

STROMBERG-CARLSON WIRE CHIEF'S TEST SET—TYPE B 419086-018 AND 419086-028 DESCRIPTION

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1. GENERAL

1.01 This practice provides the description of the S-C Wire Chief's Test Set, Type B, which is used to assist in the testing and troubleshooting of inside and outside plant equipment associated with a dial office. See Figure 1.

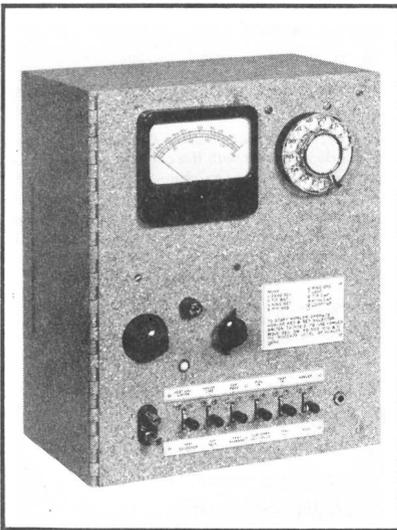


FIGURE 1. Wire Chief's Test Set, Type B

1.02 Also included in this practice are procedures for the installation, maintenance, and calibration of the Type B test set.

1.03 There are two models of the Type B test set:

a. S-C Part No. 419086-018 is supplied for use with a CDO (community dial office) test selector and is wired in accordance with Figures 1, 3, and 7 of circuit diagram S-419086 (see Figure 2, Sheets 1 and 2, foldouts).

b. S-C Part No. 419086-028 is used with an MDO (main dial office) test selector and is wired as shown in Figures 1, 2, and 3 of circuit diagram S-419086 (see Figure 2, Sheets 1 and 2, foldouts).

NOTE: Other FIG. numbers shown on the circuit diagram are for optional equipment wiring. All options are not included in any particular test set but options are selected to suit the requirements of the office in which the test set is to be installed.

1.04 An Equipment Specification may accompany the equipment. If instructions in the Equipment Specification differ from those in this practice, follow the Equipment Specification.

1.05 Refer to CTSP 405-110-728 (S-C switching series) for test procedures using the Type B test set.

2. DESCRIPTION

2.01 System Application: A block diagram of the application of the test set in a typical dial central office is shown in Figure 3 and described as follows:

a. **Test Telephone Switching Equipment:** When an external telephone set is connected to the test set, the telephone is assigned a station number and functions as a station telephone. The test set uses this number and the dial equipment associated with it to receive and originate calls through the central office equipment.

b. **Test Train Switching Equipment:** The test switchtrain consists of a test selector and a test connector. The test switchtrain is seized directly from the test set. Normally, there is only one test switchtrain in an office, but a local demand or future expansion may require an additional switchtrain.

c. **Test Shoe:** The test set is provided with a test shoe circuit. The test shoe permits the testing

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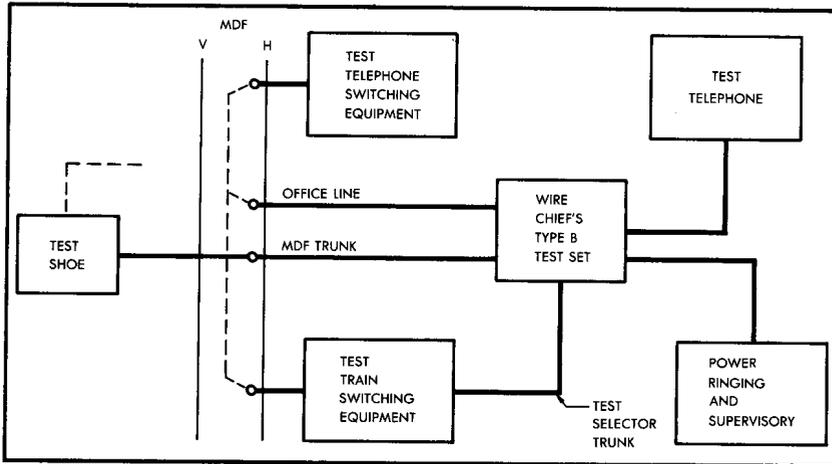


FIGURE 3. Typical Application for Type B Test Set

(without going through the dial equipment) of all lines and trunks that terminate on the protector blocks of the MDF (main distributing frame). The test shoe must be inserted manually into the protector of the line or trunk to be tested.

2.02 Capabilities: The individual requirements and specifications of the office in which the test set is to be used determine the functional circuits incorporated into the unit. Testing facilities for the following principal functions are available:

- a. Tip, ring, and loop capacitance.
- b. Tip, ring, and loop ground.
- c. Loop resistance.
- d. Tip and ring battery.
- e. Positive booster voltage (+60 volt) on tip.
- f. Single frequency, five-frequency, code, or superimposed ringing.
- g. Howler with automatic cut-off and restoration of service.
- h. Access to inside and outside plant by way of MDF protectors.
- i. Reversal of test leads.
- j. Dial pulsing.
- k. Talking path.

l. Access to inside and outside plant by way of the test selector.

m. Monitoring at MDF heat coils.

n. Permanently held line condition (MDO type test set only).

2.03 Physical Characteristics: The test set is housed in a wooden cabinet with the controls mounted on a hinged metal front panel (see Figure 1), and the assembly is finished with a stone gray multicolored lacquer. Mounting holes drilled in the cabinet rear panel allow for mounting on the end of a main distributing frame, in an equipment bay, or on a wall. Dimensions of the test set are:

- a. Height: 14-1/2 inches.
- b. Width: 12 inches.
- c. Depth: 8-1/2 inches.
- d. Weight: 20 pounds (approximately).

2.04 Technical Characteristics:

a. Operating requirements:

(1) Battery voltage: 44 to 54 VDC.

(2) Dial characteristics:

(a) Percent make: 38.5 ±2%.

(b) Speed: 8 to 12 pps.

(c) Ringing voltage: As required.

b. Volt-ohmmeter:

(1) Full scale deflection current: 0.00075 ampere.

(2) Internal resistance: 200Ω maximum.

(3) Scales:

(a) DC voltage (lower scale): 0 to 150.

(b) Ω (upper scale): 0 to infinity.

3. CIRCUIT DESCRIPTION

3.01 This circuit description applies to the Type B test set used in MDO's or CDO's. Operation of the circuit is the same for both models except for the test selector train (see paragraphs 3.09 and 3.10). Each test set provides a means of applying various test circuits and potentials to the tip and ring conductors of a line under test.

3.02 Line Connection: This circuit provides three separate means of accessing a line under test:

a. **Binding Post:** The T and R binding posts are provided to connect external test equipment to the test set circuit.

b. **MDF Test Shoe:** The MDF test shoe can be inserted into the protector strip to provide three separate points of access:

(1) The T-IN and R-IN leads are the T and R leads to the line equipment.

(2) The heat coil tip (HCT) and heat coil ring (HCR) leads provide access through the heat coils to the customer's line.

(3) The T-OUT and R-OUT leads provide direct access to the customer's line, bypassing the heat coils.

c. **Test Selector:** The test selector trunk provides access to a customer's line by way of the test selector and test connector. A metallic path may be established to the line for ringing or meter measurements.

3.03 Receiving and Transmitting: Use a hand test telephone or a regular telephone with this circuit to provide a means of listening and talking.

a. Where a hand test telephone is plugged into the TEST TEL jack mounted in the face of the unit or when the handset of the station test telephone is lifted, a circuit is closed to relay CB.

b. Relay CB operating switches the test pair away from the meter, ringing, and howler circuits and couples the test pair to the test telephone.

c. Operation of the HEAT COIL LISTEN-TEST SELECTOR switch to the HEAT COIL LISTEN position will extend the transmission path from the line through the heat coils to the test pair. If the line is accessed by way of the test selector trunk, operation of this switch to the TEST SELECTOR position extends the transmission path to the test pair.

d. To talk with someone on the line, transmission battery is furnished to the line by operating the OFFICE LINE-OUT TALK switch to the OUT TALK position. This switch short circuits the transmission capacitors, so that relay CB furnishes transmission battery to both the testman and the person on the line under test.

3.04 Office Line Connection: Provision is made in this test unit to connect to a regular exchange line circuit. An external extension ringer may be connected to provide a means of signaling on incoming calls. Operation of the OFFICE LINE-OUT TALK switch to the OUT TALK position connects the test telephone to the exchange line circuit to permit origination or termination of a call in the usual manner.

3.05 Ringing: There are various ways of applying ringing to a line as shown in the following paragraphs a. through g. (see schematic diagram, Figure 2.). One of the methods shown applies to a particular office and other methods may be ignored once the proper method has been determined. Ringing is applied to a line by way of the test shoe or the test train by positioning the selector switch to the proper position and then operating the HOWLER-RING switch to the RING position. If the test shoe is used, the TEST IN-TEST OUT switch must also be placed in the TEST OUT position. Ringing is coded by the appropriate operation of the HOWLER-RING switch since this unit supplies noninterrupted ringing. In all cases, the selector switch position number corresponds to the number of the party on the line.

a. **Five Frequency Harmonic Ringing** (see FIG. B on Figure 2, sheet 3):

GENERATOR	SIDE OF LINE	SELECTOR SWITCH POSITION
1	R	1
2	R	2
3	R	3
4	R	4
5	R	5
1	T	6
2	T	7
3	T	8
4	T	9
5	T	10

b. Five Frequency Harmonic Ringing Odd and Even (see FIG. E on Figure 2, sheet 3):

<u>GENERATOR</u>	<u>SIDE OF LINE</u>	<u>SELECTOR SWITCH POSITION</u>
1	T	1
1	R	2
2	T	3
2	R	4
3	T	5
3	R	6
4	T	7
4	R	8
5	T	9
5	R	10

c. Five Frequency Ringing Odd and Even (see FIG. L on Figure 2, sheet 3):

<u>GENERATOR</u>	<u>SIDE OF LINE</u>	<u>SELECTOR SWITCH POSITION</u>
1	R	1
2	T	2
3	R	3
4	T	4
5	R	5
1	T	6
2	R	7
3	T	8
4	R	9
5	T	10

d. Five Frequency Harmonic Ringing On Ring Lead (see FIG. G or K on Figure 2, sheet 3):

<u>GENERATOR</u>	<u>SIDE OF LINE</u>	<u>SELECTOR SWITCH POSITION</u>
1	R	5
2	R	4
3	R	3
4	R	2
5	R	1
1	R	10
2	R	9
3	R	8
4	R	7
5	R	6

e. Four Frequency Ringing (see FIG. J on Figure 2, sheet 3):

<u>GENERATOR</u>	<u>SIDE OF LINE</u>	<u>SELECTOR SWITCH POSITION</u>
1	R	1
2	R	2
3	R	3
4	R	4
1	T	5
2	T	6
3	T	7
4	T	8

f. Single Frequency Code Ringing (see FIG. C on Figure 2, sheet 3):

