

PHILCO



SERVICE

HOME RADIO

PHILCO RADIO MODEL 46-350

CIRCUIT DESCRIPTION

The Model 46-350 is an entirely new and outstanding battery-operated or ac-dc portable radio. Its design provides a combination of high sensitivity, high selectivity, and power output unprecedented in this type of set.

The six-tube superheterodyne circuit may be briefly analysed as follows: r-f signals are picked up on one of three types of antenna—the built-in loop, the external loop, or a conventional external aerial. A high signal-to-noise ratio is achieved by the tuned r-f amplifier stage, employing the super-control 1T4. The amplified r-f signals are fed through a tuned transformer to the 1R5 pentagrid converter, where they are mixed with an oscillator frequency tuned 265 kc higher than the signal frequency. Since the plate circuit of the 1R5 is tuned to 265 kc, this intermediate frequency is passed through the first i-f transformer to the grid of the 1T4 i-f amplifier. The sensitivity of this stage is considerably increased by positive feedback to the screen of the i-f amplifier from the tertiary winding in the second i-f transformer.

The modulated 265-kc signal from the plate of the 1T4 i-f amplifier is passed through the second i-f transformer and rectified by the diode section of the 1U5 second detector and first audio. The 265-kc component is by-passed to B—, leaving the audio modulation, which is passed through the volume control to the grid of the pentode section of the 1U5. From the plate of the 1U5 pentode section the amplified audio signal is applied to the grid of the 3Q5 beam-power amplifier. The signal from the plate of the 3Q5 is transformer-coupled to the voice coil of the P.M. dynamic speaker.

Power for the receiver is obtained either from a type P-81A battery, or from a 117-volt a-c or d-c power supply, using a 117Z3 rectifier.

PHILCO TROUBLE-SHOOTING PROCEDURE

The Philco trouble-shooting procedure has been described in detail in previous manuals — for example, the service manual for receiver Model 46-427. In this new type of manual, the procedure is the same; the layout of the manual, however, has been changed, in order to give more complete information on the receiver circuit and at the same time make the procedure more convenient to follow. The sectional master checks originally given in the chart on the front page are now indicated by large asterisks (*) in the charts for the sections which they isolate. The sections should be tested in their numerical order, as they are arranged in the manual.

All components in the receiver circuit are symbolized and located as follows:

C—condensor LA—loop antenna S—switch
 I—pilot lamp LS—loud speaker T—transformer
 L—choke or coil R—resistor Z—electrical assembly

100-series components are in section 1—the power supply.

200-series components are in section 2—the second detector, a. v. c. and audio.

300-series components are in section 3—the i-f amplifier.

400-series components are in section 4—the antenna, r-f and oscillator.

PRELIMINARY CHECKS

Before starting the trouble-shooting procedure, the following steps are recommended:

1. Before connecting the receiver to a source of power, inspect both sides of the chassis. Make sure that all tubes are

SPECIFICATIONS

CABINET _____ Fabrikoid finish, wood trim
 CIRCUIT _____ Six-tube superheterodyne
 FREQUENCY RANGE _____ 540 to 1600 kc.
 POWER INPUT _____ 90-volt plate supply and 9-volt filament supply from battery, or 105 to 120 volts - a.c. or d.c.
 POWER CONSUMPTION _____ From battery - 90 volts, 12 milliamperes, and 9 volts, 50 milliamperes;
 _____ From external a-c or d-c supply - 25 watts
 ANTENNA _____ Built in or external loop, or external antenna
 INTERMEDIATE FREQUENCY _____ 265 kc.
 PHILCO TUBES USED _____ 1T4 (2), 1R5, 1U5, 3Q5GT/G, 117Z3
 BATTERY USED _____ Philco type P-81A

securely in their sockets, and look for any broken or shorted connections, burned resistors, or other obvious sources of trouble.

2. Since it is difficult to determine whether or not the 1-volt miniature tubes are lighted when the set is on, check for continuity across the A+ and A- pins on the battery-cable plug (disconnected from the battery) while holding down the change-over switch S100. (See Figure 9, page 52). If the resistance measured is more than 100 ohms, one of the tube filaments is probably open-circuited.

3. Check the main filter condensor, C100, for short circuits or leakage by measuring the resistance between pins 3 and 6 of the 117Z3 rectifier socket. This resistance should be higher than 10,000 ohms.

4. Connect the receiver to a source of power, turn the volume control fully on, and check the operating condition of the set.

MAKE TEST FIRST
 If the "NORMAL INDICATION" is obtained, proceed to the next section. If not, isolate and remedy the trouble in this section.

TESTS TO ISOLATE TROUBLE WITHIN SECTION 1

Make all measurements for this section with a high-quality voltmeter, using the applicable d-c range. All voltages given in this manual are for 117-volt a-c operation, and were measured with the volume control set at minimum.

TEST POINTS	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
A to B-	90 volts	Defective 117Z3, shorted or open C100A, or shorted C100B.
C to B-	87 volts	Open R100A, shorted C100A or C100B.
D to B-	50 volts	Open R100B, or defective C100B.
E to B-	8.5 volts	Open R100C, or defective S100.
F to B-	70 volts	Open R101, shorted C100C, or defective S100.

