

Philco Radio & Television Corp.

Model: 49-602

Chassis:

Year: Pre 1950

Power:

Circuit:

IF:

Tubes:

Bands:

Resources

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MODEL 49-602

PHILCO CORP.

Circuit Description

Philco Model 49-602 is a portable four-tube superheterodyne providing reception on the standard-broadcast band. A high-impedance loop within the cabinet normally provides adequate signal pickup. However, provisions have been made for connecting an external aerial, if required.

The aerial circuit works directly into a 1R5 converter, where the incoming signal is converted to the 455-kc. intermediate frequency. A 1T4 is used in a single high-gain stage of i-f amplification, which employs neutralization to suppress oscillation. A 1.5-mmf. condenser, C304, feeds part of the i-f voltage, of the proper phase, back to the 1T4 grid through the tube-socket capacitance.

A 1U5 diode-pentode is used in the detector, a-v-c, and first audio circuits. The pentode section is resistance-coupled to a 3V4 pentode output amplifier, which works into a p-m speaker.

The d-c operating voltages are obtained from either a battery pack, Philco type P-361, or from a 105—120 volt, a-c or d-c power line. For power-line operation, the plate, screen, and filament voltages are provided by a power supply using a selenium rectifier, CR100.

Philco TROUBLE-SHOOTING Procedure

For rapid trouble shooting, the radio circuit is divided into four sections, with test points specified for each section; these sections and test points are indicated in the schematic diagram. The trouble-shooting procedure given for each section includes a simplified test chart and a bottom view of the chassis showing the locations of the test points and the components of that section.

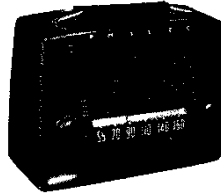
In each chart, the first step is a master check for determining whether trouble exists in that section, without going through the entire chart.

Failure to obtain the "NORMAL INDICATION" in any given step indicates trouble within the circuit under test.

After isolating the trouble to a single stage, the defect is located by: first, testing the tube; second, measuring tube electrode voltages; third, measuring circuit resistances; fourth, substituting condensers. The trouble revealed should be corrected before testing further.

Preliminary Checks

To avoid possible damage to the radio, the following preliminary checks should be made before turning on the power:



SPECIFICATIONS

CABINET	Molded Polystyrene (maroon, tan, ivory or green)
CIRCUIT	Four-tube superheterodyne
FREQUENCY RANGE	540—1600 kc.
AUDIO OUTPUT	160 milliwatts
OPERATING VOLTAGES	Battery: "B", 90 volts; "A", 7.5 volts. A.c./d.c.: 105—120 volts
POWER CONSUMPTION	Battery: "B", 13 ma. at 90 volts; "A", 50 ma. at 7.5 volts. A.c./d.c.: 25 watts
AERIAL	Built-in high-impedance loop; terminal also provided for external aerial
INTERMEDIATE FREQUENCY	455 kc.
PHILCO TUBES (4)	1R5, 1T4, 1U5, 3V4
BATTERY TYPE	Philco P-361

TP-4523

1. Inspect both the top and the bottom of the chassis. Make sure that all tubes are secure in the proper sockets, and look for any broken or shorted connections, burned resistors, or other obvious sources of trouble.

2. Check the total filament resistance, with the power switch turned on, the battery plug disconnected from the battery, and the change-over switch in the battery position (power-cord plug inserted in receptacle on rear of chassis). If the resistance between the A+ and A—pins on the battery plug is higher than 100 ohms, one of the tube filaments is probably open.

NOTE: If the 3V4 filament is open, check condenser C202 before replacing the tube.

3. Measure the resistance between B+ (output of selenium rectifier), test point D, and B—, test point B. See figure 1. When the ohmmeter leads are connected in the proper polarity, the highest resistance reading will be obtained. If the reading is lower than 2000 ohms, check condensers C101A and C101B for leakage or shorts.

The resistance value above, which is much lower than normal, does not represent a quality check of these condensers; it is the lowest value which will permit the rectifier to operate safely while the voltage checks of Section 1 (power supply) are performed.

Section 1—Power Supply

Make the tests for this section with a d-c voltmeter. Connect the negative lead to B—, test point B; connect the positive lead to the test points indicated in the chart. The voltage readings given were taken with a 20,000-ohms-per-volt meter at a line voltage of 117 volts, a.c.

Set the volume control to minimum.

The battery pack should be replaced when the "A" voltage drops below 5 volts, or the "B" voltage drops below 60 volts.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 2 (audio circuits); if not, isolate and correct the trouble in this section.