<u>SIDE OF LINE</u>	<u>SELECTOR SWITCH POSITION</u>
R	1
T	2
R	3
T	4
R	5
T	6
R	7
T	8
R	9
T	10

g. Superimposed Ringing (see FIG. D on Figure 2, sheet 3):

<u>POLARITY OF SUPERIMPOSED BATTERY</u>	<u>SIDE OF LINE</u>	<u>SELECTOR SWITCH POSITION</u>
Neg.	R	1
Neg.	T	2
Pos.	R	3
Pos.	T	4
Neg.	R	5
Neg.	T	6
Pos.	R	7
Pos.	T	8

3.06 Howler: With the HOWLER-RING switch in the normal position, the tip and ring conductors under test are extended into the testboard for connection to the test telephone.

a. To apply the HOWLER, the test telephone must be on-hook.

b. When a connection to the line is made by way of the test shoe, the TEST IN-TEST OUT switch must be operated to the TEST OUT position. See FIG. 3 on Figure 2, sheet 2, and FIG. H on Figure 2, sheet 3.

c. Operation of the TEST IN-TEST OUT switch to the TEST OUT position disconnects the customer's line T-OUT and R-OUT leads from the exchange line circuit T-IN and R-IN leads. This opens the loop to allow the held line circuit to restore to normal and extends the customer's line T-OUT and R-OUT leads through normal contacts of the TEST REVERSE switch and normal contacts of relay CB to control of relay HL contacts.

d. After operation of the TEST IN-TEST OUT switch to the TEST OUT position with the selector switch positioned to 8 (TIP CAP), operation of the HOWLER-RING switch to the HOWLER position closes a circuit to the B-D winding of relay HL from ground through normal contacts of relay HL and prepares an alternate holding loop for relay HL.

e. Operation of relay HL grounds the HST lead, causing activation of the external howler circuit. This disconnects the T-OUT and R-OUT leads from control of the HOWLER-RING switch and closes a holding loop circuit to itself by way of operated contacts of the HOWLER switch section, its own operated contacts, normal relay CB contacts, normal TEST REVERSE-CAP READ switch contacts, operated TEST OUT section of the TEST IN-TEST OUT switch contacts, the T-OUT and R-OUT leads, and the customer's telephone hookswitch.

f. The selector switch is now set to the OFF position. This opens the operating loop circuit for relay HL and places it under control of the customer's telephone on the T-OUT and R-OUT leads.

g. External howler tone, capacitor coupled in parallel with the windings of relay HL by way of the HT and HR leads, is applied through the holding path for relay HL (as described above) to the customer's telephone receiver. This provides an audible indication that the telephone is off-hook.

h. If a graduated howler is used, the tone is increased automatically, in steps, to its maximum.

i. When the telephone handset has been properly restored on the hookswitch, the T and R loop is opened to the windings of relay H.

j. Release of relay HL removes ground from the HST lead, deactivates the external howler circuit, disconnects the T-OUT and R-OUT leads from the output of the external howler circuit, and connects the customer's exchange line circuit T-IN and R-IN leads to the customer's line T-OUT and R-OUT leads by way of operated contacts of the HOWLER-RING and TEST IN-TEST OUT switches.

k. With the exchange line circuit reconnected, the customer's telephone is available for normal service.

l. After applying the howler tone for a desired time, the TEST IN-TEST OUT switch must be restored to normal before operating the HEAT COIL LISTEN-TEST SELECTOR switch to the HEAT COIL LISTEN position; then remove the telephone from the hookswitch to monitor the line.

m. Restoration of the TEST IN-TEST OUT switch reconnects the T-OUT and R-OUT leads through normal contacts of the TEST IN switch section to maintain the connection with the exchange line circuit by way of the T-IN and R-IN leads. It also disconnects the test out leads from control of the HOWLER section of the HOWLER-RING switch and relay HL.

n. The line can be monitored as described in paragraph 3.03 and resistance measurements made of the line loop (paragraph 3.07 f.) to determine if the condition has been corrected.

3.07 Meter Connections: Connection to the line is established by way of the test selector switchtrain or the MDF test shoe. When the test shoe is used, the TEST IN-TEST OUT switch must be placed in the TEST OUT position. If the test train is used, the HEAT COIL LISTEN-TEST SELECTOR switch must be placed in the TEST SELECTOR position, and the TEST IN-TEST OUT switch must be left in the normal position. Before making each resistance measurement test, the meter should be calibrated as instructed in paragraph 3.07 b. (4).

NOTE: When making meter measurements, the test telephone must be on-hook.

a. The Selector Switch: The selector switch is a twelve terminal point switch with terminal 1 not wired and referred to as the OFF position. On FIG. 1 of the schematic diagram (Figure 2, sheet 1), terminal 12 is shown as brush wiper connections on each bank A, B, C, D, E, F, and G. The test function of each terminal position of the selector switch is shown in Table A of the schematic diagram (Figure 2, sheet 1).

b. Zero Adjust: Turn the selector switch to position 1.

(1) The ground present on the C brush wiper (relay HL normal) is conducted by way of the strap to terminal 1 (C and F gang), F brush wiper to the positive (+) side of the meter.

(2) Negative battery potential is conducted by way of the resistance network composed of resistors RH1, R2 center tapped, RH2, normal

DIAL IN-LOW OHMS switch, terminal 1, G brush wiper through the winding of relay MS to the negative side of the meter.

(3) Excessive current will operate relay MS which shunts the meter, thereby protecting the meter.

(4) To set the meter needle to 0Ω , operate the ZERO ADJUST rheostat to RH1.

c. Negative Potential Measurement: Turn the selector switch to position 2.

(1) Tip battery voltage—TEST REVERSE-CAP READ switch normal.

(a) The meter circuit is returned to ground by way of the F wiper and the tip side of the line is connected to the other side of the meter circuit.

(b) Ground is applied by way of the diode and F wiper through the meter and relay MS in series with the G wiper position 2, resistors RH3 and R3, D wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and normal contacts of the TEST REVERSE-CAP READ switch to the tip side of the line under test.

(c) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the T-OUT lead of the MDF test protector shoe to the tip of the line under test.

(2) Ring battery voltage—TEST REVERSE-CAP READ switch in the TEST REVERSE position.

(a) The meter circuit is returned to ground by way of the F wiper. The ring side of the line is connected to the other side of the meter through operated contacts of the TEST REVERSE section of the TEST REVERSE-CAP READ switch.

(b) Ground is applied by way of the diode and F wiper position 2, through the meter and relay MS in series with the G wiper position 2, resistors RH3 and R3, D wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and operated contacts of the TEST REVERSE section of the TEST REVERSE-CAP READ switch to the ring side of the line under test (test telephone on-hook).

(c) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the R-OUT lead of the MDF test protector shoe to the ring side of the line under test.

(d) The meter is connected as a voltmeter and will indicate the reading of negative battery voltage of the ring conductor under test.

d. Positive Booster Voltage Measurement: Turn the selector switch to position 3.

(1) The meter circuit is returned to ground by way of the G wiper; the tip side of the line is connected to the other side of the meter circuit.

(2) Ground is applied by way of the G wiper position 3, relay MS and meter in series, the F wiper position 3, resistors RH3 and R3, D wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and normal contacts of the TEST REVERSE-CAP READ switch to the tip side of the line under test (test telephone on-hook).

(3) Operation of the TEST IN-TEST OUT switch to the TEST IN position connects the meter circuit by way of the T-IN lead to the tip conductor of either line adapter circuit.

(4) The meter is connected as a voltmeter and will indicate a reading of positive booster voltage (+60) on the tip conductor under test.

e. Line Battery Measurement: Turn the selector switch to position 4.

CAUTION: During this test, if the meter needle moves to the left (negative on tip) or moves very quickly to the right (voltage more than 150 volts), release the TEST IN-TEST OUT switch immediately.

(1) The positive side of the meter is connected to the tip side of the line under test by way of the F wiper and F gang terminal 4, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB, and normal contacts of the TEST REVERSE switch.

(2) With the selector switch in position 4, the negative side of the meter is connected to the ring side of the line under test by way of relay MS, the G wiper and G gang terminal 4, strap to G gang terminal 2, resistors RH3 and R3, strap from D gang terminal 2, E gang terminal 4, the E wiper, normal contacts of the HOWLER-RING switch, normal contacts of

relays HL and CB, and normal contacts of the TEST REVERSE switch.

(3) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit across the T-OUT and R-OUT leads of the MDF test protector shoe to the tip and ring conductors of the line under test.

(4) The meter is connected as a voltmeter and will indicate any extraneous or foreign DC voltage that may be connected across the line.

(5) Operation of the TEST IN-TEST OUT switch to the TEST IN position connects the meter circuit across the T-IN and R-IN leads of the MDF test protector shoe to the tip and ring leads of the line equipment under test. This provides a meter indication of the exchange battery voltage, unless + booster voltage is used on that line. Subtract the + booster voltage (see paragraph d.) to determine the exchange battery voltage.

f. Resistance Measurements: The meter center scale deflection indicates 50,000 Ω . When the DIAL IN-LOW OHMS switch is operated to the LOW OHMS position, the meter scale indication is one hundredth of the high Ω indication (center scale deflection is 500 Ω).

(1) Tip Resistance to Ground Meter Scale Reading—Selector switch in position 5.

(a) With the resistance ground on tip, ground is applied on wiper C, conducted by the straps on terminals 1 and 5 of gang C; then strap to terminal 1 of gang F, furnishing ground to the resistor network composed of R4, R11, R2, and RH1.

(b) The negative battery potential is conducted by way of resistor RH1 to the center tap of resistor R2, to rheostat RH2, normal contacts of the LOW OHMS switch, terminal 5 of gang C, wiper G of the selector switch through relay MS and meter in series, through F gang terminal 5, strap to gang D terminal 5, wiper D, normal contacts of the HOWLER-RING switch, relays HL and CB and normal contacts of the TEST REVERSE switch, to the tip side of the line under test.

(c) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the T-OUT lead of the MDF test protector shoe to the tip of the line under test (test telephone on-hook).

(d) The meter connected to battery through high resistance of resistor RH2, in series with the line, indicates the resistance in Ω of the tip conductor.

(2) Tip Resistance to Ground (Low Meter Scale Reading)—Selector switch in position 5.

(a) With the resistance ground on tip and the DIAL IN-LOW OHMS switch operated to the LOW OHMS position, the battery feed of the meter is transferred from high resistance to a low resistance network formed by resistors RH1, R2, R11 center tapped and R5.

(b) The meter reading multiplied by 0.01 will indicate the resistance in Ω of the tip conductor under test.

(3) Ring Resistance to Ground (Normal Meter Scale Reading)—Selector switch in position 6.