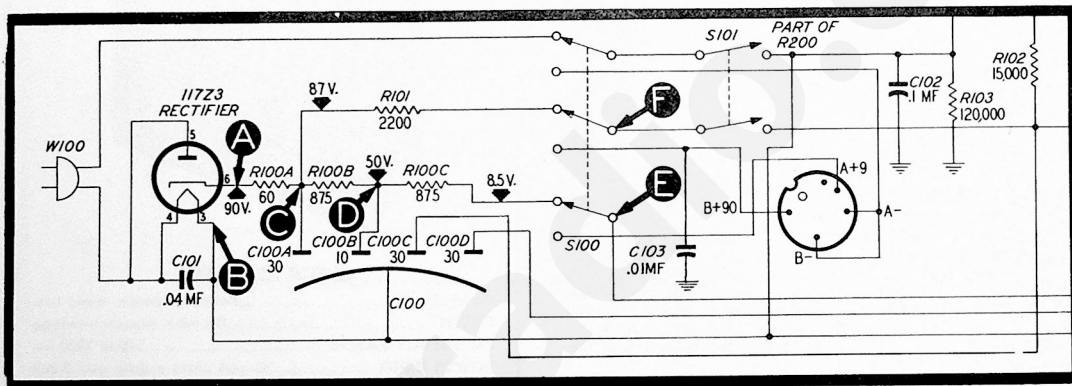


Figure 1. Section 1 schematic.

TP410-A

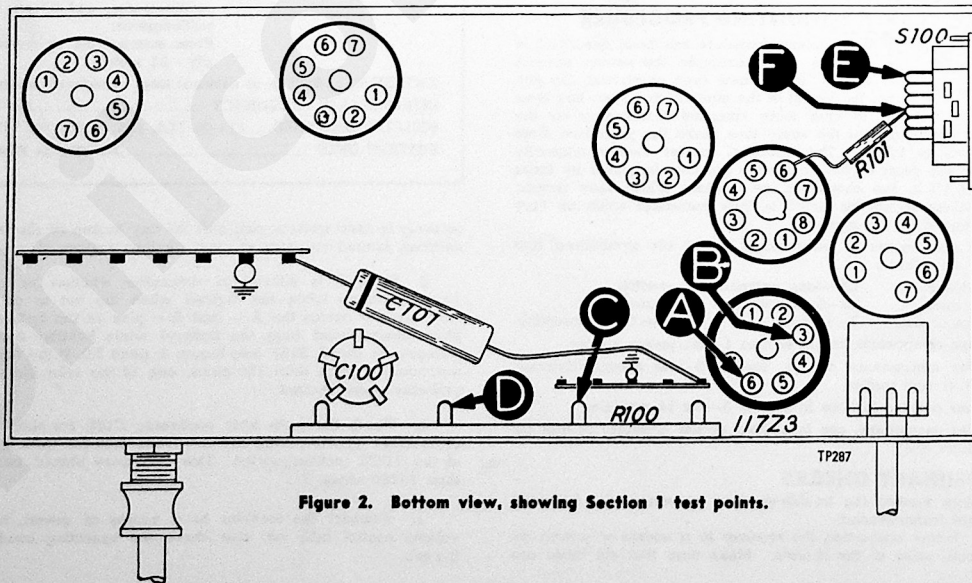


Figure 2. Bottom view, showing Section 1 test points.

TP287

MAKE TEST FIRST
 If the "NORMAL INDICATION" is obtained, proceed to the next section. If not, isolate and remedy the trouble in this section.

TESTS TO ISOLATE TROUBLE WITHIN SECTION 2

For all tests in this section, use an audio signal. Connect the generator output lead through a condenser (.01 to .25 mf.) to the test points indicated; connect the ground lead to B-. Set the receiver volume control at maximum, and adjust the signal-generator output for a loud, clear signal.

TEST POINTS	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
G to B-	Loud, clear signal.	Defective 3Q5, T200, LS200, open R206, R207, shorted C202 or C204.
H to B-	Loud, clear signal, same as preceding test.	Open C202.
J to B-	Clear signal, much louder than preceding test.	Defective 1U5, open R205, R204, or shorted C201.
K to B-	Loud, clear signal, same as preceding test.	Open C200, R203, or defective volume control R200 (rotate control through entire range for complete check).

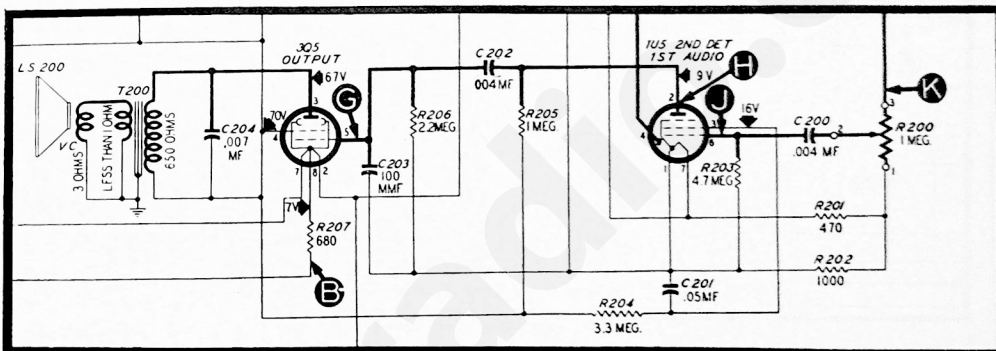


Figure 3. Section 2 schematic.

