A.E.CO. TYPE 820 HANDSET SHOP PROCEDURE

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1. GENERAL

1.01 This section has been revised to include information about supplying the A.E.Co. Type 820 Handset with retractile cords for the A.E.Co. Types 860A and 880 Telephone Sets. Because of extensive changes, marginal arrows are not used. Remove and destroy all copies of Issue 1 of this section.

1.02 The information contained in this section concerns the repair and maintenance of the Type 820 handset which is used by customers with impaired hearing. The handset (Figure 1) employs miniature techniques and close tolerances to the extent that repair and maintenance (except cap and capsule replacement) should not be attempted in the field. The procedures described in this section are to be performed by a skilled electronics craftsman in a repair facility.

1.03 The Type 820 handset is equipped at the factory with a retractile cord that is attachable to most telephone sets. The exceptions are the Types 860A and 880 telephones; these units require different cords due to the length of trim needed at the transmission unit.

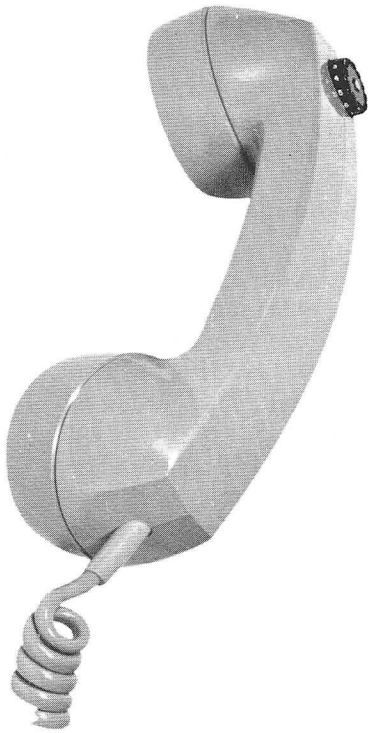


Figure 1. Type 820 Handset.

1.04 The repair shop is responsible for providing the Type 820 handset with the appropriate cord. The cords which are adaptable to the Types 860A and 880 telephone sets are D-543302 and D-543336, respectively.

1.05 Shop procedures for the Type 820 handset can be accomplished by replacing defective components. These components are identified in Figure 2. Replacement procedures are provided in Part 2 of this section. A receiver amplifier card assembly test is described in Part 3.

2. REPLACEMENT PROCEDURES

Volume Control

2.01 To replace the volume control, proceed as follows:

(1) Remove the receiver cap and capsule from the handset.

(2) At the receiver cavity, remove the 1-72 × 5/32-inch hex nuts, flat washers, and lockwashers (see Figure 3)

from the visible end of the receiver amplifier card assembly.

(3) Pull the volume control free from the top side of the handset.

(4) Set the replacement volume control to its full counterclockwise position and then insert the two threaded studs through the mounting holes in the handset and the card assembly.

NOTE: With the volume control set to extreme counterclockwise, position the 0 up toward the receiver end of the handset. Align the 0 with the handset center line.

(5) Replace the washers and hex nuts and tighten.

(6) Replace the receiver capsule and cap.

Receiver Amplifier Card Assembly

2.02 When a problem develops in the receiver amplifier card assembly (WA-1095-A), replace it in its entirety. To replace the card assembly, proceed as follows:

(1) Remove the transmitter and receiver caps and transmitter capsule from the handset. Disconnect the black and white leads from the receiver capsule.

(2) Remove the volume control as described in Paragraph 2.01, steps (2) and (3).

(3) Remove the central contact spring (Figure 3) from the transmitter cavity, loosen the terminal screw, and disconnect the two green leads.

(4) Loosen the terminal screw on the rim contact spring (Figure 3) and disconnect the two red leads.

(5) From the outer side of the handset, insert a thin rod or pick into the outer end hole vacated by removal of the volume control. Exert slight pressure inward to force the terminal stud of the card assembly over the cast ridge inside the handset. The card assembly is flexible enough to permit this operation.