(a) With the selector switch in position 6 and the DIAL IN-LOW OHMS switch in normal position, the negative battery is fed by way of resistors RH1 to the center tap R2, RH2, normal contacts of the LOW OHMS switch, G gang terminal 6, G wiper, relay MS and meter in series, the F wiper, F gang terminal 6, strap to F gang terminal 5, D gang terminal 5, E gang terminal 6, E wiper, normal contacts of the HOWLER-RING switch, normal contacts of relays HL and CB and the TEST REVERSE switch, to the ring side of the line under test.

(b) Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the R-OUT lead of the MDF test shoe to the ring of the line under test (test telephone on-hook).

(c) The meter connected to battery through high resistance RH2 in series with the line indicates the resistance in Ω of the ring conductor.

(4) Ring Resistance to Ground (Low Meter Scale Reading)—Selector switch in position 6.

(a) With the selector in position 6 and the DIAL IN-LOW OHMS switch operated to the LOW OHMS position, the battery feed of the meter is transferred to low resistance formed by resistor network RH1, R2, center tap R11 and R5.

(b) The meter reading multiplied by 0.01 will indicate the resistance in Ω of the ring conductor under test.

(5) Loop Leakage Resistance—Selector switch in position 7.

(a) With the selector switch in position 7 and the DIAL IN-LOW OHMS switch normal, the ring side of the line under test is connected to battery by way of the TEST REVERSE switch, relays CB and HL, the HOWLER-RING switch, E wiper, E gang terminal 7, strap to E gang terminal 6, strap to D gang terminal 5, strap to F gang terminals 5, 6, and 7, wiper F to the meter and relay MS in series, wiper G, G gang terminal 7 to the normal LOW OHMS switch, resistor RH2 center tap resistor R2, and resistor RH1. The tip conductor of the line under test is grounded at D gang terminal 7 by way of the normal contacts of the TEST REVERSE switch, relays CB and HL, the HOWLER-RING switch, and the D wiper.

(b) **Normal Meter Scale Deflection**—Operation of the TEST IN-TEST OUT switch to the TEST OUT position connects the meter circuit by way of the R-OUT lead onto the ring side of the line under test. Also, ground is placed on the tip of the line by way of the T-OUT lead for testing leakage resistance between the tip and ring conductors. With a customer's telephone handset on-hook, the leakage resistance is measured between tip and ring. The meter will indicate the high scale leakage resistance in Ω of the line under test. The center scale deflection indicates 50,000 Ω .

(c) **Low Scale Deflection**—Operation of the DIAL IN-LOW OHMS position transfers the meter circuit to low resistance. The

meter will indicate in Ω the low scale leakage resistance of the line under test. The center scale deflection is 500 Ω .

(6) Line Loop Resistance—The circuit description is the same as that described for the loop leakage resistance in paragraph (5) above.

(a) **Normal Meter Scale Deflection**—With the customer's telephone handset off-hook and the DIAL IN-LOW OHMS switch normal, the line loop resistance measured includes the telephone resistance.

(b) **Low Meter Scale Deflection**—With the customer's telephone handset off-hook and the DIAL IN-LOW OHMS switch operated to the LOW OHMS position, a low scale line loop resistance is measured which includes the telephone resistance.

g. Capacitance Measurement: The tip, ring, or loop capacitance of a line under test can be determined by operating the TEST REVERSE-CAP READ switch to the CAP READ position, with the selector switch placed in the appropriate position. The observed meter deflections are interpreted by using Table A.

NOTE: The TEST REVERSE-CAP READ switch should be operated repeatedly to the CAP READ position to obtain an average reading.

(1) **Tip Capacitance**—With the selector switch in position 8, high resistance battery is extended to the relay side of the meter by way of resistor R1 and the G wiper. The other side of the meter is connected through the F wiper and the normal contacts of the TEST REVERSE switch to D gang terminal 10 wiper D, normal contacts of the HOWLER-RING switch, relays HL and CB normal contacts of the TEST REVERSE switch to the tip side of the line under test. Operating the TEST IN-TEST

TABLE A. Conversion of Meter Deflection to Capacity Value

DEFLECTION (in volts)	CAPACITY (in μf)	DEFLECTION (in volts)	CAPACITY (in μf)	DEFLECTION (in volts)	CAPACITY (in μf)
19	0.5	36	1.0	110	6.0
22	0.6	62	2.0	116	7.0
26	0.7	78	3.0	122	8.0
30	0.8	94	4.0	128	9.0
32	0.9	102	5.0	132	10.0

OUT switch to the TEST OUT position connects the meter circuit by way of the T-OUT lead to the tip of the line under test. When the TEST REVERSE-CAP READ switch is operated to the CAP READ position, the tip conductor is grounded. On release of the switch, the tip conductor is connected to the meter and the meter is returned to battery, so that the capacitance is charged in series with the meter. This results in a meter deflection which is proportionate to the capacitance. Refer to Table A for approximate values.

(2) **Ring Capacitance**—Turn the selector switch to position 9. The ring capacitance is determined in a manner similar to that used to determine tip capacitance except for the position of the selector switch. This measurement is made with the selector switch in position 9. The ring lead of the line under test is connected to the meter by way of the E wiper and E gang terminal 9.

(3) **Loop Capacitance**—The loop capacitance is determined in a manner similar to that used to determine tip capacitance except for the position of the selector switch. This measurement is made with the selector switch in position 10. The meter circuit is connected to the tip lead of the line under test by way of the D wiper, D gang terminal 10; the ring lead of the line under test is grounded by way of the E wiper and the E gang terminal 10. With the TEST IN-TEST OUT switch in the TEST OUT position, operation of the TEST REVERSE-CAP READ switch to the CAP READ position connects the tip and ring conductors to ground, which provides a metallic shunt, discharging the total line capacitance. When the TEST REVERSE-CAP READ switch is returned to normal position, the tip lead is connected to the meter and the meter is returned to battery potential so that the total line capacitance is charged in series with the meter. This results in a meter deflection which is proportionate to the loop capacitance. Refer to Table A for approximate values.

3.08 Testing Office Equipment (Using the Test Shoe): Connect the test shoe to the line to be tested at the MDF. To perform tests on the customer's line equipment inside the office, place the selector switch in the OFF position and proceed as follows:

a. To check the customer's office equipment, the Wire Chief's test telephone must be off-hook. If the line is free and the associated line circuit furnishes ground on the tip side (T-IN) lead, operate the DIAL IN-LOW OHMS switch to the

DIAL IN position. A loop is placed across the T-IN and R-IN leads, seizing the line circuit; dial tone will be returned to the Wire Chief's test telephone.

b. Use the dial on the test telephone to dial any connection served by the exchange to check the functional operation of the exchange equipment for the line circuit under test.

c. If the line is free, but the associated line circuit does not furnish ground on the tip side (T-IN) of the line (which is common on circuits associated with PABX combination trunks), connect a ground to the R binding post and operate the DIAL IN-LOW OHMS switch to the DIAL IN position. This connects a loop across the T-IN and R-IN leads but will not operate the line relay in that circuit.

d. The line circuit is seized when the TEST IN-TEST OUT switch is placed to the TEST IN position. This places the R binding post ground on the R-IN lead which seizes the line circuit, initiating a linefinder action. When the exchange equipment finds the line, dial tone will be returned to the wire chief's test telephone.

e. When dial tone is heard, operate the TEST IN-TEST OUT switch to the TEST OUT position. Ground is removed from the test telephone dial impulse springs.

f. The testman may now use the test set dial to dial any connection served by the exchange to check the functional operation of the inside equipment for the office line.

3.09 Testing Line Equipment, Using the CDO Test Train: The CDO test train control circuits are described in the following paragraphs. See FIG. 7 of the schematic diagram (sheet 2 of Figure 2) for wiring details.

a. **Supervisory Lamp:** The supervisory (SR) lamp, mounted on the front panel of the test set, serves as a combined busy and supervisory lamp for the test selector. When the HEAT COIL LISTEN-TEST SELECTOR switch is in the normal position and the SR lamp is illuminated, it indicates that the test selector is busy. The HEAT COIL LISTEN-TEST SELECTOR switch should not be operated to the TEST SELECTOR position unless the SR lamp is extinguished.

b. **Test Selector Seizure:** To reach a line by way of the switchtrain, place the HEAT COIL LISTEN-TEST SELECTOR switch to the TEST SELECTOR position and dial the last four digits of the line number, using the position dial shown in FIG. 7 (sheet 2 of Figure 2). If the line is busy, the SR

lamp will be illuminated and conversation may be heard on the Wire Chief's telephone. If the line is idle, the testman can make meter measurements or other tests on that line.

c. Meter Measurements, Ringing or Placing Howler on Line Under Test: Placing the HEAT COIL LISTEN-TEST SELECTOR switch to the TEST SELECTOR position connects the test T and R leads of the test position (see FIG. 1 on sheet 1 of Figure 2) to the TTS and TRS leads of the test selector circuit (see FIG. 7 on sheet 2 of Figure 2). The TTS and TRS leads are extended on a metallic basis through to the test selector and test connector circuits as the line number is dialed. Upon connection to an idle circuit, the test selector causes operation of the cut-off relay CO in that line circuit which frees the associated line of attachments, allowing meter measurements (see paragraph 3.07), application of ringing (see paragraph 3.05), or connection of the howler to the line (see paragraph 3.06).

d. Testing Lines In Same Test Connector Bank Level: To test the next consecutive line in the same connector bank level, dial the digit 1 using the test set dial (see FIG. 7 on sheet 2 of Figure 2). The test selector then steps the associated test connector to the next wire bank position.

e. Release of Test Switchtrain: To seize a line in a different level or to seize a different test connector, the HEAT COIL LISTEN-TEST SELECTOR switch (see FIG. 7 on sheet 2 of Figure 2) must be returned to the neutral position, releasing the test selector and test connector circuit.

3.10 Testing Line Equipment, Using the MDO Test Train: The MDO test train control circuits are described in the following paragraphs. (Refer to FIG. 2 on sheet 1 of Figure 2) for wiring details.

a. Supervisory Lamp: The supervisory lamp (SR), mounted on the front panel of the test set, serves as a combined busy and supervisory lamp for the test selector. When the HEAT COIL LISTEN-TEST SELECTOR switch (see FIG. 2 on sheet 1 of Figure 2) is in the normal position and the SR lamp is illuminated, it indicates that the test selector is busy. The HEAT COIL LISTEN-TEST SELECTOR switch should not be operated to the TEST SELECTOR position unless the SR lamp is extinguished.

b. Test Selector: Placing the HEAT COIL LISTEN-TEST SELECTOR switch (see FIG. 2 on sheet 1 of Figure 2) to the TEST SELECTOR position causes the following functions:

- (1) Connects the A-C winding of relay BY across the T and R leads to the test selector.