TP4108

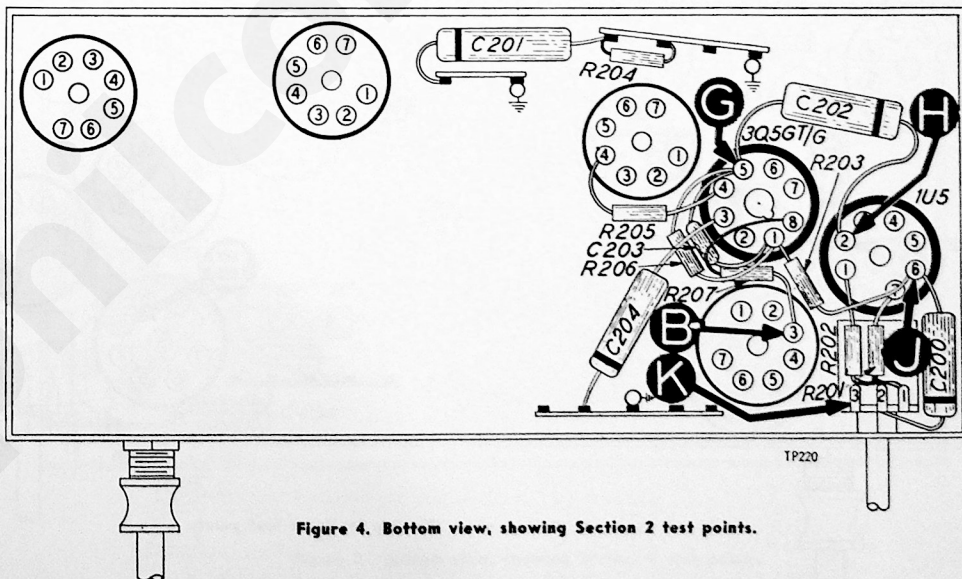


Figure 4. Bottom view, showing Section 2 test points.

MAKE TEST FIRST
 If the "NORMAL INDICATION" is obtained, proceed to the next section. If not, isolate and remedy the trouble in this section.

TESTS TO ISOLATE TROUBLE WITHIN SECTION 3

For all tests in this section, set the signal generator at 265 kc., with modulation on. Connect the generator output lead through a condenser (.01 to .25 mf.) to the test points indicated; connect the ground lead to B-. Set the receiver volume control at maximum, and adjust the signal-generator output for a loud, clear signal.

TEST POINTS	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
L to B-	Loud, clear signal from speaker.	Defective 1T4 or Z301, shorted C302, or misaligned Z301.
M to B-	Loud, clear signal, same as preceding test.	Defective Z300.

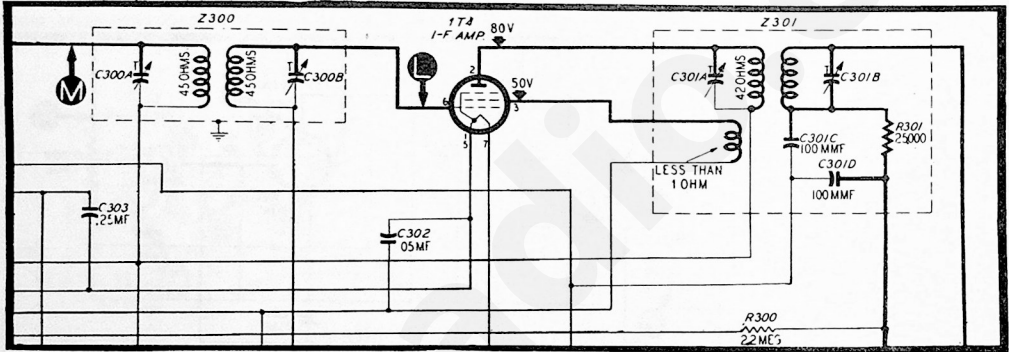


Figure 5. Section 3 schematic.