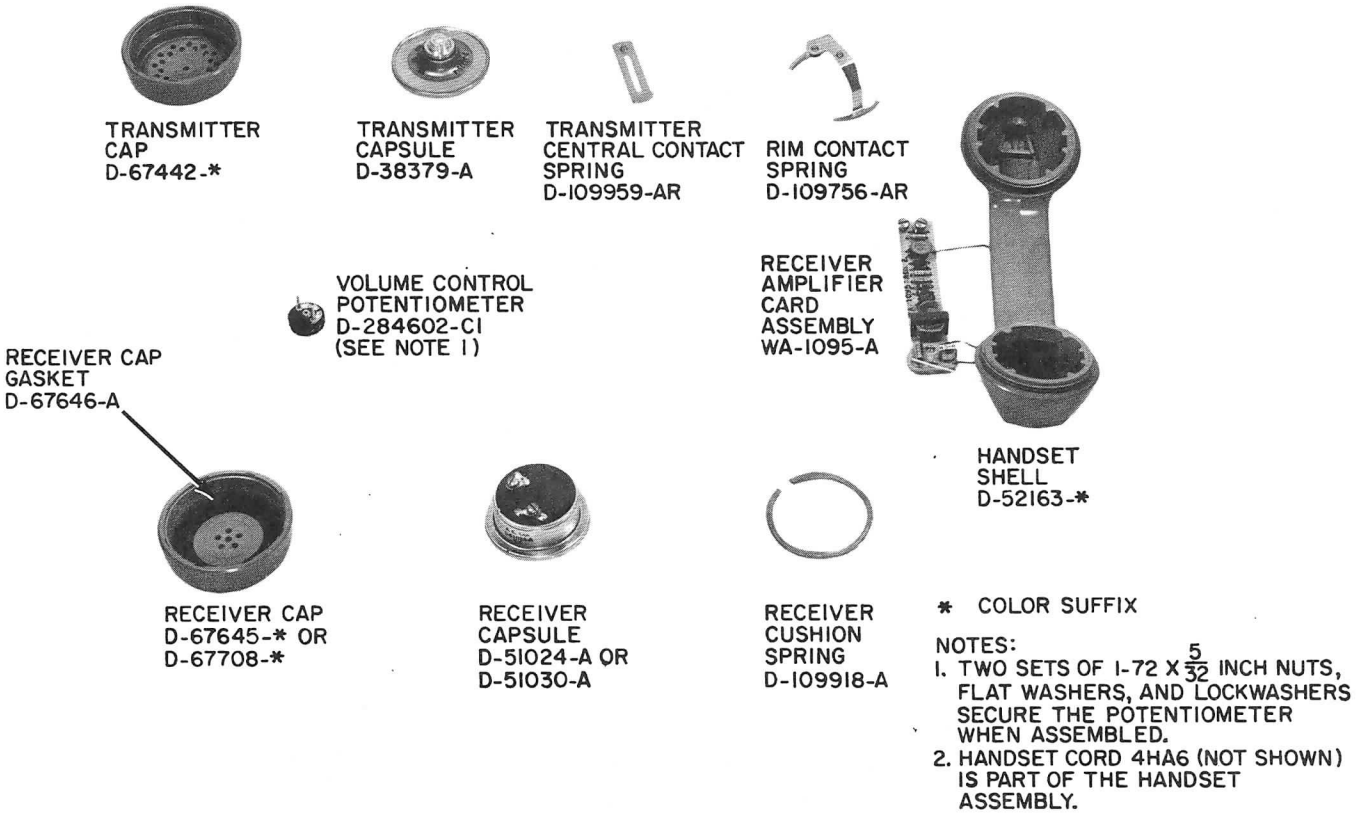


Figure 2. Type 820 Handset—Components.