- (2) This loop across the T and R leads seizes the test selector.

- (3) The test selector returns ground on the S lead to operate relay BY through the B-D winding.

- (4) Operation of relay BY connects ground to light the supervisory lamp, indicating that the selector is available for dialing.

c. Dialing: Operation of the test set dial causes the following functions:

- (1) When the dial is moved off normal, ground is forwarded from the operated off-normal springs to operate relay DA through the A-C winding.

- (2) Operation of relay DA connects ground to operate relay DB.

- (3) Operation of relay DB connects the dial impulse springs across the T and R leads to the test selector, disconnects the A-C winding of relay BY from the dialing loop (to prevent impulse distortion), and disconnects resistance ground from the HS lead to the test selector.

- (4) While the dial is returning to normal, the impulse springs open and close the loop on the T and R leads to the test selector, causing the test selector to step in accordance with the digit dialed.

- (5) When the dial has returned to normal, the following functions occur:

- (a) The impulse springs remain closed, holding the loop to the seized test selector.

- (b) The off-normal spring open, causing relay DA to release.

- (c) Release of relay DA reconnects ground on the HS lead and opens the circuit to slow release relay DB.

- (d) Release of relay DB transfers the T and R leads from the dial to the loop provided by the A-C winding of relay BY.

- (6) The dialing sequence is repeated until sufficient digits have been dialed to reach the line to be tested.

d. Idle Line Connection: When the test selector trunk connects to an idle line, battery is returned on the HS lead to operate relay SA. Operation of relay SA connects ground (from the CONN RLS switch) to operate relay SB. Operation of relay SB causes the following functions:

- (1) Removes ground from the supervisory lamp, causing the lamp to extinguish.

- (2) Disconnects the A-C winding of relay BY from across the T and R leads.
- (3) Extends the T and R leads from the test selector to the testing circuits in the test set.
- (4) Provides a locking path for relay SB to ground at the CONN RLS switch.
- (5) Ground pulses received on the HS lead from the test connector cause relays SA and SB to operate and light the supervisory lamp in accordance with the line conditions detected by the test connector as follows:

<u>LAMP INDICATION</u>	<u>LINE CONDITION</u>
120 IPM flashing	Line busy
1 flash	Battery on line
2 flashes	Ground on line
3 flashes	Low loop leakage resistance
4 flashes	No fault on line

e. Additional Digit Dialing: After a line has been seized through the test selector trunk, dialing an additional digit 1 at the test set dial causes the test connector wipers to step to the next consecutive line on the test connector bank. This function is performed by the regular operation of the dialing circuit, with the test connector operating under control of the loop provided by the dial impulse springs.

f. Busy Conditions: When the test train from the test selector trunk detects a busy condition, the supervisory lamp on the test set gives a busy indication as follows:

- (1) **Test Connector Busy**—When a busy test connector is detected, ground is applied to the S lead of the test selector and the HS lead becomes open (instead of having battery applied). Relay BY remains operated but relays SA and SB will not operate, causing any further dial pulses to be ineffective. On completion of dialing, the supervisory lamp remains lighted (from the ground on the BY relay contacts) to give a visual indication of the busy condition.
- (2) **Line Busy**—When the test connector is stepped to a busy line, 120 IPM battery pulses are forwarded on the HS lead to pulse the SA and SB relays, causing the supervisory lamp to flash at 120 IPM.
- (3) **Monitoring a Busy Line**—Placing the DIAL IN-LOW OHMS switch to the DIAL IN position, and the TEST OUT-TEST IN switch to

the TEST IN position removes transmission battery from the T and R leads of the TEST TEL jack on the test set and connects these leads to the test selector. The line can then be monitored through capacitors in the test selector circuit from a hand test telephone plugged into the TEST TEL jack.

g. Releasing a Permanently Held Line Circuit: Placing the IN TEST-RELS PERM switch to the RELS PERM position releases any battery feed relay held by a faulty condition (loop more than 50 Ω) on the line circuit. The RELS PERM switch connects low resistance battery on the test selector S lead, in place of the high resistance battery from the B-D winding of the BY relay. This low resistance battery causes the test selector to apply ground on the tip conductor and low potential battery on the ring conductor of the line. These conditions cause the battery feed relay to release.

h. Releasing CO Relay on Regular Line Circuit: Operation of the IN TEST-RELS PERM switch to the IN TEST position and the CO CONTROL-CONN RELEASE switch to the CO CONTROL position causes release of the CO relay of the line circuit selected by the test selector test train. It is necessary to release the CO relay so that tests may be performed on the line equipment inside the office. The release sequence is:

- (1) Place the IN TEST-RELS PERM switch to the IN TEST position which applies ground to operate relay DB.
- (2) Operation of relay DB connects the T and R leads from the test selector to the dial impulse springs.
- (3) Place the CO CONTROL-CONN RELEASE switch to the CO CONTROL position to shunt the B-D winding of relay SB which applies low resistance ground to the HS lead of the test selector.
- (4) The test selector removes ground from the sleeve lead of the line circuit, causing release of relay CO in the line circuit.
- (5) Release of relay CO transfers the line circuit LR relay to control of the loop provided by the test set dial impulse springs.
- (6) The line circuit can now be pulsed from the test set dial.

i. Connecting the Hand Test Telephone to the Test Train: When the hand test telephone (in the off-hook condition) is connected to the TEST TEL jack on the test set, the telephone may be

connected to the line accessed by the test connector in the following manner:

(1) Place the DIAL IN-LOW OHMS switch to the DIAL IN position and the TEST IN-TEST OUT switch to the TEST IN position to connect the T and R leads of the telephone to the test selector trunk circuit. The T and R leads are then extended through the operated contacts of the TEST SELECTOR switch and relay SB to the open contacts on relay DB.

(2) Restore the IN TEST-RELS PERM switch to its normal position which removes ground from relay DB. Relay DB releases, connecting the T and R leads of the test selector train to the leads of the test telephone.

(3) Place the OFFICE LINE-OUT TALK switch to the OUT TALK position which connects battery and ground from the CB relay to the T and R leads of the line. This energizes the transmitters of the telephones on the line so that conversation is possible between the test set operator and the called party.

j. Disconnecting the Hand Test Telephone from the Line Being Tested: The hand test telephone is restored on-hook before the operated CO CONTROL switch is restored to normal.

(1) When the hand test telephone is restored on-hook, the T and R loop is opened which releases the line circuit under test.

(2) When the CO CONTROL switch is restored to normal, the shunt is removed from the B-D winding of relay SB. This causes high resistance ground to be applied to the HS lead of the test selector. The test selector then applies ground on the S lead of the line circuit, reoperating the CO relay. Operation of the CO relay causes the test selector train T and R leads to be connected to the outside line equipment (and disconnected from the office equipment) of the line under test.

k. Releasing the Test Selector Trunk: The testing train from the test selector trunk can be released by releasing the test connector only, or by releasing both the test selector and the test connector.

l. Releasing the Test Connector: The test connector is released in the following manner:

(1) Operate the CO CONTROL-CONN RELEASE switch to the CONN RELEASE position to perform the following:

(a) Remove ground from the A-C winding of relay SB.

(b) Disconnect the T lead from FIG. 1.

(c) Connect a holding battery through RT2 to the T lead of the test selector.

(d) Disconnect high resistance ground from the HS lead, causing release of the line relay of the test selector.

(e) Open the loop for A-C winding of relay BY to prevent connection across the T and R leads of the test selector after release of relay SB.

(2) Release of relay SB performs the following:

(a) Connects ground from operated BY relay contacts to light the supervisory lamp.

(b) Opens the path to the A-C winding of relay BY.

(c) Opens the R lead to the test selector, releasing the pulse control relay in the test selector which releases the associated test connector.

(3) Restoring the CO CONTROL-CONN RELEASE switch to normal performs the following:

(a) Reinstates high resistance ground through relays SA and SB to the HS lead.

(b) Reconnects ground to operate relay SB.

(c) Reconnects the A-C winding of relay BY across the test selector T and R leads and removes resistance battery from the tip lead, causing reseizure of the test connector.

m. Test Selector and Test Connector Release:

The entire test selector train is released by restoring the HEAT COIL LISTEN-TEST SELECTOR switch to normal. Restoring the switch to normal performs the following:

(1) Disconnects the holding ground from relay SB.

(2) Opens the HS lead.

(3) Opens the loop across the T and R leads, causing release of the test selector and test connector.

(4) Release of the test selector removes ground from the S lead to the B-D winding of relay BY.

(5) Release of relay BY removes ground from

the supervisory lamp, causing the lamp to extinguish.

3.11 Heat Coil Test: To test the protectors, go off-hook with the test telephone and turn the selector switch to the OFF position. Operating the HEAT COIL LISTEN-TEST SELECTOR switch to the HEAT COIL LISTEN position will capacitor couple the line under test to the test telephone. If the line is free, operation of the TEST IN-TEST OUT switch to the TEST OUT position will capacitor couple the customer's line T-OUT and R-OUT leads to the test telephone. This disconnects the associated line circuit T-IN and R-IN leads, transferring seizure of the line circuit under test to the control of a loop circuit composed of the test telephone, the OUT TALK section of the OFFICE LINE-OUT TALK switch, and the test shoe connected to the coils. Operation of the OFFICE LINE-OUT TALK switch to the OUT TALK position shunts the transmission capacitors, closing a T and R loop, seizing the line circuit under test by way of the HC-TIP and HC-RING conductors through the heat coils. Seizure of the line circuit initiates an allletter linefinder action, returning dial tone if the coils are not open.

3.12 Test Lead Reversal: To reverse the conductors under test into the test set, operate the TEST REVERSE-CAP READ switch to the TEST REVERSE position. The T and R leads are transposed from the test set access through the springs of the TEST REVERSE switch. The TEST REVERSE switch is used in conjunction with position 2 of the selector switch to test for battery on the ring lead of a line or trunk.

3.13 Use of External Test Equipment: With the TEST IN-TEST OUT switch in the TEST OUT position, the selector switch in the OFF position and the test telephone on-hook, the T-OUT and R-OUT pair from the test shoe are connected to the T and R binding posts on the front panel of the test set. Equipment such as a Wheatstone bridge or a dial speed and percent make test set may be connected to the binding posts for making tests from the customer's line. If the test selector circuit is used, the external test equipment connected to the binding posts is connected to the line under test when the HEAT COIL LISTEN-TEST SELECTOR switch is placed in the TEST SELECTOR position.