TRUBLE SHOOTING

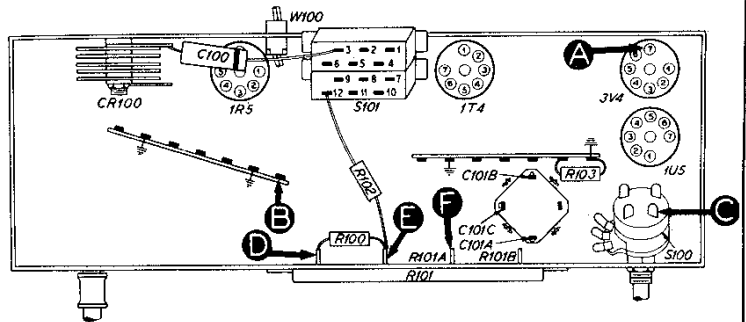


Figure 1. Bottom View, Showing Section 1 Test Points

TP-5355A

STEP	TEST POINT	NORMAL INDICATION	ABNORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1(a)	A	7.5v		Trouble in this section. Isolate by the following tests.
1(b)	C	90v		
2	D	125v	Low voltage No voltage	Defective: CR100. Open C101A. Defective: CR100. Open: S100, S101.
3	E	120v	Low voltage No voltage	Changed resistance: R100. Leaky: C101A. Open: R100. Shorted: C101A.
4	F	65v	Low voltage No voltage	Changed resistance: R101A. Leaky: C101B. Open: R101A. Shorted: C101B.
5	A	7.5v	Low voltage High voltage No voltage	Changed resistance: R101B. Open: One or more filaments, R205*. Open: R101B, S101.
6	C	90v	Low voltage High voltage No voltage	Changed resistance: R102. Leaky: C101C. Open: R205*, T200*, S100. Open: R102, S101. Shorted: C101C.

Listening Test: Abnormal hum may be caused by open C101B, C101C, or C202*.

*This part, located in another section, may cause abnormal indication in this section.

Section 2—Audio Circuits

For the tests in this section, use an audio-frequency signal generator. Connect the generator ground lead to B—, test point B; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Set the radio volume control to maximum.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 3 (i-f, detector, and a-v-c circuits); if not, isolate and correct the trouble in this section.

TRUBLE SHOOTING

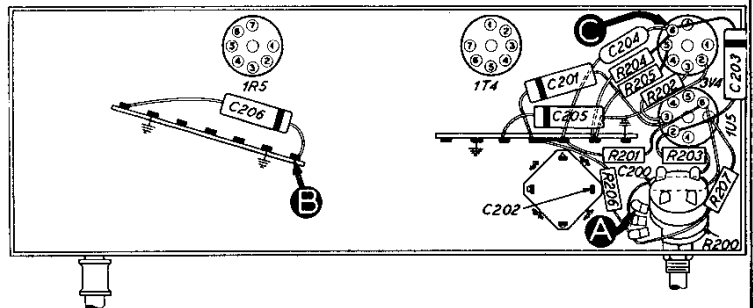


Figure 2. Bottom View, Showing Section 2 Test Points

TP-5355B

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	Loud, clear speaker output with moderate generator input.	Trouble in this section. Isolate by the following tests.
2	C	Clear speaker output with strong generator input.	
3	A	Same as step 1.	Defective: 1U5, R200 (rotate). Open: C200, R201, R202, R203, C203. Shorted: C201, C301C*.

Listening Test: Distortion may be caused by leaky or shorted C203, or by changed resistance of R202. Distortion or strong signals may be caused by leaky or shorted C200.

*This part, located in another section, may cause abnormal indication in this section.

Section 3—I-F, Detector, And A-V-C Circuits

TROUBLE SHOOTING

For the tests in this section, use an r-f signal generator, with modulated output, set at 455 kc. Connect the generator ground lead to B—, test point B; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Set the radio volume control to maximum.

If the "NORMAL INDICATION" is obtained in step 1, proceed with the tests for Section 4 (r-f and converter circuits); if not, isolate and correct the trouble in this section.

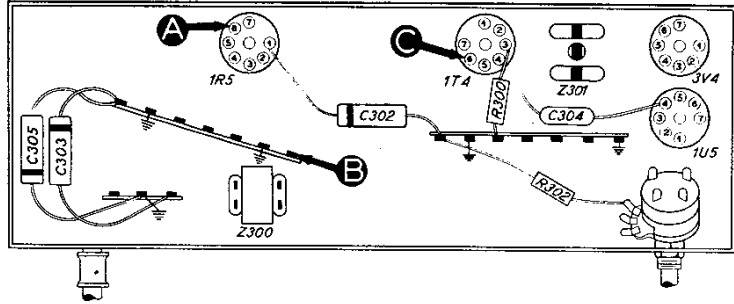


Figure 3. Bottom View, Showing Section 3 Test Points

TP-5355C

To provide a complete i-f amplifier check, test point A for this section is placed at the grid of the mixer in Section 4; therefore, the effectiveness of step 1 as a master check is dependent upon the condition of certain parts in the mixer circuit. These parts are listed below under "POSSIBLE CAUSE OF ABNORMAL INDICATION."