TP410C

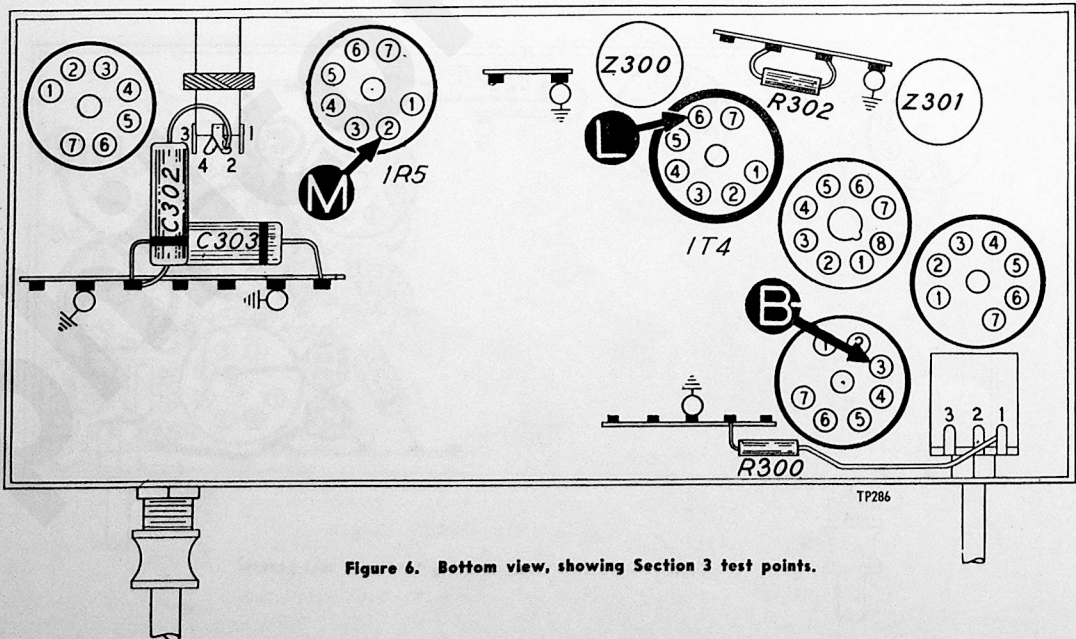


Figure 6. Bottom view, showing Section 3 test points.

TP286

TESTS TO ISOLATE TROUBLE WITHIN SECTION 4

MAKE TEST FIRST
If the "NORMAL INDICATION" is not obtained, isolate and remedy the trouble in this section.

1. Set the receiver volume control at maximum. Rotate the tuning condenser through its entire range. Any scraping noise from the speaker indicates bent plates, or dirt between plates or on wiper contacts. Remedy such conditions before proceeding further.
2. Attach the positive lead of a 20,000-ohms-per-volt meter to B-, and the prod end of the negative lead through a 50,000-ohm resistor to point R. Set the meter on the 10-volt or similar d-c range, and rotate the tuning condenser through its entire range. Absence of voltage at any point indicates that the oscillator is not functioning properly. If so, check the components listed in the first test below.
3. Connect the generator output lead through a condenser (.01 to .25 mF.) to the test points indicated; connect the ground lead to B-. Tune the receiver and signal generator to 1000 kc., and adjust the generator output for a loud, clear signal with the receiver volume control at maximum.

TEST POINTS	NORMAL INDICATION	POSSIBLE CAUSE OF ABNORMAL INDICATION
N to B- (Tune set until signal is heard.)	Loud, clear signal from speaker.	Defective 1R5, T401, open R402, shorted C400A, C402, C402B, or C402C.
P to B-	Clear signal, noticeably louder than preceding test.	Defective 1T4 or Z400, shorted C402 or C402A.
Q to B-	Loud, clear signal, same as preceding test.	Defective T400, open C403 or LA400.

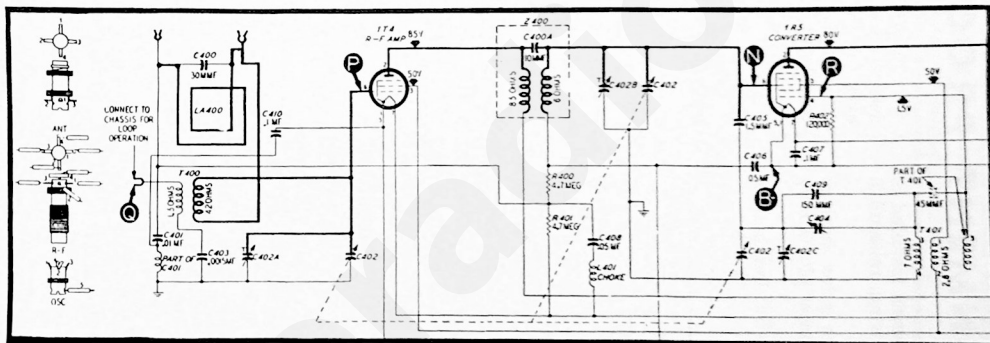


Figure 7. Section 4 schematic.

TP4100

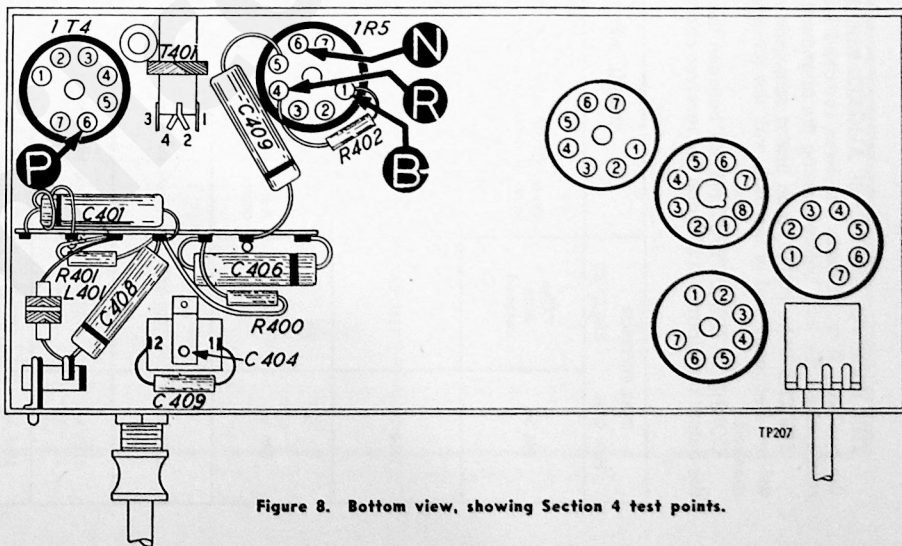


Figure 8. Bottom view, showing Section 4 test points.