3.14 Generator Ground Cut-Off:

a. When the selector switch is placed to the position for the desired frequency selection, and the DIAL IN-LOW OHMS switch is placed to the LOW OHMS position, ground is removed from the GEN GRD leads of FIGS. B, C, D, E, G, J, K, or L (sheet 3 of Figure 2). This function is called

generator ground cut-off and is used on lines with subsets that do not remove ringers from the line when the telephone is off-hook; or on lines having telephones equipped with varistors connected across the receiver.

b. The **howler** would not be effective for signaling a customer who had left the handset off-hook on these lines. When the testman places the DIAL IN-LOW OHMS switch to the LOW OHMS position, ground is removed from the line, removing the shunt from the ringers on both the tip and ring (due to the off-hook subset). When applied, ringing current will not short circuit or damage the receiver of the off-hook telephone.

c. Operation of the HOWLER-RING switch to the RING position applies the desired ringing current to the line and rings the parties on both the tip and ring, with ringers connected from one side of the line to ground when both parties are rung normally with the same frequency on separate sides of the line (divided circuit ringing). This is due to the off-hook telephone bridging both the tip and ring of the line.

4. INSTALLATION PROCEDURES

4.01 Mounting Instructions: The test set can be mounted in a relay rack, on a wall, or on the end of the MDF. Figure 4 shows the typical methods of mounting the test set and the location of the required mounting holes to be drilled. When mounting on a wall, all four mounting holes in the corners of the base should be used. For MDF mounting, the installer must drill the cross channel for the two top mounting holes and use suitable screws for securing the test set. When the test set is to be mounted in a relay rack, the installer should drill the base as shown in FIG. B (sheet 3 of Figure 2), and the unit mounted on the brackets supplied as shown in FIG. A of Figure 4.

4.02 Wiring Instructions: A cable entry hole should be drilled in the test set base or top to permit the cabling to be run to the MDF, local telephone, supervisory terminal block, etc. (refer to the equipment specification for details of cable runs required). These cables are terminated on the terminal block inside the test set. Remove the terminal block mounting nuts and turn the block on its side to facilitate wiring. Wire as shown in FIG. A of Figure 2 (sheet 3), then replace the terminal block after all connections have been completed.

5. MAINTENANCE PROCEDURES

5.01 Performance Routine: The performance routine checks in the following paragraphs should be

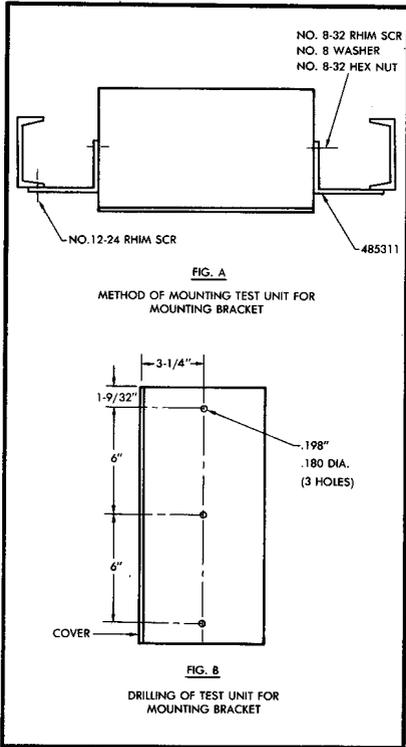


FIGURE 4. Wire Chief's Test Set, Type B, Mounting Details

periodically applied to the Type B Wire Chief's test set. Refer to paragraph 6 for ordering information for any replacement parts required.

a. Material Required: The following materials are required to perform routine checks on the Type B Wire Chief's test set:

- (1) Single conductor test cords with an alligator clip at each end of the cord (two cords are required).
- (2) 510 Ω resistor (1-watt, carbon, ±5%), Stromberg-Carlson No. 554003-511, or equivalent.

- (3) 5100 Ω resistor (1 watt, carbon, ±5%), Stromberg-Carlson No. 554003-512, or equivalent.

- (4) 2 μf capacitor (+38%, -0%, 200-watt VDC), Stromberg-Carlson No. 202886-865, or equivalent.

b. Preliminary Procedures:

- (1) Restore all switches to normal on the test set.
- (2) Assign a convenient local telephone as a test telephone.

c. ZERO ADJ Check:

- (1) Rotate the selector switch to position 1 (ZERO ADJ).
- (2) Rotate the ZERO ADJ control in each direction in turn. Check that the meter needle moves freely in each direction as the control is rotated.
- (3) Use the ZERO ADJ control to set the meter indication at 0 on the upper meter scale.

d. Resistance Check:

- (1) Connect the 510 Ω resistor to the test set T and R binding posts.
- (2) Operate the DIAL IN-LOW OHMS key to the LOW OHMS position.
- (3) Rotate the test selector switch to position 7 (LOOP).
- (4) The meter should indicate 51 K.
- (5) Disconnect the 510 Ω resistor from the binding posts.
- (6) Connect the 5100 Ω resistor across the binding posts.
- (7) The meter needle should indicate approximately 500 K.
- (8) Restore the DIAL IN-LOW OHMS key to normal.
- (9) The meter should indicate 5.1 K.
- (10) Disconnect the 5100 Ω resistor from the T and R binding posts.

e. TIP GRD, RING GRD, TEST REVERSE Check:

- (1) Rotate the test set selector switch to position 5 (TIP GRD).
- (2) Connect one end of the 5100 Ω resistor to the T binding post and the other end to ground.

- (3) Check that the meter indicates 5.1 K.
- (4) Rotate the test set selector switch to position 6 (RING GRD). The meter should indicate infinity on the upper scale.
- (5) Operate the TEST REVERSE-CAP READ key to the TEST REVERSE position. The meter should indicate 5.1 K.
- (6) Disconnect both test leads and restore the TEST REVERSE-CAP READ key to normal.

f. Voltmeter, TIP BAT, RING BAT Check:

- (1) Rotate the selector switch to position 2 (BAT ON TIP).
- (2) Connect the test lead from the battery to the T binding post on the test set. The test set meter should indicate the same voltage as the meter on the powerboard.
- (3) Operate the TEST REVERSE key. The test meter should indicate zero.
- (4) Disconnect test lead T from the binding post and connect to the R binding post on the test set. The test set meter should indicate the same voltage as in (2) above.
- (5) Restore the TEST REVERSE key. The test set meter should indicate zero.
- (6) Disconnect the test lead from the R binding post and battery.

g. Capacitance Check:

- (1) Rotate the selector switch to position 8 (TIP CAP).
- (2) Connect the test lead from the T binding post to one lug of a 2 μ f capacitor.
- (3) Connect the test lead from ground to the other lug of a 2 μ f capacitor.
- (4) Rapidly operate and restore the CAP READ-TEST REVERSE key from CAP READ to the normal position several times.
- (5) The maximum reading on the meter should be approximately 62.
- (6) Disconnect the test lead from the T binding post and connect it to the R binding post.
- (7) Rotate the selector switch to position 9 (RING CAP).
- (8) Repeat steps (4) and (5) above.
- (9) Disconnect the test lead from ground and connect it to the T binding post.

(10) Rotate the selector switch to position 10 (LOOP CAP).

(11) Repeat steps (4) and (5) above.

(12) Disconnect the test leads.

h. OFFICE LINE Key and Test Set Dial Check:

- (1) Insert a hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.
- (2) Operate the OFFICE LINE-OUT TALK key to the OFFICE LINE position.
- (3) Use the test set dial to dial the test telephone number assigned in paragraph 5.01 c. (2).
- (4) The circuit is operating correctly if conversation can take place when the called party answers.
- (5) Restore the OFFICE LINE-OUT TALK key to normal and remove the hand test telephone from the TEST TEL jack on the test set.

i. TEST SELECTOR and RING Keys Check (CDO Model Test Set):

- (1) From a convenient local telephone, dial the test telephone number assigned in paragraph 5.01 c. (2).
- (2) When the called party answers, instruct him to monitor the line while a test is performed from the Wire Chief's test set.
- (3) Leave the handset off-hook on the telephone used to dial the test number.
- (4) At the Wire Chief's turret, operate the HEAT COIL LISTEN-TEST SELECTOR key to the TEST SELECTOR position.
- (5) The SR supervisory lamp lights.
- (6) Use the test set dial to dial the last four digits used in step (1).
- (7) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.
- (8) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.
- (9) Check that conversation is possible with the party at the telephone in step (2) above; then instruct that party to replace the receiver of the handset.
- (10) Replace the receiver of the handset of the local telephone used in step (1) above.

- (11) Restore the OFFICE LINE-OUT TALK key to normal; remove the test telephone from the TEST TEL jack on the test set.
- (12) Restore the HEAT COIL LISTEN-TEST SELECTOR key to normal.
- (13) Repeat steps (4), (5), and (6) above.
- (14) Position the test set selector switch on the position corresponding to the ringing digit for the telephone used in step (6) above.
- (15) Operate the HOWLER-RING key to the RING position for 2 or 3 seconds.
- (16) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.
- (17) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.
- (18) Check that conversation is possible with the party at the telephone extension dialed in step (6) above; then instruct the party to replace the receiver of the handset.
- (19) Restore the OFFICE LINE-OUT TALK and HEAT COIL LISTEN-TEST SELECTOR keys to normal.
- (20) Remove the hand test telephone from the TEST TEL jack.
- (21) Restore the test set selector switch to the OFF position.

j. TEST SELECTOR, CONN RLS, and RING Key Check:

- (1) From a convenient local telephone, dial the test telephone number assigned in paragraph 5.01 c. (2).
- (2) When the called party answers, instruct him to monitor the line while a test is performed from the Wire Chief's test set.
- (3) Leave the handset off-hook on the telephone used to dial the test number.
- (4) At the Wire Chief's turret, operate the HEAT COIL LISTEN-TEST SELECTOR key to the TEST SELECTOR position.
- (5) The SR supervisory lamp lights.
- (6) Use the test set dial to dial the same digits as in step (1) above.
- (7) The supervisory lamp flashes at 120 IPM.
- (8) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(9) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(10) Check that conversation is possible with the party at the telephone used in step (2) above; then instruct the party to replace the receiver on the handset.

(11) Replace the receiver of the handset of the local telephone used in step (1) above.

(12) Restore the OFFICE LINE-OUT TALK key to normal; remove the hand test telephone from the TEST TEL jack on the test set.

NOTE: Perform the following steps (13) through (19) only when testing the MDO model test set.

(13) Operate the CO CONTROL-CONN RLS key to the CONN RLS position for 2 or 3 seconds; then restore the key to normal.

(14) Use the test set dial to dial the last two digits of the number used in step (1) above.

(15) Position the test set selector switch on the position corresponding to the ringing digit for the phone used in paragraph 5.01 c. (2).

(16) Operate the HOWLER-RING key to the RING position for 2 or 3 seconds.

(17) Insert the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(18) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(19) Check that conversation can take place with the called party.

(20) Restore all keys on the test set to normal and remove the hand test telephone from the test set jack.

k. Test Shoe Check:

(1) Restore all keys on the test set to normal and rotate the selector switch to the OFF position.