STEP	TEST POINT	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	Loud, clear speaker output with weak generator input.	Trouble in this section. Isolate by the following tests.
2	C	Loud, clear output with moderate input.	Defective: 1T4, 1U5 (diode section). Misaligned: Z301. Open: R300, C303, L301A, R301, L301B, C301A. Shorted: C300B, C303, L301A, L301B, C301A, C301B.
3	A	Same as step 1.	Defective: 1R5*. Misaligned: Z300. Open: C300A, L300A, L300B, C300B, T400*. Shorted: C400A*, C400B*, C300A, L300A, L300B, C300B.

*This part, located in another section, may cause abnormal indication in this section.

Section 4—R-F And Converter Circuits

TROUBLE SHOOTING

For the tests in this section, with the exception of the oscillator test, use an r-f signal generator with modulated output. Connect the generator ground lead to B—, test point B; connect the output lead through a .1-mf. condenser to the test points indicated in the chart.

Set the radio volume control to maximum. Set the tuning control and signal-generator frequency as indicated in the chart.

If the "NORMAL INDICATION" is obtained in step 1, further tests should be unnecessary; if not, isolate and correct the trouble in this section. If the trouble is not revealed by the tests for this section, check the alignment.

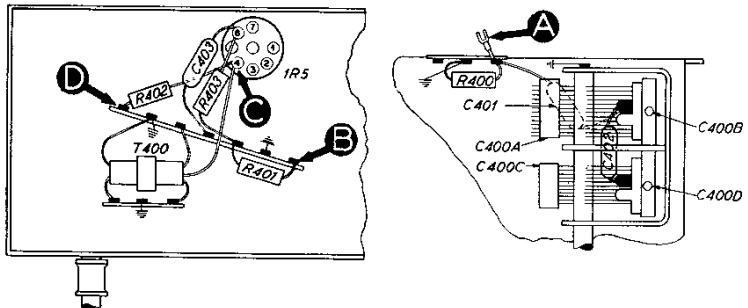
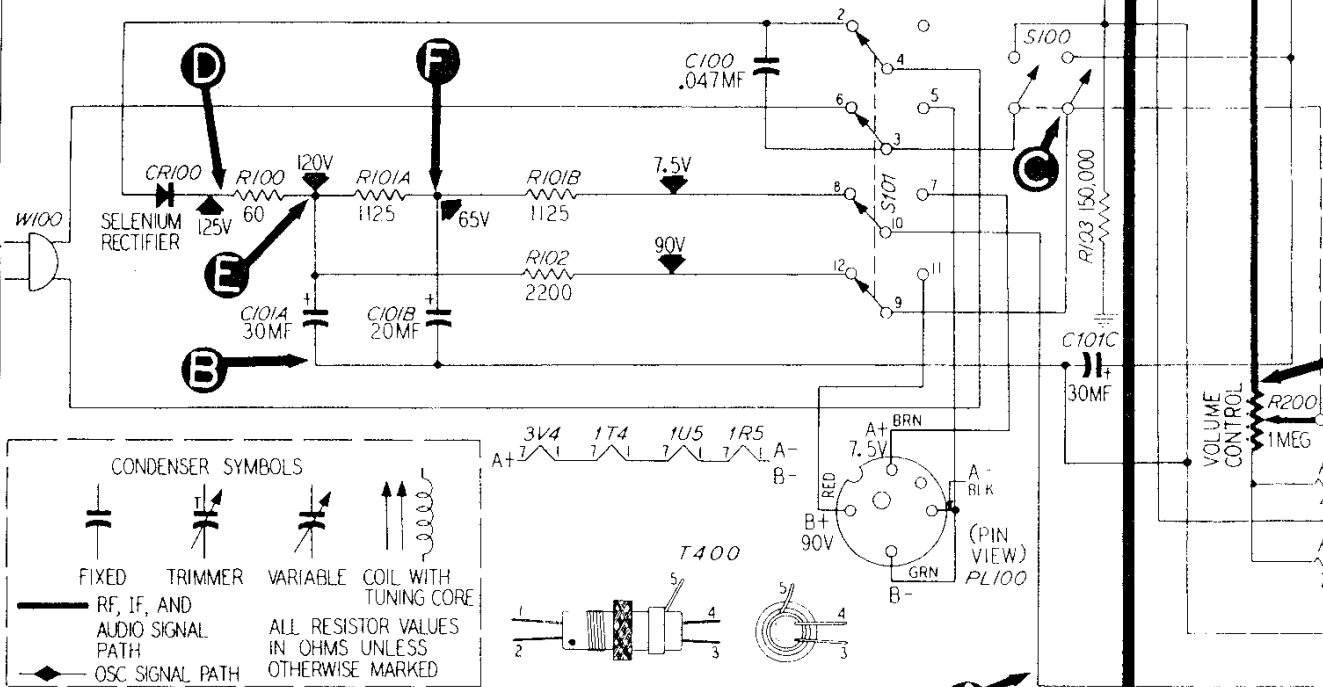
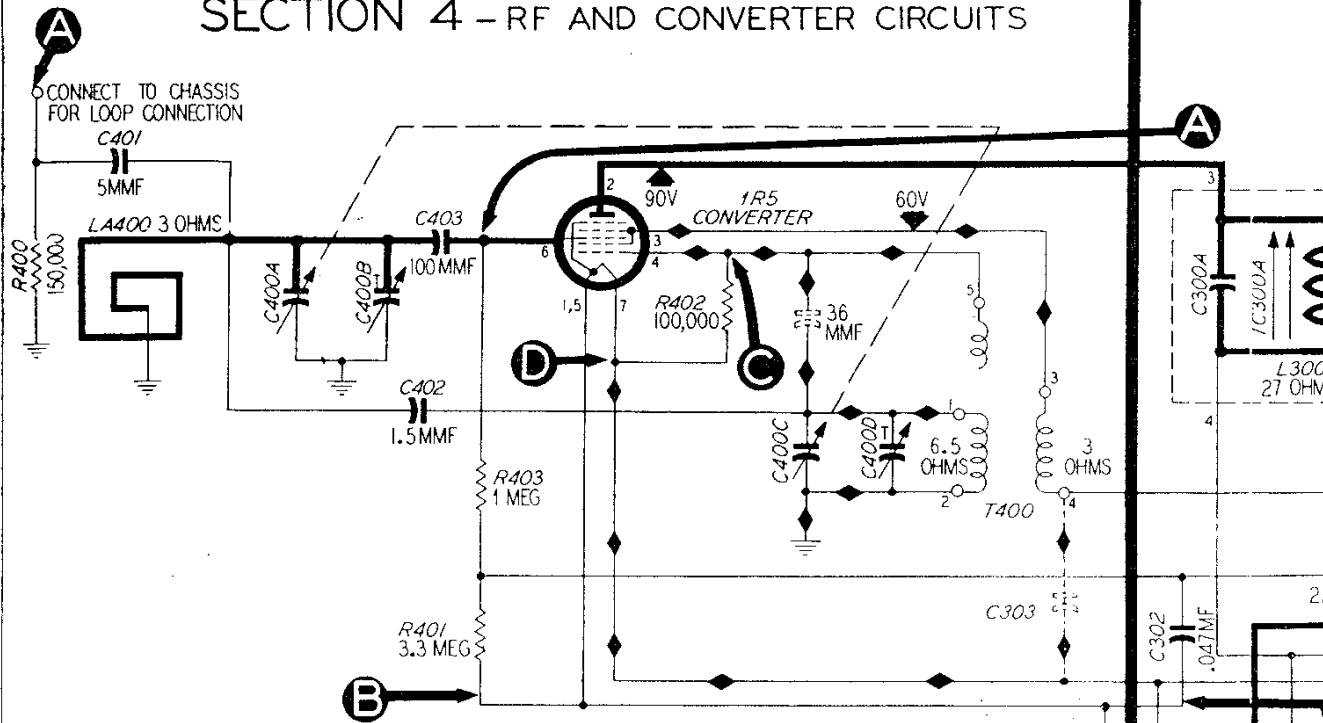