ALIGNMENT PROCEDURE

THIS RECEIVER SHOULD BE ALIGNED with the chassis installed in the cabinet. If the chassis has been removed for servicing, reinstall it and connect the loop before starting the alignment.

SET THE DIAL POINTER so that it coincides with the index mark at the low-frequency end of the dial, with the tuning-condenser plates fully meshed.

CONNECT THE OUTPUT METER between the voice-coil terminal on the output transformer (T200) and the receiver chassis.

CONNECT THE SIGNAL-GENERATOR output across the primary of the antenna transformer, as follows: Connect the output lead to the external antenna lead (if the lead is connected to its ground point on the chassis, disconnect it, and restore the connection after alignment is completed). Connect the ground lead as indicated in figure 9 below.

SET THE RECEIVER VOLUME CONTROL at maximum. Using the lowest voltage range on the output meter, adjust the signal-generator output as alignment progresses to keep the meter needle near center scale.

DIAL SETTINGS		SPECIAL INSTRUCTIONS	ADJUST TRIMMERS
SIG. GEN.	RECEIVER		
285 kc.	Plates fully meshed	Preset C300B fully tight. Then adjust for maximum in order as numbered — 1, 2, 3, 4.	2. C301A 1. C301B 4. C300B 3. C300A
1600 kc.	1600 kc.	Adjust for maximum.	C402C
580 kc.	580 kc.	Adjust C404 for maximum while rocking tuning control.	C404
1600 kc.	1600 kc.	Adjust for maximum.	C402C
1500 kc.	1500 kc.	Adjust for maximum.	C402B
1500 kc.	1500 kc.	Adjust for maximum.	C402A

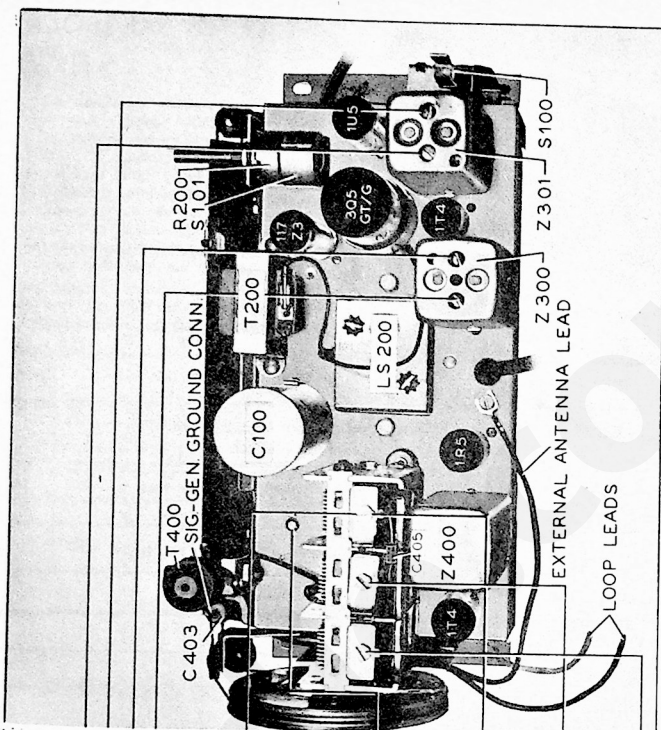
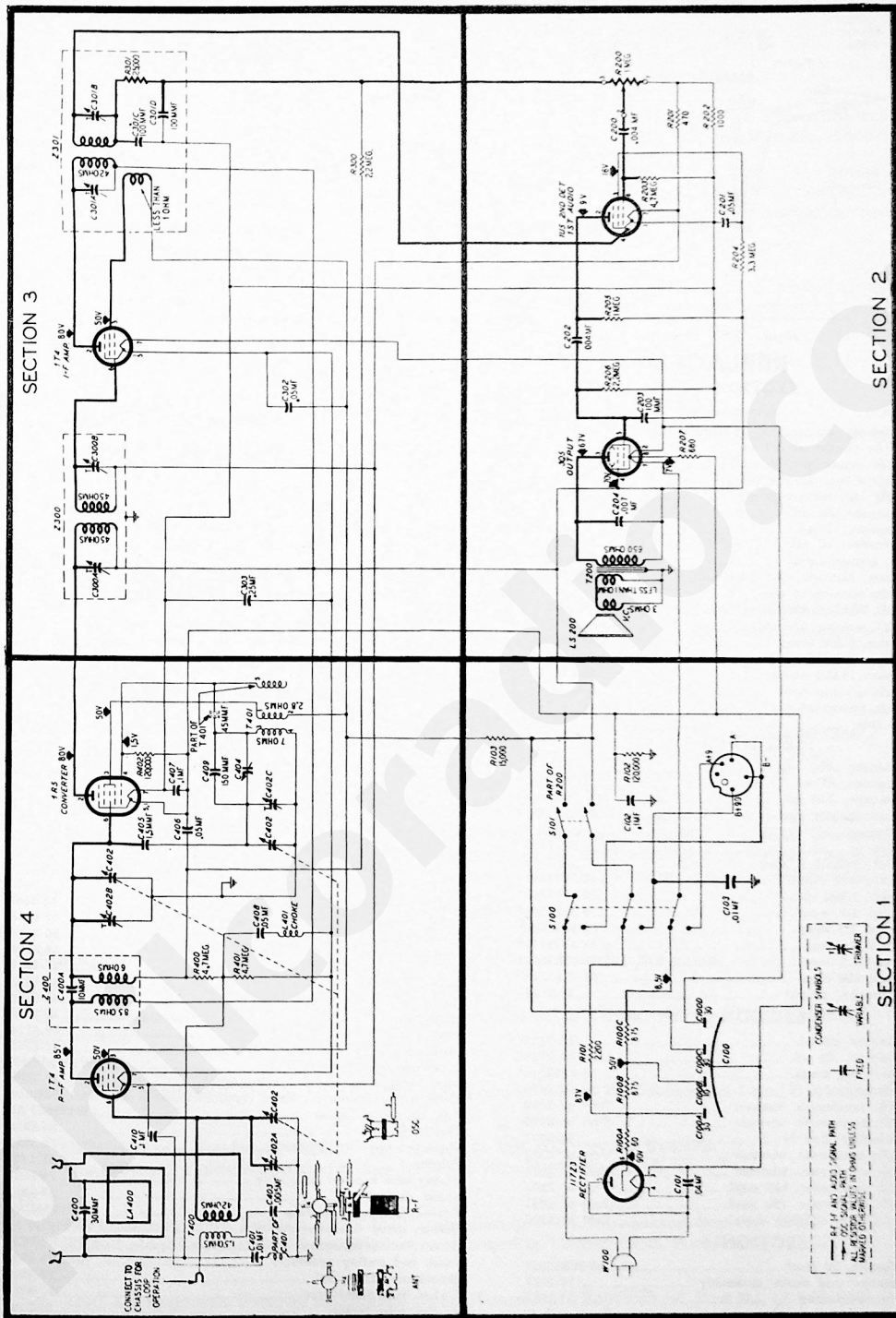