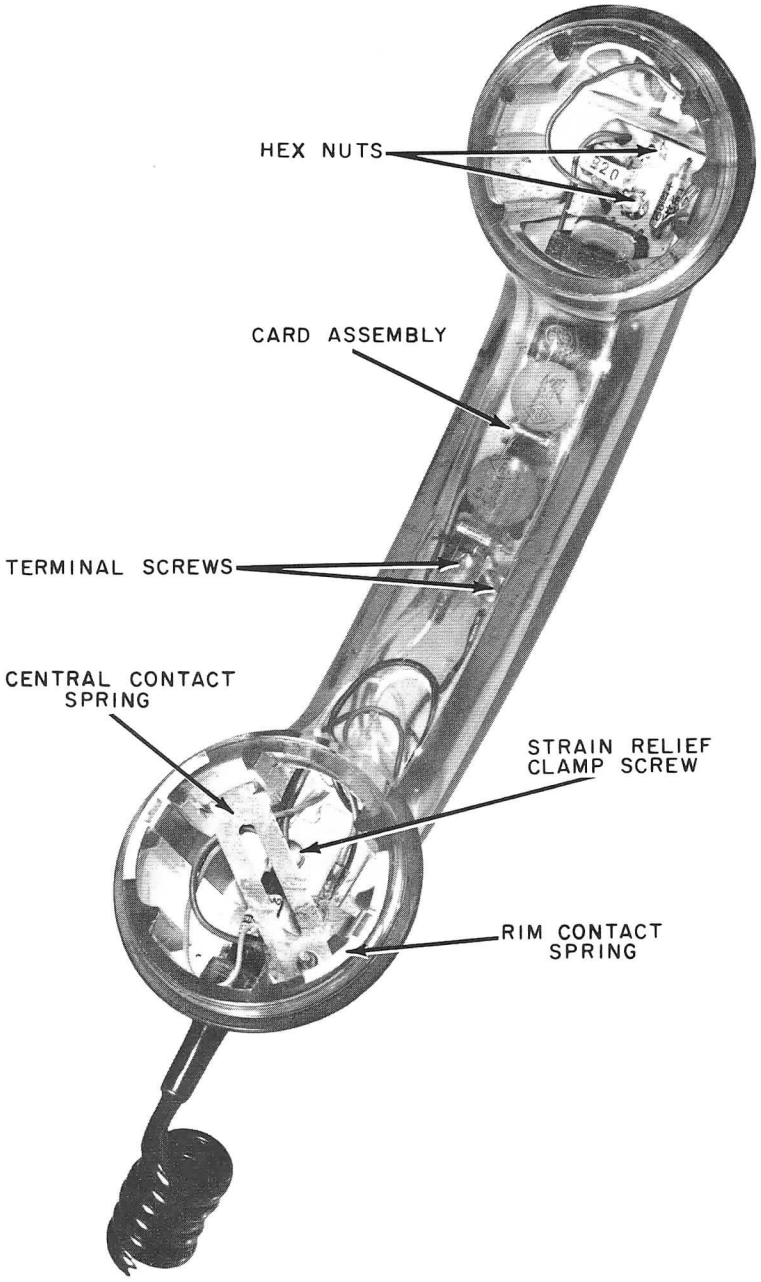


Figure 3. Type 820 Handset (Bottom View).

(6) Grasp the edges of the card assembly with narrow duckbill pliers and "walk" it out of the receiver cavity.