Figure 4. Bottom View, Showing Section 4 Test Points

TP-5355D

STEP	TEST POINT	SIGNAL GEN. FREQUENCY	RADIO TUNING	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
1	A	1000 kc.	Tune to signal.	Loud, clear speaker output with weak generator input.	Trouble in this section. Isolate by the following tests.
2	C to D (Osc. test; see note below.)		Rotate through range.	Negative 5 to 10 volts.	Defective: 1R5. Open: R402, T400. Shorted: C402, C400C, C400D.
3	A	1000 kc.	Tune to signal.	Same as step 1.	Open: C401, C403, R401, R403, LA400.

SECTION 4 - RF AND CONVERTER CIRCUITS



CONDENSER SYMBOLS

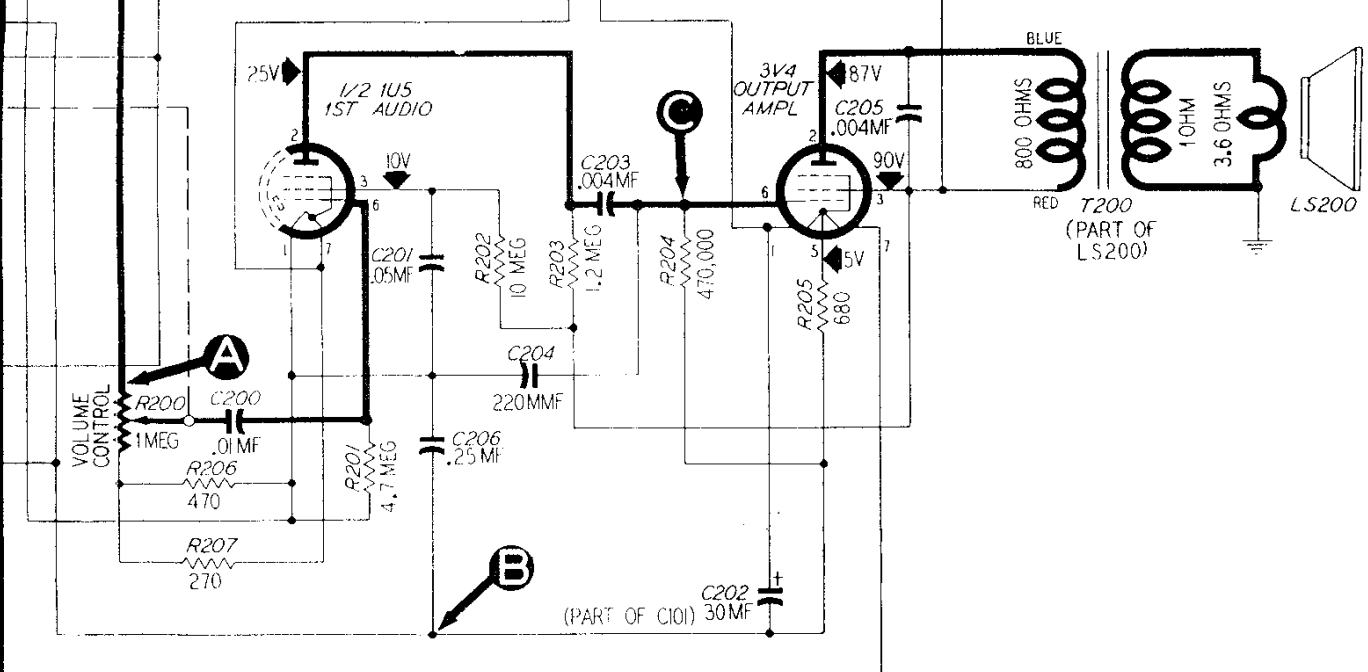
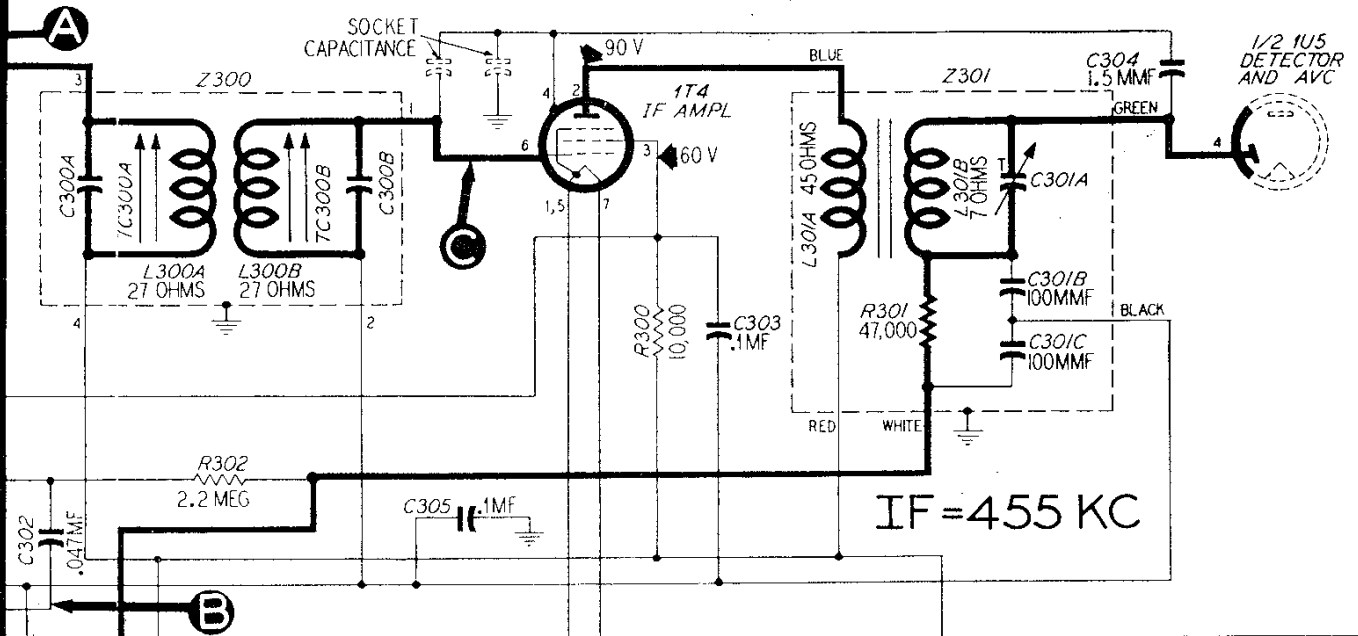
FIXED	TRIMMER	VARIABLE	COIL WITH TUNING CORE
— RF, IF, AND AUDIO SIGNAL PATH			
◆ OSC SIGNAL PATH			
ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE MARKED			