Figure 9. Chassis view, showing trimmer locations.



TP410

Figure 10. Complete schematic.

NOTE: All voltage, capacity, and resistance values shown are average. The voltages given were measured with a 20,000-ohms-per-volt meter between the indicated points and B— (the negative return of the power supply), with the volume control at minimum and the tuning-condenser plates fully meshed. These voltages are for 117-volt a-c operation.

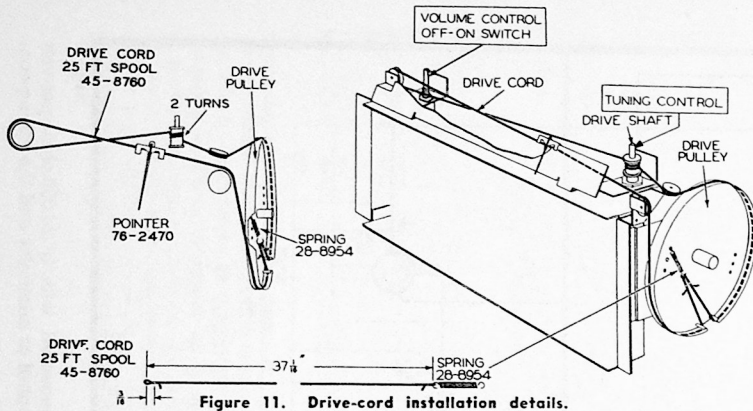


Figure 11. Drive-cord installation details.

NOTE: Parts marked with an asterisk (*) are general replacement items, and the part numbers will not be identical with those used on factory assemblies. Use only the "Service Part No." shown in the parts list when ordering replacements.

REPLACEMENT PARTS LIST — MODEL 46-350

SECTION 1

Reference No.	Description	Service Part No.
C100	Condenser, electrolytic, 30.10-20-30 mf.	30-2563
C100A:	condenser, 30 mf.	Part of C100
C100B:	condenser, 10 mf.	Part of C100
C100C:	condenser, 30 mf.	Part of C100
C100D:	condenser, 30 mf.	Part of C100
†C101	Condenser, .04 mf.	45-3500-2*
C102	Condenser, .1 mf.	61-0113*
C103	Condenser, .01 mf.	61-0120*
PL100	Plug, battery-cable	54-4272
†R100	Resistor, filament, 60-875-875 ohms	33-3431
R100A:	resistor, 60 ohms	Part of R100
R100B:	resistor, 875 ohms	Part of R100
R100C:	resistor, 875 ohms	Part of R100
R101	Resistor, 2,200 ohms	66-223340
R102	Resistor, 120,000 ohms	66-4123340*
†R103	Resistor, 15,000 ohms	66-3153340*
†S100	Switch, change-over	42-1553-1
†S101	Switch, power (off-on)	Part of R200
W100	Cord, line	L-3339