(2) Insert the test shoe into the MDF protector block of the local telephone line assigned as the test number in paragraph 5.01 c. (2).

(3) Insert the plug of the hand test telephone (with the switch in the center position) into the TEST TEL jack on the test set.

(4) Operate the HEAT COIL LISTEN-TEST SELECTOR key to the HEAT COIL LISTEN position. Monitor the line to see if it is in use.

(5) If the line is not in use, restore the HEAT COIL LISTEN-TEST SELECTOR key to normal.

(6) Remove the hand test telephone from the test set jack.

(7) TEST IN-TEST OUT Key Check—

(a) Operate the TEST IN-TEST OUT key to the TEST IN position.

(b) Rotate the selector switch on the test set to position 2 (RING BAT). Operate the TEST REVERSE-CAP READ key to the TEST REVERSE position. The test set meter should indicate approximately 48 volts.

(c) Restore the TEST REVERSE-CAP READ key to normal.

(d) Rotate the selector switch to position 5 (TIP GRD). The meter should give full scale deflection to the right.

(e) Operate the TEST IN-TEST OUT key to the TEST OUT position.

(f) Rotate the selector switch to position 10 (LOOP CAP).

(g) Operate and restore the CAP READ-TEST REVERSE key from CAP READ to normal two or three times. The meter should indicate above 10 on the lower scale.

(h) Restore the selector switch to the OFF position.

(8) DIAL IN Key Check—

(a) Insert the hand test telephone (with the switch in the center position) into the test jack.

(b) Operate the DIAL IN-LOW OHMS key to the DIAL IN position. Dial tone is heard.

(c) Dial the digits of the number assigned as the test number in paragraph 5.01 c. (2). Busy tone (60 IPM) is heard in the hand test telephone receiver.

(d) Restore the DIAL IN-LOW OHMS key to normal; remove the hand test telephone plug from the test set jack.

(9) HOWLER-RING and OUT TALK Keys Check—

(a) Operate the TEST IN-TEST OUT key to the TEST OUT position.

(b) Rotate the selector switch to position 8 (HOWLER START).

(c) Operate the HOWLER-RING key to the RING position for 2 or 3 seconds.

(d) The local test telephone ringer sounds.

(e) Insert the hand test telephone (with the switch in the center position) into the test set jack.

(f) Operate the OFFICE LINE-OUT TALK key to the OUT TALK position.

(g) Instruct the party answering the test telephone to leave the handset off-hook for a few seconds for the howler test, and to replace the handset on-hook after the howler tone reaches maximum volume.

(h) Restore the OFFICE LINE-OUT TALK key to normal and operate the C switch of the hand test telephone.

(i) Operate the HOWLER-RING key to the HOWLER position.

(j) Rotate the selector switch on the test set from position 7 (HOWLER START) to positions 8, 9, and 10. At position 8, howler tone is heard in the test telephone receiver used in step (g) above. In positions 9 and 10, the level of the howler tone is increased progressively.

(k) When the test telephone is placed on-hook, the howler tone is cut off.

(l) Restore the HOWLER-RING and TEST IN-TEST OUT switches to normal and rotate the selector switch to the OFF position.

(m) Remove the hand test telephone from the test set jack.

(10) Remove the test shoe from the MDF protector block.

I. Positive (+) Booster Battery on Tip:

(1) Rotate the selector switch to position 3 (+BOOSTER VOLTAGE ON TIP).

(2) Connect a +60V battery supply to the T binding post. The test set meter should indicate 60 volts.

(3) Remove the +60V battery connection.

(4) Restore the selector switch to the OFF position.

5.02 Repair and Replacement:

a. Access is gained to the components in the test set by loosening the captive screws in the right-hand upper and lower corners of the front panel and swinging the panel open.

b. The test set components consist of standard relays, capacitors, resistors, and switches. Repair and replacement procedures should be performed in accordance with good basic maintenance practices. Refer to paragraph 6 for identification and part numbers of components and for method of mounting replacement components.

c. When required, relay adjustments should be made to conform with the specifications in Table B. The column headings in Table B indicate the following:

(1) The **RELAY** column lists the relays in each circuit by their functional designations. For example, the designation HL means **howler**; BY means **busy**, etc.

(2) The **BLOCK OR INSULATE** column provides necessary instructions for preparing the relay for testing. For example, when checking the electrical operation, it may be necessary to block another relay (hold it nonoperated) or to insulate between a pair of contacts.

(a) Where the notation (NO) appears in this column, block relay DB (hold it nonoperated) by inserting a toothpick between the core and the armature. Be sure to remove toothpicks when testing is completed.

(b) Where the notation SA (1,2) appears in this column, insulate contact 1 from contact 2 on the SA relay by inserting a piece of bond paper between them. Be sure to remove the paper after testing is completed.

(3) The **TEST WITH** column provides reference to one or more of the following notes:

(a) Positive battery through the test set to the point indicated.

(b) Test set across the points indicated.

(4) The **TEST SET POINT** column lists the relay terminals to which alligator clips of the test cords are connected.

TABLE B. Relay Adjustment for Wire Chief's Type B Test Set Circuit (S-419086)

RELAY	BLOCK OR INSULATE	TEST WITH	TEST SET POINT	RESID (Inch)	TEST WDG	TEST FOR	READJ MA	TEST MA	REMARKS
CB		1	CB (B)	0.006	B-D	O NO	36.0 30.0	40.0 27.0	FIG. 1
HL		1	HL (B)	0.004	B-D	O H R	13.0 8.0 6.8	14.0 8.8 6.4	
MS		2	MS (A+, C-)	0.004	A-C	O NO	9.0 6.5	10.0 6.0	Disconnect wires from terminal MS (A)
DA	DB (NO)	1	DA (A)	0.004	A-C	O NO	11.0 9.0	12.0 8.0	FIG. 2 Disconnect wires from terminal DA (A)
DB		1	DB (A)	0.004	A-C	O NO	37.0 30.0	41.0 27.0	Disconnect wires from terminal BY (B)
BY		1	BY (B)	0.004	A-C	O NO	9.5 6.5	10.5 6.0	
SA		2	SA (A+, C-)	0.006	A-C	O NO R	24.0 20.0 9.5	26.0 18.0 8.5	
SB	SA (1,2)	1	SB (A)	0.004	A-C	O NO	13.0 10.0	14.0 9.0	

- (a) If one point is specified, the alligator clip is attached to that terminal only. For example, if the notation CB (B) appears, this means that the alligator clip is attached to terminal B of relay CB.
- (b) If two points are specified, one alligator clip is attached to each of the two terminals noted. For example, if the notations MS (A,C) appears, one alligator clip is attached to terminal A and the other to terminal C on relay MS.
- (5) The **RESID** (Inch) column lists the minimum operated air gap for each relay. The air gap is determined by the projection of the residual screw.
- (6) The **TEST WDG** column designates the winding through which current flows during the test.
- (7) The **TEST FOR** column lists relay response for a particular test. Designations appearing in this column are: O (operate); NO (nonoperate); H (hold); R (release). Each designation is associated with current values in the **READJ MA** (milliamperes) and **TEST MA** columns. The designations relate to the current values in the **TEST MA** column as follows:
- (a) When the indicated value of current for NO (nonoperate) is flowing through the winding (before operation), the relay should not operate.
- (b) When the indicated value of current for O (operate) is flowing through the winding, the relay should operate.
- (c) When the indicated value of current for H (hold) is flowing through the winding (after current has been reduced from operate value), the relay should remain operated.
- (d) When the indicated value of current for R (release) is flowing through the winding (after the current value has been reduced from the operate value), the relay should release.
- (8) The **READJ MA** column indicates the value of current to which the relay must be adjusted if the relay does not meet the requirements in the **TEST MA** column.
- (9) The **REMARKS** column lists any pertinent information not listed in the other columns.

d. A relay current flow test set is used to check the relays with respect to the requirements specified in Table B. The procedures for making these tests are:

NOTE: It is not necessary to remove the relay from the test set for the electrical test.

- (1) Ensure that battery and ground are connected to the test set.
- (2) Ensure that all switches on the test set are in the normal position.
- (3) Test the relay with the test current specified.
- (4) Check the electrical requirements in the relay adjustment tables. If the mechanical adjustment is correct, the relay should function properly in the circuit.
- (5) If the relay does not operate properly on the **TEST MA** column values, readjust the relay to meet the **READJ MA** column values specified.
- (6) If the relay does not meet readjust values, check the mechanical adjustments.

e. If required, make mechanical adjustments in the following manner:

- (1) If the relay operates on the nonoperated value, increase the tension on the force springs.
- (2) If the relay fails to operate on the operate value, decrease the tension on the force springs.
- (3) If adjustments cannot be made by adjusting the tension of the force springs, carefully adjust the tension of the movable springs.
- (4) If hold or release adjustments cannot be made by adjusting the springs, the setting of the residual screw may be changed; however, residual projection must be perceptible at all times.

5.03 Calibration Routines:

a. Meter Calibration Operation Check:

Although the meter is calibrated before leaving the factory, an operational check is recommended prior to initial use and thereafter as often as it appears necessary. When making resistance measurements, the meter should be set to zero before each measurement to ensure accuracy of the check. See (1), (a), (b), and (c) for zero setting procedures. Office battery and

ground must be connected to the test set by way of the terminal block terminals 54 and 58, respectively. The telephone assigned to the test set office must be on-hook and the hand test telephone plug removed from the jack on the front panel of the test set.

NOTE: A resistance decade box is recommended for use in steps (1), (a), and (b) below. If proper indications for resistance checks are not obtained, calibrate the meter according to instructions in paragraph 5.03 b.

(1) Low Resistance Check—

- (a) Place the selector switch to position 1 (ZERO ADJ).
- (b) Operate the DIAL IN-LOW OHMS key to the LOW OHMS position.
- (c) Adjust the ZERO ADJ control of the 0 indication on the meter.
- (d) Connect a 500 Ω resistor (that is known to be accurate) across the T and R binding posts.
- (e) Rotate the selector switch to position 7 (LOOP).
- (f) A midscale deflection of 50 K should be indicated on the resistance scale of the meter. With the LOW OHMS key operated, the scale indication is divided by 100 to obtain the resistance value (50,000 \div 100 = 500 Ω).
- (g) Remove the 500 Ω resistor from the T and R binding posts and return the LOW OHMS key to normal. Rotate the selector switch to the OFF position.

(2) High Resistance Check—

- (a) Place the selector switch to position 1 (ZERO ADJ).
- (b) Check that all test keys are in the normal position.
- (c) Adjust the ZERO ADJ control for 0 indication on the meter.
- (d) Connect a 50,000 Ω resistor (that is known to be accurate) across the T and R binding posts.
- (e) Rotate the selector switch to position 7 (LOOP).
- (f) A midscale deflection of 50 K should be indicated on the resistance scale of the meter.