SECTION 1 - POWER SUPPLY

Figure 5. Philco Model 49-602, Sectionalized Schematics

OSCILLATOR TEST: Connect the positive lead of a high-resistance voltmeter to test point D; connect the prod end of the negative lead to such as 0 -10 volts. Proper operation of the oscillator is indicated by negative voltage within the range given in the chart (measured with

SECTION 3 - IF, DETECTOR AND AVC CIRCUITS



SECTION 2 - AUDIO CIRCUITS

Sectionalized Schematic Diagram, Showing Test Points
 the negative lead through a 100,000-ohm isolating resistor to the oscillator grid (pin 4 of the 175), test point C. Use a suitable meter range, art (measured with a 20,000-ohms-per-volt meter) throughout the tuning range.

ALIGNMENT

DIAL—Calibration and pointer-index measurements are shown in figure 7. With tuning condenser fully meshed, set pointer to index mark.

RADIO CONTROLS—Set volume control to maximum.

OUTPUT METER—Connect across voice-coil terminals.

SIGNAL GENERATOR—Use modulated output.

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SPEC
align
back,

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to B— (test point B in figure 4). Positive lead through .05-mf. condenser to external-aerial lead. Make sure that radio loop aerial is connected to radio.	455 kc.	Tuning condenser fully meshed.	Adjust, in order given, for maximum output.	C301A—2nd i-f TC300B—1st i-f TC300A—1st i-f
2	Radiating loop (see note below).	1600 kc.	1600 kc.	Adjust for maximum output.	C400D—
3	Same as step 2.	1500 kc.	1500 kc.	Adjust for maximum output while rocking tuning condenser.	C400B—a

RADIATING LOOP: Make up a 6—8-turn, 6-inch-diameter loop, using insulated wire; connect to signal-generator leads and place near radio loop aerial. Make sure that radio loop aerial is connected to radio.

CALIBRATING DIAL BACKPLATE

When the radio chassis has been removed from the cabinet, dial calibration and alignment points may be marked on the dial (chassis) backplate at the end of the pointer with a pencil. The method of measuring for these points is illustrated in figure 7.

With the tuning gang fully meshed, the pointer should be adjusted on the dial-drive core to coincide with the index mark.

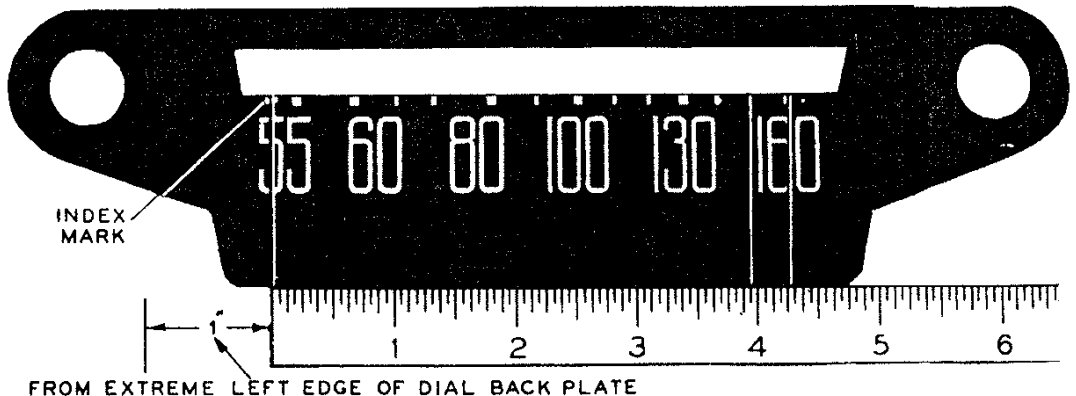


Figure 7. Dial-Backplate Calibration Measurements

TP-5776

ADJUSTMENT PROCEDURE

OUTPUT LEVEL—During alignment, adjust signal-generator output to maintain output-meter indication below .5 volt.

SPECIAL NOTE—The orientation of the loop with respect to the chassis is critical for correct tracking. During alignment, with the cabinet back (containing the loop) laid down on the bench, the chassis should be laid on its back, in approximately its normal relation to the loop.