SECTION 2

C200	Condenser, .004 mf.	61-0179*
C201	Condenser, .05 mf.	61-0122*
C202	Condenser, .004 mf.	61-0179*
C203	Condenser, 100 mmf.	60-10105407*
†C204	Condenser, .007 mf.	45-3500-7*
LS200	Speaker	36-1598
R200	Control, volume (1 meg.)	33-5526
R201	Resistor, 470 ohms	66-1473340
R202	Resistor, 1,000 ohms	66-2103340*
R203	Resistor, 4.7 megs.	66-5473340*
†R204	Resistor, 3.3 megs.	66-5333340*
†R205	Resistor, 1 meg.	66-5103340*
R206	Resistor, 2.2 megs.	66-5223340*
†R207	Resistor, 680 ohms	66-1683340*
T200	Transformer, output	32-8259

SECTION 3

C302	Condenser, .05 mf.	61-0122*
C303	Condenser, .25 mf.	61-0125*
†R300.	Resistor, 2.2 megs.	66-5223340*
Z300	Transformer, 1st i.f.	32-3971*
C300A:	condenser, trimmer	Part of Z300
C300B:	condenser, trimmer	Part of Z300
†Z301	Transformer, 2nd i.f.	32-3971*
C301A:	condenser, trimmer	Part of Z301
C301B:	condenser, trimmer	Part of Z301
C301C:	condenser, 100 mmf.	Part of Z301
C301D:	condenser, 100 mmf.	Part of Z301
R301:	resistor, 25,000 ohms	Part of Z301

SECTION 4

C400	Condenser, 30 mmf.	60-00305307
C401	Condenser and choke assembly	76-2271
C402	Condenser, tuning	31-2689
C402A:	condenser, trimmer	Part of C402
C402B:	condenser, trimmer	Part of C402
C402C:	condenser, trimmer	Part of C402
C403	Condenser, .0015 mf.	45-3500.6*
C404	Condenser, oscillator-padder	31-6410
C405	Condenser, 1.5 mmf.	30-1221-3

SECTION 4 (Continued)

C406	Condenser, .05 mf.	61-0122*
C407	Condenser, .1 mf.	61-0113*
C408	Condenser, .05 mf.	61-0122*
C409	Condenser, 150 mmf.	60-10155407
C410	Condenser, .1 mf.	61-0113*
L401	Choke, r-f	32-4007
LA400	Loop assembly	32-4080
R400	Resistor, 4.7 megs.	66-5473340*
R401	Resistor, 4.7 megs.	66-5473340*
†R402	Resistor, 120,000 ohms	66-4123340*
T400	Transformer, antenna	32-3972
T401	Transformer, oscillator	32-4095-1
Z400	Transformer, r-f	32-3974
C400A:	condenser, 10 mmf.	Part of Z400

MISCELLANEOUS

Back, removable	45-6391
Battery	P-841A
Bolt, speaker	W2022
Bushing, shaft-and-pulley-assembly	56-6174
Cabinet	10647A
†Loop assembly	32-4080
Cable, battery	41-3712
Catch assembly, rear cover	76-2273
Clip, coil-mounting	28-5002FA1
Cord, drive (25-foot spool)	45-8760*
Cover, switch (volume control)	56-3177
Dial backing plate and pulley assembly	76-2023
Feet	45-6041
Front, roll	45-6418
†Grille, metal, front	56-3351
Grille, metal, rear	56-3208
Grommet, tuning-condenser-mounting	27-4596
Handle	45-6295
Hinge	45-6182
Jack, pin	27-6183
Knob	54-4214
Lead and lug assembly	76-2250
Lockwasher, tuning-condenser	1W24256FA3
Loop, handle mounting (bracket type)	56-3209
Loop, handle mounting (later type)	56-3954
Nut, tuning-condenser	1W19986FA3
Plastic guard	54-4390
Plunger assembly, switch	76-2025
Pointer	76-2470
Pulley and bracket assembly	76-2027
Scale, dial	27-5891
Screw, dial-backing-plate	1W19670FA3
Screw, drive (tuning-condenser)	1W19674FA3
Screw, scale mounting	1W25327FE11
Shaft and pulley assembly	76-2028
Shield assembly, coil	76-2043
Socket, tube (miniature)	27-6203
Socket, tube (octal)	27-6199
Spacer, tuning-condenser-mounting	56-1307FA3
Spring, drive-cord	28-8954
Strap, scale (early type)	56-2068
Strap, scale (later type)	56-3846
Swivel arm and plate assembly	76-2134

†Refer to PRODUCTION CHANGES.

PRODUCTION CHANGES FOR MODEL 46-350

CODE 121

RUN 2

A 120,000-ohm resistor, Part No. 66-4123340*, was added, between B— and chassis.

RUN 3

The original cabinet-and-loop assembly, Part No. 76-2430, was discontinued. This assembly was replaced by two separate assemblies: Cabinet, Part No. 10647A, and loop assembly (LA400), Part No. 32-4080.

RUN 4

Resistor R100, Part No. 33-3431, was changed to a new type, Part No. 33-3431-4, having no integral 60-ohm section; a new 60-ohm section (R100A) having fiberglass insulation was connected across the open section of the new-type R100.

RUN 5

Condenser C101 was moved from the terminal-panel lug nearest the 117Z3 tube to the lug on the opposite end of the same panel. Resistor R103 was connected from the second lug from the end of the terminal panel nearest the 117Z3 tube to the chassis. All associated wiring was changed to correspond.