- (g) Remove the 50,000 Ω resistor from the T and R binding posts. Rotate the selector switch to the OFF position.

(3) Voltage Check and Calibration—

- (a) Check that all test keys are in the normal position.
- (b) Connect a vacuum tube voltmeter (VTVM), set to the proper DC scale, across terminal 54 (-48 volts) and terminal 58 (+ ground) of the test set terminal block.
- (c) Rotate the selector switch to position 2 (TIP BAT).
- (d) Connect a wire between terminal 54 (-48 volts) on the terminal block and the T binding post on the front panel of the test set.
- (e) The indications on the test set meter and on the VTVM should be identical. If not, adjust RH3 on the back of the test set panel until the test set meter indication matches that of the VTVM.
- (f) Lock the RH3 adjustment with a light touch of Glyptal cement, or equivalent.

NOTE: The above procedures can be modified to use any source of DC voltage up to 150 volts, provided the DC voltage value is known accurately. For example, the VTVM could be deleted in favor of the voltage reading on the powerboard meter. It is recommended that the DC voltage source be in the office battery range, i.e., approximately 50 volts.

b. Calibration of Meter for Resistance Readings: Calibration of the meter should not be necessary unless the operational check requirements in paragraph 5.03 a. cannot be met.

(1) Low Resistance (LOW OHMS) Calibration—

- (a) Perform steps (1), (a) through (f) above, except in step (1), (c), adjust the ZERO ADJ control to approximately midposition of its range, regardless of the meter indication.
- (b) Check that R11 on the back of the panel is adjusted to midposition of its range. If the factory seal is not disturbed, no adjustment is necessary; if the seal is broken, adjust R11 to midposition.
- (c) On the back of the panel, alternately adjust R4 and R5 for 50,000 Ω and 0 Ω .

indication, respectively. The selector switch must be in position 7 (LOOP) when adjusting R4, and switched to position 1 (ZERO ADJ) when adjusting R5 for 0 Ω indication on the meter. Repeat the adjustments until both indications are accurate. Lock R4 and R11 with a light touch of Glyptal cement, or equivalent.

(d) Remove the 50,000 Ω resistor from the T and R binding posts. Rotate the selector switch to the OFF position.

(2) High Resistance Calibration—

(a) Perform steps (1), (a) through (g) in paragraph 5.03 a. except in step (1), (c), adjust the ZERO ADJ control to approximately midposition of its range.

(b) On the back of the panel, alternately adjust R2 for 50,000 Ω indication on the meter and RH2 for 0 indication. The selector switch must be in position 7 (LOOP)

while adjusting R2, and in position 1 (ZERO ADJ) when adjusting RH2. Repeat the adjustments until both indications are accurate. Lock R2 and RH2 with a light touch of Glyptal cement, or equivalent.

(c) Remove the 50,000 Ω resistor from the T and R binding posts. Rotate the selector switch to the OFF position.

6. PARTS IDENTIFICATION AND PARTS LIST

6.01 Parts Identification: Individual components for the Wire Chief's Type B test set can be identified by locating the part on Figure 5 (foldout) and obtaining the associated part identification item number.

6.02 Parts List: Table C lists the part numbers opposite the item numbers referred to in paragraph 6.01 and gives a brief description of the item. Be certain to include all the information provided on Table C to ensure that you will receive the correct replacement part in the fastest possible time.

TABLE C. Replacement Parts List

ITEM	DESCRIPTION	STOCK NO.
1	Cabinet Assembly	303700-499
3	Bracket Assembly	481936-000
4	Binding Post (Red Top)	209572-000
5	Binding Post (Black Top)	209571-000
6	Mounting Plate (Resistor)	302850-362
7	Spacer	481903-000
8	Insulation Strip	481908-000
9	Insulator (Binding Post)	205794-000
10	Relay (MS)	352258-000
12	Relay (HL)	206267-401
13	Relay (CB)	352262-000
14*	Relay (DA)	352263-000
15*	Relay (DB)	352264-000
16*	Relay (BY)	352265-000
17*	Relay (SA)	352266-000
18*	Relay (SB)	352267-000
19	Key Assembly (172-C)	204964-000
20	Key Assembly (173-N)	802621-000
21*	Key Assembly (172-D)	204965-000
22	Key Assembly (172-E)	802619-000
24	Key Assembly,	211367-000
25	Handle	6541-000
26	Capacitor, 2 x 2 μ f (C-1, C-2; C-6, C-7)	42375-000
27	R/C Network, 0.5 μ f / 150 ohms	202895-213
29	Capacitor Bracket	480793-000
30	Resistor, 200 Ω , 25 W (R-9, R-10)	203618-000
31	Resistor, 68K Ω , 1/2 W (R-1)	554001-683
32	Resistor, 1500 Ω , 25 W, (variable) (R-2)	203657-000
33	Resistor, 150K Ω , 1/2 W (R-3)	554001-154
34	Resistor, 25 Ω , 25 W, variable (R-4)	205961-000
35	Resistor, 250 Ω , 25 W, variable (R-5)	149224-000
36	Resistor, 510 Ω , 5 W (R-20)	554554-511
37	Diode, 5C827 (CR1)	202852-138
39	Bracket, Standoff	302859-101
40**	Key Blank	204279-000
41	Resistor, 2 Ω , 25 W, variable (R-11)	206789-000
42	Resistor, 300 Ω , 10 W (R-13)	554580-301
43	Rheostat, 350 Ω , 25 W (RH-1)	203675-000
44	Rheostat, 70 K Ω , 4 W (RH-2, RH-3)	204916-000
45	Knob	203955-000
46	Meter	202812-499
47	Selector Switch	208249-000
48	Dial (DE 209)	213084-000
49	Dial Plate	208250-000
50	Terminal Block (6 x 10)	211695-000
51	Lamp Socket (No. 13)	801421-000
52	Lamp (48 C)	42201-000
53	Lamp Cap No. 31-A	801412-000
54	Fuse Holder	128008-000
55	Fuse (1-1/2 amp)	21566-000

*Used on MDO Test Set (419086-028) only.

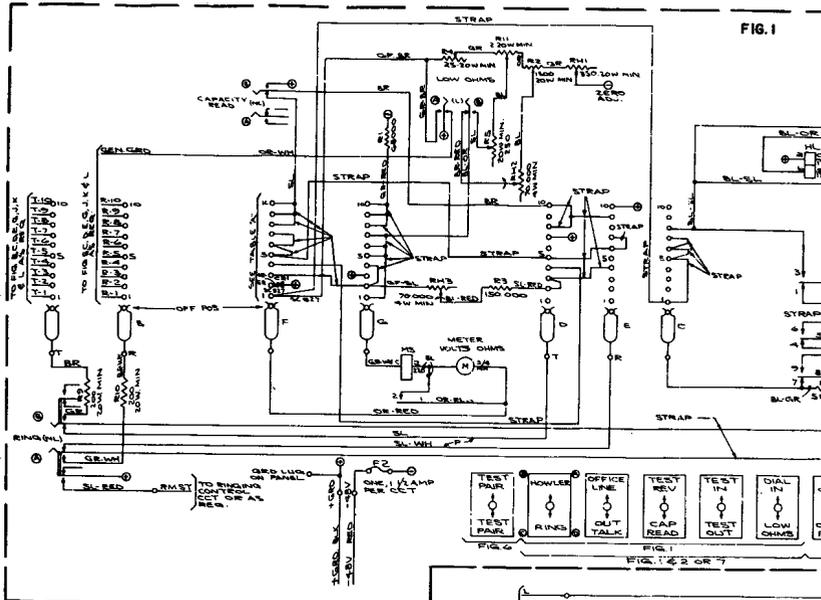
**Used on CDO Test Set (419086-018) only.

TABLE C. Replacement Parts List (cont'd)

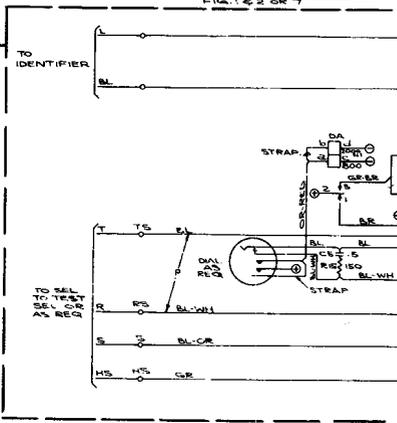
ITEM	DESCRIPTION	STOCK NO.
56	Spacer	36787-000
57	Jack Assembly (No. 140)	49907-000
58	Designation Holder	205960-000
59	Designation Card	E-73304-63
60	No. Card Package Assembly	204785-012
61**	Impedance Coil (RE)	36299-000
62	Dial Adapter Ring	16321-000
64	Terminal	540570-021
65	Protector (8-5/8 Inches Long)	E-35275-1
66	Paper Strip (8-5/8 Inches Long)	E-73304-22
67	Paper Strip (8-5/8 Inches Long)	E-73304-23
69*	Resistor, 100 Ω , 25 W (R-16, R-19)	149240-000
70*	Resistor, 1000 Ω , 5 W (R-12), (R-14)	554554-102
72	Cable	202017-094
73	Board, Component	202136-061
74	Terminal	202135-335
75	Clamp	540202-006
77	No. 8-32 x 2-1/2 Inches RHIM Screw	506752-000
78	No. 8-32 x 2-1/4 Inches FHIM Screw	506682-000
80	No. 8-32 x 3/4 Inch BHIM Screw	505872-000
82	No. 8-32 x 5/16 Inch SEMS Fastener	207353-000
83	No. 8-32 x 1/4 Inch RHIMS (SEMS)	35746-000
84	No. 6 x 3/8 Inch RHIW Screw	521012-000
85	No. 4-40 x 1-1/4 Inches BHIM Screw	503273-000
86	No. 4-36 x 3/8 Inch SSBH Screw	515423-000
87	No. 4-36 x 3/16 Inch BHIM Screw	515172-000
88	No. 0 x 1/4 Inch PK Drive Screw	205900-000
89	No. 3-48 x 3/8 Inch PHIM Screw	501472-000
90**	No. 4-48 x 1/4 Inch RHIM Screw	513252-000
91	No. 8 Washer (Insulated)	34987-000
92	Lockwasher, (Shakeproof)	526210-000
95	No. 4 Washer, (Shakeproof)	526281-000
96	No. 3 Washer, flat	525502-000
97	No. 8-32 Hex Nut	525152-000
98	No. 4-40 Hex Nut	525122-000
99	3/8-32 Hex Nut	540417-119
100	Bushing	9927-000
101**	No. 4-48 Hex Nut	525232-000
103	3-48 ESNA Nut	540334-115
105	Instruction Manual	SCP 76-001-10
106	No. 6 Washer, flat	525532-000
107	No. 6-32 Hex Nut	525132-000
108	No. 8-32 Speed Nut	302850-412
109	No. 6-32 Speed Nut	540463-006
110	No. 6-32 x 3/8 Inch RHIMS Screw	503852-000