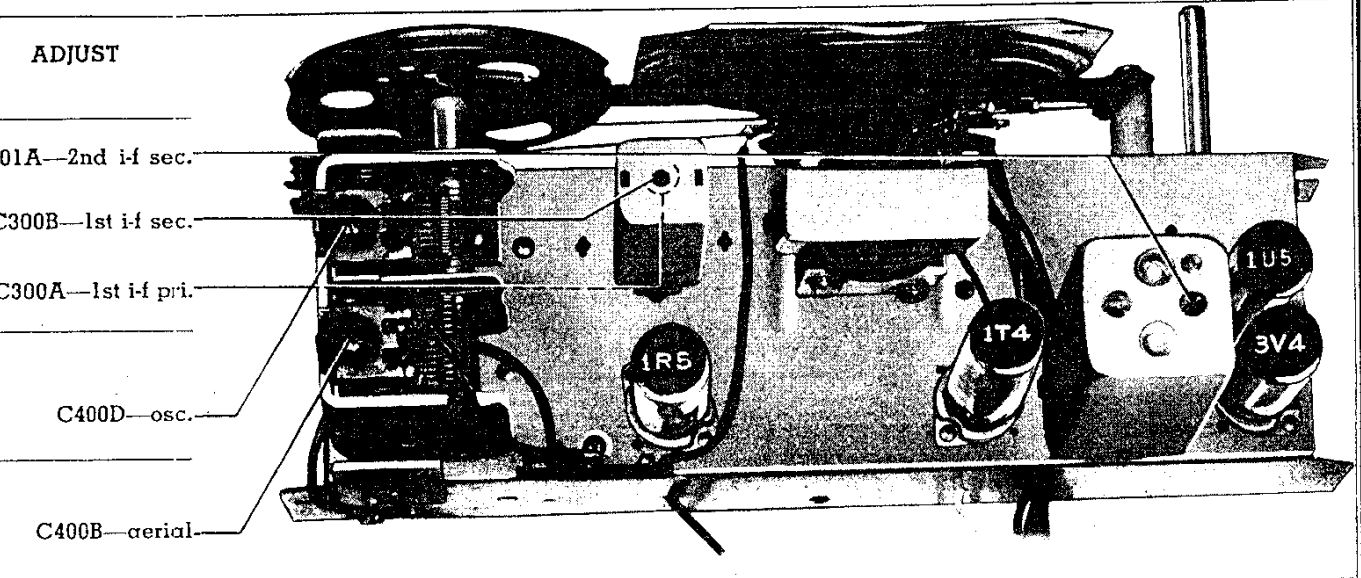


Figure 6. Top View, Showing Trimmer Locations

nal-generator

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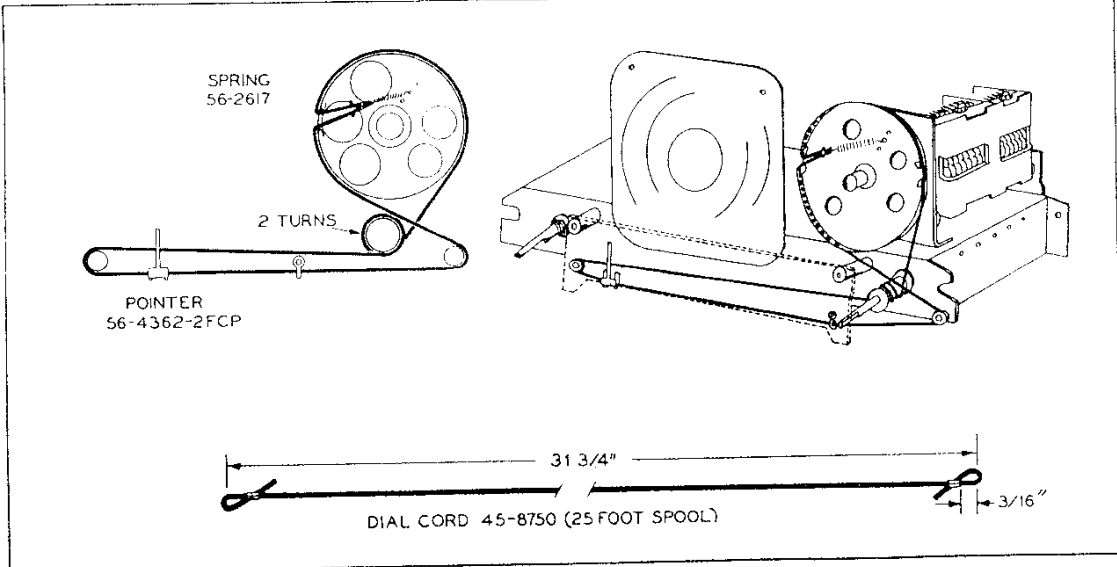


Figure 8. Drive-Cord Installation Details

REPLACEMENT PARTS LIST

SECTION 1 POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100	Condenser, line filter, .047 mf.	61-0122*
C101	Condenser, electrolytic, 4-section	30-2568-21
C101A	Condenser, filter, 30 mf., 150v	Part of C101
C101B	Condenser, filter, 20 mf., 150v	Part of C101
C101C	Condenser, filter, 30 mf., 150v	Part of C101
CR100	Rectifier, selenium	34-8003-1
PL100	Battery-cable-and-plug assembly	41-3712-3
R100	Resistor, current limiting, 60 ohms, 1 watt	33-1334
R101	Resistor, 2-section	33-3431-5
R101A	Resistor, filament-dropping, 1125 ohms, 3 watts	Part of R101
R101B	Resistor, filament-dropping, 1125 ohms, 3 watts	Part of R101
R102	Resistor, filter, 2200 ohms	66-2223340*
R103	Resistor, leakage 150,000 ohms	66-4153340*
S100	Switch, on-off	Part of 33-5538-28
S101	Switch, change-over	42-1821
W100	Line-cord-and-plug assembly	L2183*

