1 turn clockwise
( ) 29.5	L409	1 turn clockwise

## BOARD G

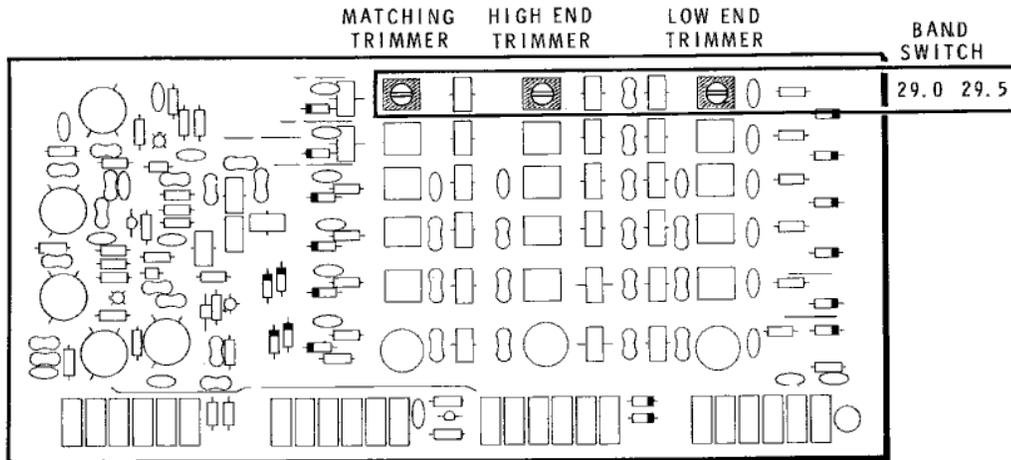


Figure 3-3

## POSSIBLE CAUSE CHART

1. HFO will not oscillate on one or both bands (meter remains at 0).
  - A. BAND switch.
  - B. Chassis wiring.
  - C. Refer to the HFO/Premix circuit board in the "Maintenance" section of the HW-104 Operation Manual.

## PRESELECTOR BANDPASS FILTER ALIGNMENT

The object of this procedure is to adjust each bandpass filter for a uniform response across its frequency range. A separate filter is used for the upper two band segments of 10 meters. The alignment of this filter calls for a coarse adjustment to a center frequency, followed by equalizing adjustments at the band edges. Although the band edge responses will not be exactly equal, they will be reasonably close.

- ( ) Release the ON button.
- ( ) Disconnect the voltmeter and remove board D from the extender board.
- ( ) Remove the extender board.
- ( ) Replace the extender board pin assembly removed earlier.
- ( ) Reinstall circuit board D in compartment DD.
- ( ) Inspect both sides of the circuit board to be sure no circuit component touches a metal shield, which could cause a short circuit.

The following steps assume that the adjustment signal will be furnished by the calibrator (circuit board A), and that the S-meter will be used as a signal level indicator. You may be able to improve the filter response to a small degree if you have a signal generator and an audio voltmeter available which you can substitute as a signal source and a level indicator. The signal generator can be connected directly to the ANT jack, and the audio voltmeter can be connected across the speaker terminals.

- ( ) Plug a 50  $\Omega$  dummy load into the REC jack on the rear panel. Be sure the ANTENNA switch on the rear panel is in the SEP position.



Figure 3-3 identifies the trimmer capacitors to be adjusted in the following steps.

- ( ) Install the extender board and circuit board G in position GG.

- ( ) Adjust the three trimmer capacitors across the top of the board so the slots are parallel with the top edge of the circuit board, as shown in Figure 3-3.

- ( ) Set the front panel controls as follows:

RF GAIN	Fully clockwise and pulled out
ALC	Depressed
AGC	Fast
USB	Depressed
ON	Depressed
AF GAIN	As desired
25 kHz	Depressed

Buttons not mentioned should be released.

- ( ) Turn the BAND switch to 29.0.
- ( ) Tune the Transceiver to the calibrator signal near 29,400 kHz. Be sure to tune for a maximum S-meter reading.
- ( ) Refer to Figure 3-3 and adjust the three trimmers for the 29.0 band to obtain the greatest deflection of the S-meter needle. Repeat the adjustment two or three times until no greater deflection can be seen.
- ( ) Tune to the calibrator signal near 29,000 kHz. Be sure to tune for a maximum S-meter reading.
- ( ) Adjust the LOW END trimmer for maximum S-meter deflection and write down the reading in the margin opposite this step.
- ( ) Turn the BAND switch to 29.5 and tune to 29,700 kHz. Be sure to tune for a maximum S-meter reading.

- ( ) Adjust the HIGH END trimmer for maximum S-meter deflection. Note the meter reading.

- ( ) Compare the two S-meter readings and adjust the trimmers according to the following examples:

Examples:

1. If the meter reading at 29,700 kHz is lower than the 29,000 kHz reading, adjust the LOW END trimmer at 29,700 kHz to increase the meter reading.
2. If the meter reading at 29,000 kHz is lower than the 29,700 kHz reading, turn the BAND switch to 29.0 and tune the Transceiver to 29,000 kHz. Then adjust the HIGH END trimmer to increase the meter reading.

- ( ) Repeat the preceding adjustments two or three times to obtain the most uniform response.

- ( ) Release the ON button.

- ( ) Disconnect the dummy load from the REC jack on the rear panel.

- ( ) Remove the extender board and board G from compartment GG. Then reinstall circuit board G in compartment GG.

## TEN METER IF/PREDRIVER FILTERS

- ( ) Connect your dummy load to the ANT socket on the rear panel.