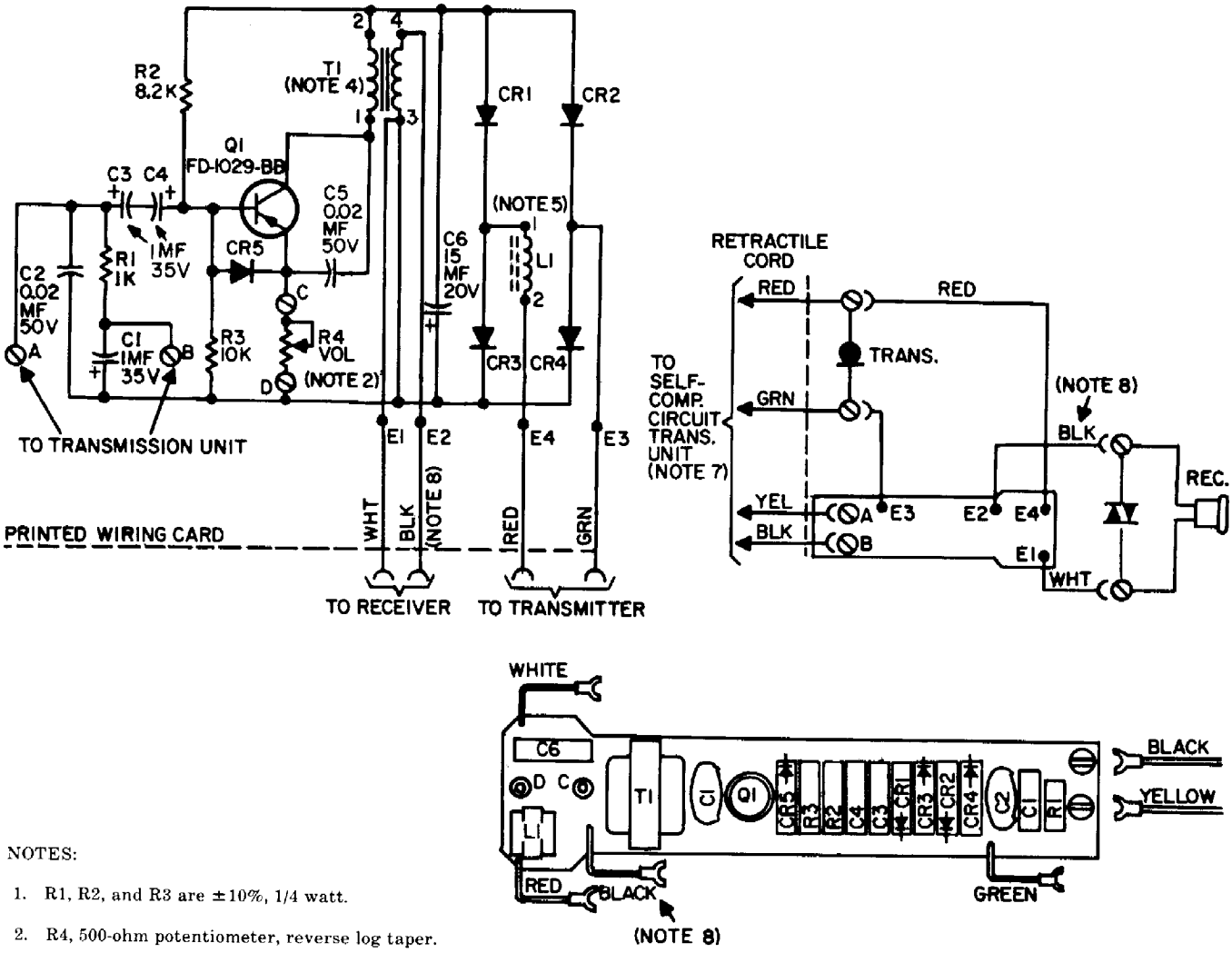
NOTE: Do not attempt to pull the card assembly directly outward as it can crack. Also, do not attempt to remove the card assembly by pulling the black and white leads.

(7) Loosen the two terminal screws on the end of the card assembly and disconnect the yellow and black leads.

(8) Place the new card assembly near the receiver cavity and connect the black and yellow leads of the handset cord to the card assembly terminal screws according to the wiring diagram (see Figure 4).

(9) Insert the red and green leads of the card assembly into the receiver cavity and through the hollow handgrip.

(10) Insert the card assembly into the receiver cavity and slide it into the



NOTES:

1. R1, R2, and R3 are ±10%, 1/4 watt.

2. R4, 500-ohm potentiometer, reverse log taper.

*3. CR1 through CR5 on card assemblies of early manufacture (silicon diodes) are A.E. Co. FD-1029-DF (Texas Inst. G-1016 or Transitron Elec. SG1255 or Equiv.) CR1 through CR5 on later card assemblies (germanium diodes) are A.E.Co. FD-1029-FB (General Inst. Co. CGD1347 or Sylvania Elec. D-3922 or Transitron Elec. S3460G, or equiv.) Early card assemblies can be distinguished from later card assemblies by the presence of a blue wire in place of the black wire on later card assemblies.

*4. T1, audio output transformer, P-500 ohms, S-150 ohms, A.E.Co. FD-1008-AW (Midwest Coil and Transformer Co. 382AB75 or Electronics Components Type X443642 or equiv.).

*5. L1, isolation choke coil, A.E. Co. FD-1011-CM (Midwest Coil and Transformer Co. 382CB20 or equiv.).