SECTION 2 AUDIO CIRCUITS

C200	Condenser, d-c blocking, .01 mf.	61-0120*
C201	Condenser, screen by-pass, .05 mf.	61-0122*
C202	Condenser, filter, 30 mf., 25v	Part of 30-2568-21
C203	Condenser, d-c blocking, .004 mf.	61-0179*
C204	Condenser, r-f by-pass, 220 mmf.	62-122001001*
C205	Condenser, tone compensation, .004 mf.	61-0179*
C206	Condenser, by-pass, .25 mf.	61-0125*
LS200	Loud-speaker, p-m	36-1627-1
R200	Volume control, 1 megohm	33-5538-28
R201	Resistor, grid return, 4.7 megohms	66-5473340*
R202	Resistor, screen dropping, 10 megohms	66-6103340*
R203	Resistor, plate load, 1.2 megohms	66-5123340*
R204	Resistor, grid return, 470,000 ohms	66-4473340*
R205	Resistor, bias, 680 ohms	66-1683340*
R206	Resistor, diode return, 470 ohms	66-1473340*
R207	Resistor, diode return, 270 ohms	66-1273340*
T200	Transformer, output	Part of LS200

SECTION 3 I-F, DETECTOR, AND A-V-C CIRCUITS

C300A	Condenser, shunt	Part of Z300
C300B	Condenser, shunt	Part of Z300
C301A	Condenser, trimmer	Part of Z301
C301B	Condenser, filter	Part of Z301
C301C	Condenser, filter	Part of Z301
C302	Condenser, a-v-c filter, .047 mf.	61-0122
C303	Condenser, screen by-pass, .1 mf.	61-0113*
C304	Condenser, neutralizing, 1.5 mmf.	30-1221-3

SECTION 3 (Continued) I-F, DETECTOR, AND A-V-C CIRCUITS

Reference Symbol	Description	Service Part No.
C305	Condenser, i-f by-pass, .1 mf.	30-4527
L300A	Transformer primary, 1st i-f	Part of Z300
L300B	Transformer secondary, 1st i-f	Part of Z300
L301A	Transformer primary, 2nd i-f	Part of Z301
L301B	Transformer secondary, 2nd i-f	Part of Z301
R300	Resistor, screen dropping, 10,000 ohms	66-3103340*
R301	Resistor, filter, 47,000 ohms (Part of Z301)	66-3473340*
R302	Resistor, a-v-c filter, 2.2 megohms	66-5223340*
Z300	Transformer, 1st i-f	32-4160-4
Z301	Transformer, 2nd i-f	32-3987-2*

SECTION 4 R-F AND CONVERTER CIRCUITS

C400	Condenser, tuning gang	31-2727-2
C400A	Condenser, tuning, aerial section	Part of C400
C400B	Condenser, trimmer, aerial	Part of C400
C400C	Condenser, tuning, oscillator section	Part of C400
C400D	Condenser, trimmer, oscillator	Part of C400
C401	Condenser, isolating, 5 mmf.	30-1224-5*
C402	Condenser, neutralizing, 1.5 mmf.	30-1221-3
C403	Condenser, d-c blocking, 100 mmf.	60-10105407*
LA400	Loop aerial	32-4274
R400	Resistor, leakage, 150,000 ohms	66-4153340*
R401	Resistor, grid return, 3.3 megohms	66-5333340*
R402	Resistor, oscillator bias, 100,000 ohms	66-4103340*
R403	Resistor, a-v-c divider, 1 megohm	66-5103340*
T400	Transformer, oscillator	32-4282

MISCELLANEOUS

Description	Service Part No.
Cabinet and Cabinet Parts	
Cabinet (M), maroon	10703
Cabinet (T), tan	10703A
Cabinet (I), ivory	10703B
Cabinet (G), green	10703C
Handle	76-3742
Lever assembly, switch	76-3686
Terminal, aerial strip	76-3674
Dial-Scale Hardware	
Dial-backplate assembly	56-5425FCP
Drive cord, 25-foot spool	45-8750*
Pointer	56-4362-2FCP
Spring, drive-cord	56-2817
Knob (M)	54-4557
Knob (T)	54-4557-1
Knob (I)	54-4557-2
Knob (G)	54-4557-3
Socket, tube, miniature	27-6203
Spring, voltage change-over switch	28-9010FA1—Part of 76-3686