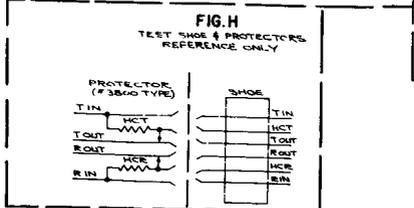
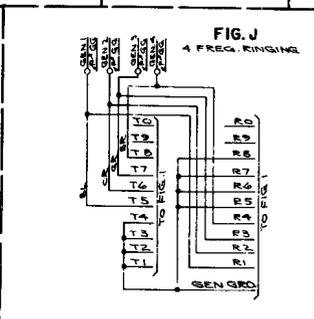
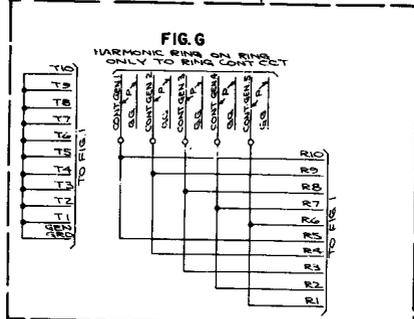
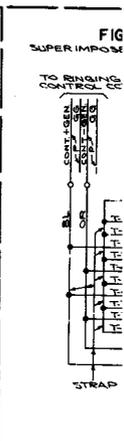
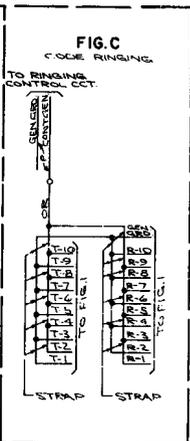
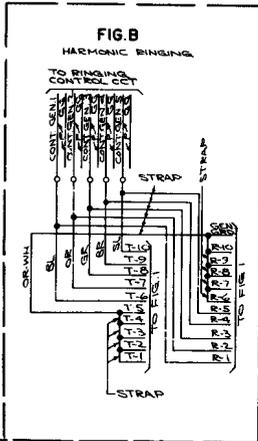
*Used on MDO Test Set (419086-028) only.

**Used on CDO Test Set (419086-018) only.



STEP	FUNCTION
0	OFF
1	ZERO ADJUST
2	BAT ON TIP (REVERSE KEY NORMAL)
3	BAT ON RING (REVERSE KEY OPERATED)
4	+ BOOSTER VOLTAGE ON TIP
5	LINE BATTERY
6	TIP GRD. (OHMS)
7	RING GRD. (OHMS)
8	LOOP (OHMS)
9	TIP CAP.
10	RING CAP.





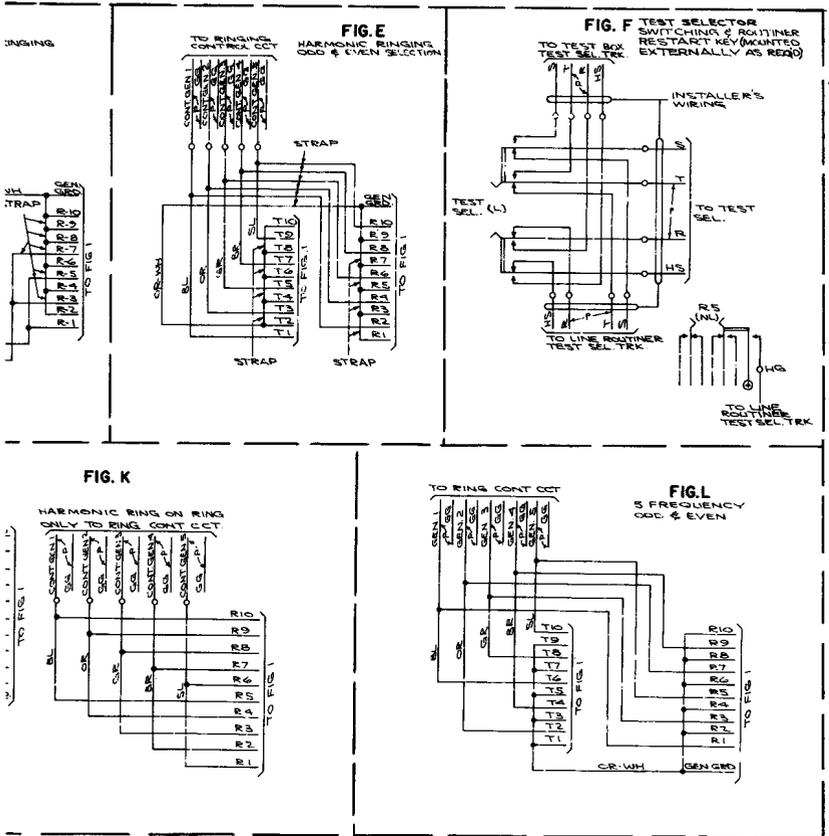
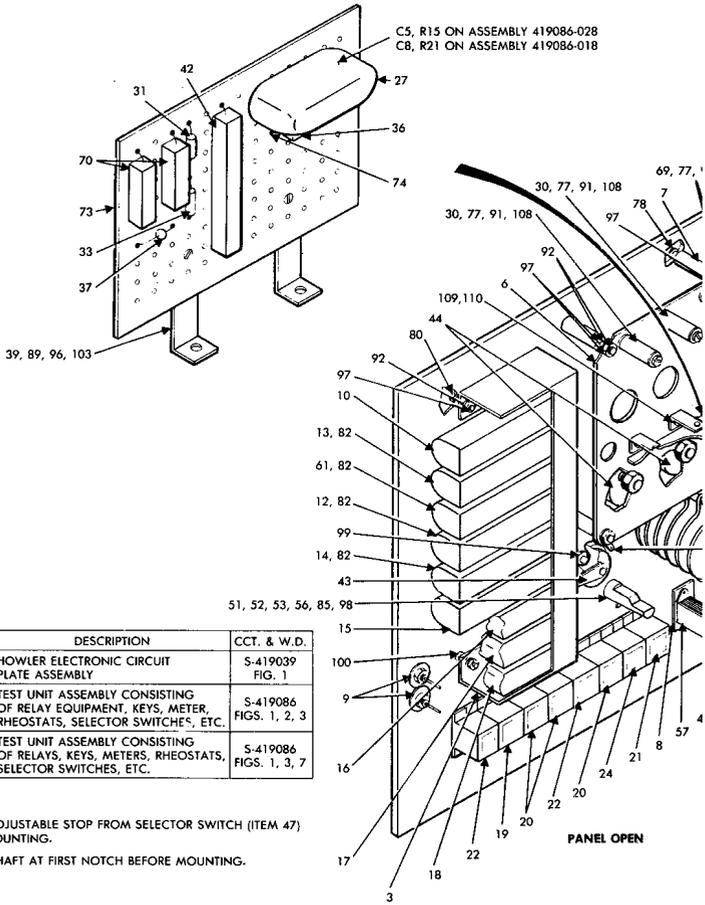


FIGURE 2. Wire Chief's Test Set, Type B, Schematic Diagram (S-419086) (Sheet 3 of 3)



ASSEMBLY	DESCRIPTION	CCT. & W.D.
419039-032	HOWLER ELECTRONIC CIRCUIT PLATE ASSEMBLY	S-419039 FIG. 1
419086-028	TEST UNIT ASSEMBLY CONSISTING OF RELAY EQUIPMENT, KEYS, METER, RHEOSTATS, SELECTOR SWITCHES, ETC.	S-419086 FIGS. 1, 2, 3
419086-018	TEST UNIT ASSEMBLY CONSISTING OF RELAYS, KEYS, METERS, RHEOSTATS, SELECTOR SWITCHES, ETC.	S-419086 FIGS. 1, 3, 7

- NOTES:
- 1 REMOVE ADJUSTABLE STOP FROM SELECTOR SWITCH (ITEM 47) BEFORE MOUNTING.
 - 2 CUT OFF SHAFT AT FIRST NOTCH BEFORE MOUNTING.

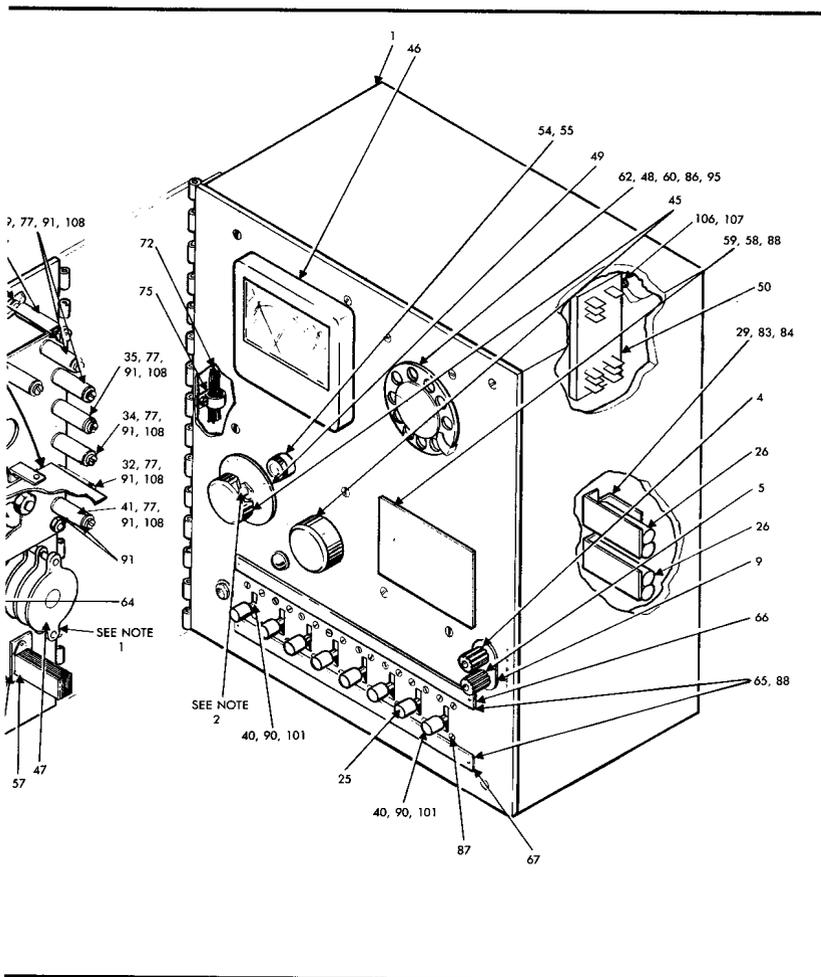


FIGURE 5. Wire Chief's Test Set, Type B, Parts Identification and Modification Details