RUN 6

Some sets from this run used the old-type R100 resistor, Part No. 33-3431.

RUN 7

The following changes were made to prevent the possibility of damage to filter components in case of tube failure.

- a. The 117Z3 socket was turned 180°. The filament connections to this tube were reversed.
- b. The lead from the 680-ohm resistor, R207, and the black lead from the power switch, S101, were removed from pin 3 of the 117Z3 tube and connected to pin 4.
- c. The jumper of bare wire between pins 4 and 5 of the 117Z3 tube was removed.
- d. A brown lead was connected between pins 3 and 5 of the 117Z3 tube.

RUN 8

- a. R402, 120,000 ohms, Part No. 66-4123340*, was changed to 100,000 ohms, Part No. 66-4103340*.
- b. The 120,000-ohm resistor, Part No. 66-4123340* (added in Run 2, between B— and chassis), was changed to 150,000 ohms, Part No. 66-4153340*.

CODE 122

RUN 1

- a. Z301, the 2nd i-f transformer, Part No. 32-3971, was changed to Part No. 32-3971-2.
- b. R204, 3.3 megohms, Part No. 66-5333340*, was changed to 2.7 megohms, Part No. 66-5273340*.
- c. R205, 1 megohm, Part No. 66-5103340*, was changed to 1.2 megohms, Part No. 66-5123340*.
- d. The cabinet-and-loop assembly, Part No. 76-2430, was changed to Part No. 76-2430-2.
- e. The metal front grille, Part No. 56-3351, was changed to Part No. 56-3351-1.
- f. The triple-pole, double-throw, change-over switch, S100, Part No. 42-1553-1, was changed to a double-pole, double-throw type, Part No. 76-2573. Two spacers, Part No. 56-3990, two lock washers, Part No. 1W2425FA3, and a 2-lug terminal panel, Part No. 12W45646, were used with the new switch. The B— leads from the battery and a-c supply were permanently connected at the 2-lug terminal panel instead of being switched through the change-over switch.

CODE 125

RUN 1

The 3Q5GT/G output tube was replaced by a 3LF4. Voltages remain the same.

RUN 2

A 100,000-ohm resistor, Part No. 66-4103340, was added, in series with the "high-potential" end of the volume control.

RUN 3

A 100-mmf. condenser, Part No. 62-110009001, was added, across R100A (figures 1 and 2 of manual).

RUN 4

- a. C204, .007 mf., Part No. 30-4630*, was changed to .004 mf., Part No. 61-0179.
- b. The 100-mmf. condenser added across R100A in Run 3 was removed.

RUN 5

- a. R204, 3.3 megohms, Part No. 66-5333340*, was changed to 2.7 megohms, Part No. 66-5273340*.
- b. R205, 1 megohm, Part No. 66-5103340*, was changed to 1.2 megohms, Part No. 66-5123340*.

RUN 6

- a. R300, 2.2 megohms, Part No. 66-5223340*, was changed to 470,000 ohms, Part No. 66-4473340*.
- b. R204, changed to 2.7 megohms in Run 5, was changed to 10 megohms, Part No. 66-6103340*.

GENERAL INFORMATION ON MODEL 46-350

A-C HUM

On those sets having a 3-section resistor (R100) in the power supply, if the braid covering the 60-ohm line resistor, R100A, is in contact with, or close to, the chassis, hum is likely to occur under high humidity conditions. The leakage path exists in the .1-mf. condenser, C102, between the chassis and B—, and the hum voltage appears on the grids of the r-f and mixer tubes.

CABINET BACK

The separate cabinet back, Part No. 45-6391, is now available. This back is the same as the one used in present production. By making two slots in the bottom of the cabinet, old-style cabinets may be adapted to this removable back.

CRITICAL LEAD DRESS AND PARTS PLACEMENT FOR MODEL 46-350, CODES 121 AND 122

1. The rear lead of the loop, LA400, should be connected to the center lug of the external loop jack; the front loop lead should be connected to the bottom lug of this jack.
2. Condenser C400 in the cabinet-and-loop assembly should be connected across the external loop jack, between the center and bottom lugs.
3. The white lead from the hole at the end of the chassis should be connected to the bottom lug of the external loop jack; the brown lead from the external-aerial coil, T400, should be connected to the top lug of this jack.
4. The green lead from the 1T4 r-f tube to the aerial section of the tuning-condenser gang (C402) should be dressed toward the end of the subbase, and away from all oscillator wiring.
5. The green lead from the external-aerial coil to the aerial section of the tuning-condenser gang should be wired around the ground lug on the chassis and dressed toward the end of the chassis, away from the oscillator section of the tuning-condenser gang.
6. The white lead on the oscillator section of the tuning-condenser gang should be wired over the tubular condenser and wiring panel to the series padder, C404; this wire should be dressed away from the chassis.
7. The white lead on the series padder should be wired over the tubular condenser and wiring panel to the oscillator coil, T401; this lead should be dressed away from the chassis.
8. All wiring and components should be dressed away from the wire-wound resistor, R100.
9. The power cord, wired across the chassis to the wiring panel, should be dressed away from resistor R205 and the 1T4 i-f-amplifier socket.