**NOTE:** The coil adjustments in the following steps should not require turning the coil slugs more than 1/4 turn from their present setting. Be sure to correctly identify each coil before you insert the alignment tool. Also, be sure the meter drops to 0 when the MIC/CW LEVEL control is fully counterclockwise.

- ( ) Depress the ALC and ON buttons.

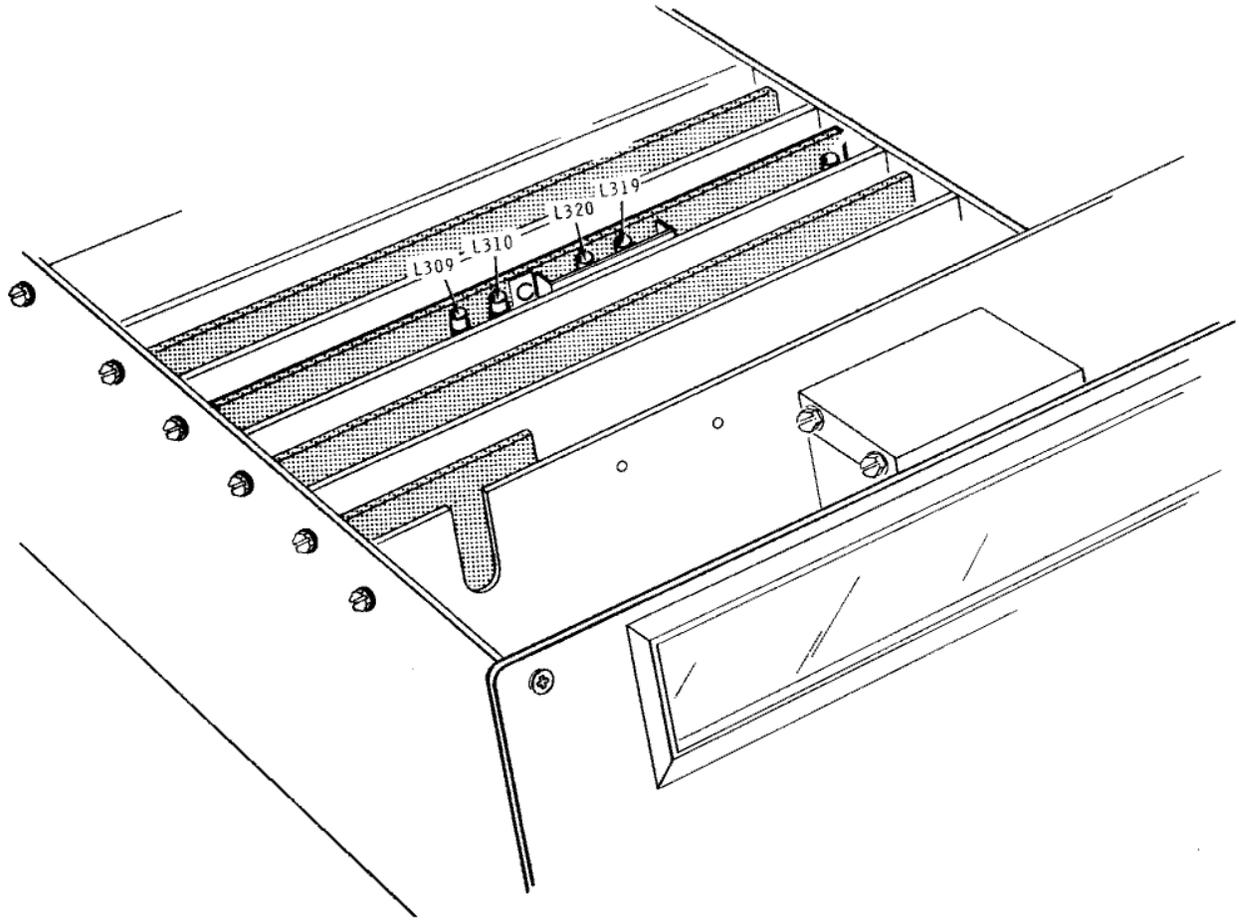


Figure 3-4

Refer to Figure 3-4 for the following steps.

( ) Turn the BAND switch to 28.0.

( ) Tune the transceiver to 28,100 kHz.

NOTE: During the following coil adjustments, the ALC indication will vary with the setting of the LEVEL control. Keep the meter reading at midrange.

( ) Depress the TUNE button.

( ) Adjust coil L310 for a peak indication on the meter.

( ) Release the TUNE button.

( ) Turn the BAND switch to 29.0 and tune the Transceiver to 29,100 kHz.

( ) Depress the TUNE button.

( ) Adjust coil L319 for a peak indication on the meter.

( ) Release the TUNE button.

( ) Turn the BAND switch to 29.5 and tune the Transceiver to 29,600 kHz.

( ) Depress the TUNE button.

( ) Adjust coils L309 and L320 for a peak indication on the meter. Repeat the adjustment until you cannot obtain a higher reading.

( ) Repeat the "Ten Meter IF/Predriver Filters" adjustments two or three times until you are sure you have obtained the maximum reading.

( ) Release the TUNE and ON buttons.

( ) Disconnect your dummy load from the ANT socket on the rear panel.

This completes the assembly and alignment of the 10 Meter Accessory. Replace the top cover on your Transceiver.

## SPECIFICATIONS

Frequency Coverage . . . . . 29.0 MHz through 29.7 MHz.

NOTE: All other specifications can be found in the "Specifications" section of the HW-104 Transceiver Manual.

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