*6. Q1, transistor, A.E. Co. FD-1029-BB (General Elec. 4JD1C104 or Texas Inst. GA928 or equiv.).

7. Leads must not be transposed, connections must be made (color for color) to the same terminal from which the standard retractile handset cord leads were disconnected.

8. On boards of early manufacture, this wire is blue.

* In NOTES 3, 4, 5 and 6: the use of components other than those with an A.E. Co. "FD" number is not recommended. They are to be used only when emergency repairs are required and "FD" numbered components are not available. Handset performance cannot be guaranteed unless A.E. Co. "FD" numbered components are used.

Figure 4. Type 820 Handset – Schematic and Wiring Diagrams.

hollow handgrip until it is in place. Be careful not to damage components while inserting the card assembly.

(11) Replace the volume control as described in Paragraph 2.01, steps (4) and (5).

(12) In the transmitter cavity, connect the two red leads to the terminal screw on the rim contact spring.

(13) In the transmitter cavity, connect the two green wires to the terminal screw on the central contact spring and insert the central contact spring in place in the cavity.

(14) In the receiver cavity, connect the black and white leads to the receiver capsule.

(15) Replace the transmitter and receiver capsules and caps.

Retractile Handset Cord

2.03 The procedure for replacing the retractile handset cord on the Type 820 handset is similar to replacing the receiver amplifier card assembly. To replace the handset cord, proceed as follows:

(1) Disassemble the handset as described in Paragraph 2.02, steps (1) through (7).

(2) In the transmitter cavity, loosen the strain relief clamp screw (Figure 3), slide the clamp to the left, and pull the handset cord from the cord entrance.

(3) Slip the new handset cord through the cord entrance hole, then hook the strain relief clamp on the strain relief screw and tighten.

(4) Insert the yellow and black leads of the handset cord through the hollow handgrip.

(5) Place the card assembly near the receiver cavity and connect the black and yellow leads of the handset cord to the card assembly terminal screws (see Figure 4).

(6) Reassemble the handset according to the procedures outlined in Paragraph 2.02, steps (8) through (15).

NOTE: Information pertaining to handset cord connections at the telephone set is provided in the section applicable to the telephone set in the 473 division of General System Practices.

3. RECEIVER AMPLIFIER CARD ASSEMBLY TEST

Operation

3.01a The receiver amplifier card assembly (Figure 4) has a single PNP germanium transistor in a common-emitter configuration providing approximately 28-dB gain for the received signal. The amplifier input impedance between terminals A and B is suitable for direct coupling to the telephone network. Resistor R1 and capacitor C2 stabilize this input impedance, and together with capacitor C5, suppress high-frequency radio or television signals that might cause interference with the speech signals.

3.01b With the volume control potentiometer R4 set at 9 (shorted), the amplifier operates at full gain; at other settings of the volume control, gain is reduced. Also, with resistor R4 in series with the emitter, circuit stability is provided and differences caused by variations in component characteristics are minimized. With the volume control set at 0 or 1, the performance of the handset is essentially the same as that of the A.E.Co. Type 810 handset; consequently, the amplifier does not have to be switched out of the circuit when used by people with normal hearing.

Inspection

3.02 The most likely reason for malfunction of the handset would be damage to the receiver amplifier card assembly. The card assembly should be carefully examined for loose wires or loose components and for breaks in the laminated copper conductor network. The card assembly uses a semi-flexible printed circuit board. This board can be bent a limited amount when installing or removing it from the handset.

Test Circuit

3.03a Figure 5 illustrates the test circuit used for testing the receiver amplifier card assembly used in the Type 820 handset. Table 1 lists the positions of switches S1 and S2, the various input frequencies (with a constant input voltage of 0.015 V ac) that should be applied to the amplifier input circuit, and the approximate current expected for each frequency and switch position. To test the card assembly, construct the circuit as shown in Figure 5 and proceed with the tests described in the following paragraphs. The test equipment required is:

(a) Hewlett-Packard 3550 Series Test Set, or equivalent; the oscillator portion only is used.

(b) Hewlett-Packard 400-Series VTVM, or equivalent (used as meter M2).

(c) Simpson 260 VOM, or equivalent (used as meter M1).

(d) Three Switches—two 2-position; one double-pole/double-throw.

(e) Four resistors—one 150 ohms ± 1 percent, 1/2 watt; one 20 ohms ± 1 percent, 1/2 watt; one 500 ohms ± 1 percent, 1/2 watt; one 100 ohms ± 5 percent, 3 watts.

(f) Power source—3 and 6 volts dc (±2 percent).

Diode Bridge Test

3.03b The diode bridge configuration is designed to provide correct polarity to the amplifier, regardless of the voltage polarity developed across the telephone transmitter. Check the diode bridge on the card assembly as follows:

(1) Connect a 20-ohm ±1 percent, 1/2-watt resistor across the 600-ohm output terminals of the audio oscillator.

(2) Connect the output of the audio oscillator to terminals A and B.

(3) Set the audio oscillator to 1000 Hertz at 0.015 V ac.

(4) Connect a 150-ohm ±1 percent, 1/2-watt resistor across the secondary of the output transformer T1.

(5) Connect milliammeter M1 as shown in Figure 5 to monitor the transistor collector current.

(6) Set switch S1 in position 1 and switch S3 in the normal position.

(7) Set switch S2 in position 2.

(8) Record the current value indicated on meter M1. After this value is recorded, move switch S3 to the reverse position. Record the current value on meter M1. If the current values differ more than 15 percent, check each diode of the bridge with an ohmmeter and replace, if necessary. If good, the diodes should show a high resistance in one polarity (close to infinity) and a much lower resistance in the opposite polarity.

(9) Compare the current values to those in Table 1. As noted in Table 1, the approximate current value with switch S3 in the normal position should range from 3.5 mA to 6.0 mA.

Isolation Choke L1

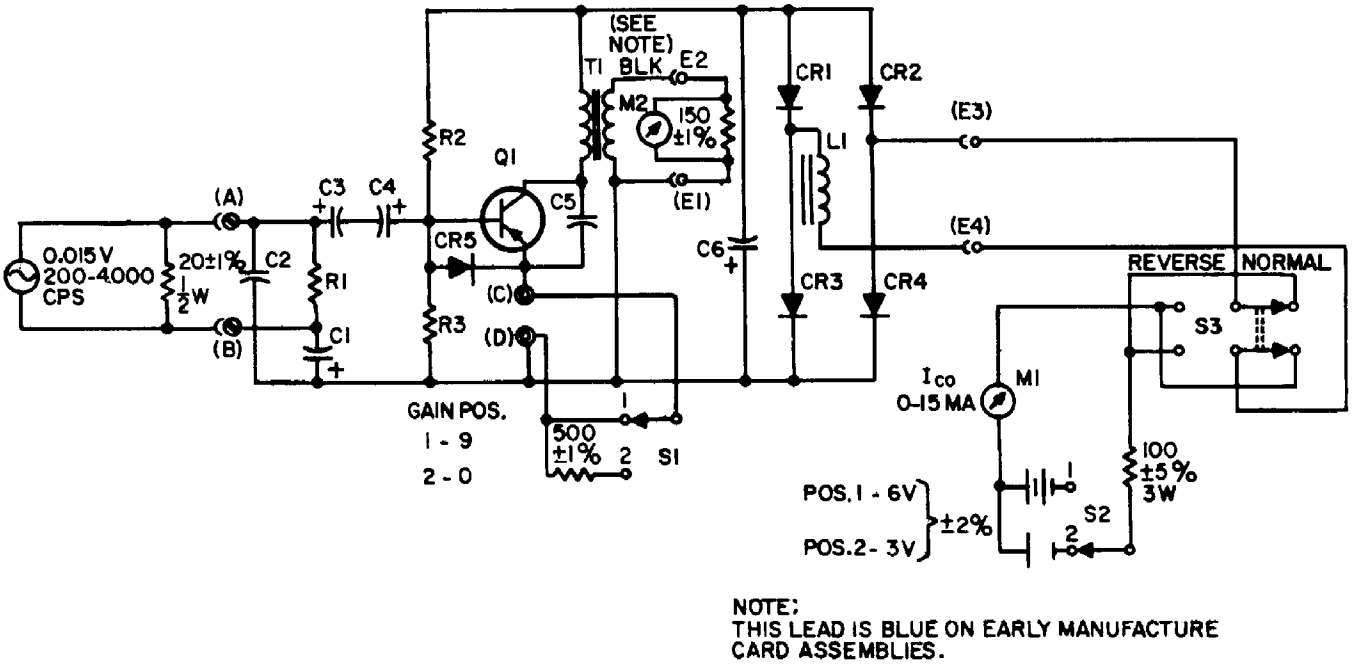
3.03c The isolation choke and capacitor C6 form a filter network for the varying transmitter speech current. From a dc standpoint the choke coil is not important; that is, if the coil is partially shorted it is very unlikely that it would be discernible on an ohmmeter. However, under ac conditions, if the choke is partially shorted or completely shorted, it will cause a substantial reduction in the output signal because it also isolates the low-impedance bridge from the transmitter. Voltmeter M2 indicates a reduction in output voltage if choke L1 is defective.

Filter Capacitor C6

3.03d If capacitor C6 is shorted, meter M2 indicates 0 volts while meter M1 at the same time shows a significant increase in collector current I_{CO}. If thought to be defective, check this capacitor with an ohmmeter as follows:

(1) Unsolder one lead of capacitor C6.

(2) Set the ohmmeter to a high resistance scale.



NOTE:
THIS LEAD IS BLUE ON EARLY MANUFACTURE CARD ASSEMBLIES.

Figure 5. Receiver Amplifier Card Assembly Test Circuit.

Table 1. Receiver Amplifier Card Assembly Test Data.

SWITCH		FREQUENCY IN HERTZ					
POSITION		200	500	1,000	2,000	4,000	Ico mA
S1	S2	DECIBELS RELATIVE TO 0.01 VOLT ACROSS 150 OHMS					
2	1						
	MAX.	−6.6	−2.5	−1.4	−0.9	0	4.5
	MIN.	−8.3	−3.4	−2.1	−1.6	−1.9	3.5
1	1						
	MAX.	3.3	18.1	25.6	31.0	33.5	15.0
	MIN.	−5.3	6.0	20.5	27.2	28.8	9.0
1	2						
	MAX.	13.3	23.2	27.3	28.8	30.9	6.0
	MIN.	9.5	20.2	25.5	27.7	26.0	3.5

(3) Connect the positive lead of the ohmmeter to the positive side of the capacitor and the negative side to the negative lead. The ohmmeter needle should rise toward 0 but stop at a high resistance value.

(4) If the ohmmeter indicates an infinite value, the capacitor is probably open and should be replaced.

(5) If the ohmmeter indicates 0, the capacitor is shorted and should be replaced.

Audio Output Transformer T1

3.03e Transformer T1 provides the amplified output voltage to the receiver in the telephone handset. If the transformer is partially shorted or totally defective, it will be indicated by meter M2. However, the transformer should not be replaced until other components in the signal path have been first checked. For example, capacitors C3 or C4 could be open, causing zero output voltage, or capacitor C1 could be shorted, thus removing the signal from the transistor base circuit.

Capacitor C1 and Resistor R1

3.03f These two components help to stabilize the input impedance and, along with capacitor C5, suppress high-frequency radio or television signals that might cause interference with the speech signals. If the customer is located near radio or television stations and complains of noise interference, check these components using a reliable ohmmeter.

Transistor Q1

3.03g Transistor Q1 should not be unsoldered from the printed circuit board until all other possibilities of trouble have been eliminated, and then a low-wattage soldering iron especially designed for transistor work should be used. If the transistor is shorted, a decrease in output voltage will appear on meter M2 and a slight increase in collector current I_{CO} on meter M1. If the transistor is found to be defective, check bias resistor R4 and diode CR5 as it is very likely that either component is also defective.

Diode CR5

3.03h This diode protects the transistor during large signal variations which can cause changes in the bias and consequently result in the transistor becoming overheated and burning up. Check this diode with an ohmmeter, as mentioned previously, whenever the transistor needs to be replaced.