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

## 1. GENERAL

**1.01** This practice provides instructions on the operation of and test procedures for the S-C Wire Chief's Test Set, Type B. See Figure 1.

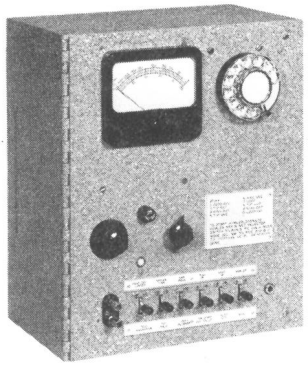


**FIGURE 1. Wire Chief's Test Set, Type B**

**1.02** The test set is used to assist in the testing and troubleshooting of inside and outside plant equipment associated with a dial office.

**1.03** An equipment specification may accompany the equipment. If instructions in the equipment specification differ from those in this practice, follow the equipment specification.

**1.04** Refer to CTSP 405-110-328 for the description and other information regarding the Type B Wire Chief's test set.

## 2. TOOLS AND TEST EQUIPMENT

**2.01** The following tools and test equipment are required to perform the test procedures in this practice:

**a.** Hand test telephone, Stromberg-Carlson No. 203685-000, or equivalent.

**b.** 510Ω resistor (±5%, 1 watt, carbon), Stromberg-Carlson No. 554003-511, or equivalent.

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

**d.** 2μf capacitor (+30%, –0%, 200 WVDC), Stromberg-Carlson No. 202886-865, or equivalent.

**e.** Two test leads, single conductor, terminated in test clips.

## 3. OPERATING INSTRUCTIONS

**3.01** The test set can be connected to the equipment to be tested by one of the following methods:

**a.** Through a test shoe at the MDF (main distributing frame) protector blocks.

**b.** By connecting to the binding posts of the test set.

**c.** By accessing the equipment through a test selector train.

**3.02** When using the test set, the selector switch should be in the OFF position unless the operating instructions state otherwise.

**3.03** In the test procedures in paragraph 6, the test set is in the **on-hook** condition when the hand test telephone is removed from the TEST TEL jack (or the test telephone C switch is operated) and the test set station telephone handset is resting on the cradle.

*CAUTION: If the meter needle deflects to the left when connected to a line to be tested, immediately disconnect from the line (by restoring the last key operated) to prevent damage to the meter.*

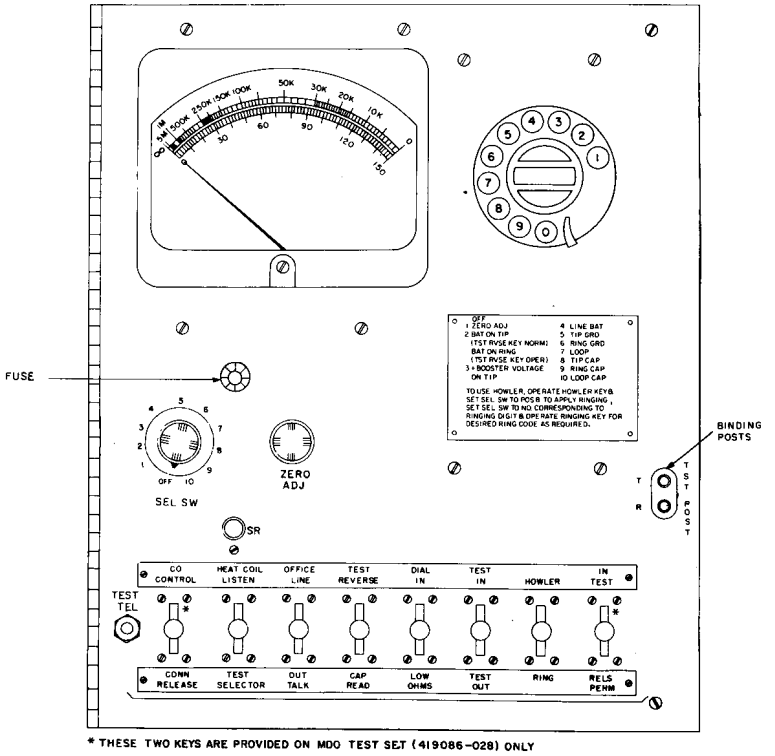
**3.04 Controls and Indicators:** Tables A through E list the test set controls, indicators, and terminals that are shown in Figure 2 and describe the function of each.

**a. Test Keys:** Three-position, lever type key switches are used to provide the desired operating condition. The midposition (normal) is off. The operating position is either nonlocking (spring loaded return to midposition upon release), or locking as indicated in Table A.

*NOTE: Some positions may not be equipped depending on the model number, options, and whether application is for CDO (community dial office) or MDO (main dial office).*

**b. Selector Switch:** The selector switch is a ganged, seven section, wafer type assembly which can be rotated to any one of eleven positions. The

twelfth terminal of the assembly is for the wiper connection of each section. The first position (extreme counterclockwise) is the OFF position. The other positions of the selector switch are labeled 1 through 10, and the function of each position is listed on the designation card on the front of the test set. When performing the operating procedures in this practice, make certain that the selector switch is in the proper functional position. See Table B.




* THESE TWO KEYS ARE PROVIDED ON MDO TEST SET (419086-028) ONLY

**FIGURE 7 Wire Chief's Test Set, Type B, Controls and Indicators**

**TABLE A. Key Functions**

| *KEY* | *FUNCTION* |
|---|---|
| HEAT COIL LISTEN–TEST SELECTOR | HEAT COIL LISTEN (locking) position–used to test heat coils and to monitor on the MDF trunk circuit.<br><br>TEST SELECTOR (locking) position–seizes test selector. |
| OFFICE LINE–OUT TALK | OFFICE LINE (locking) position–connects test telephone jack to line circuit allocated to test set.<br><br>OUT TALK (locking) position–connects transmission battery to line being tested. |
| TEST REVERSE–CAP READ | TEST REVERSE (locking) position–reverses tip and ring test set connections to line being tested.<br><br>CAP READ (nonlocking) position–permits capacitance tests to be made on line being tested. |
| DIAL IN–LOW OHMS | DIAL IN (locking) position–permits test telephone dial to step XY® dial equipment through test shoe.<br><br>LOW OHMS (locking) position–permits meter to make low resistance measurements. Also removes generator ground from ringing circuit to permit ringing of some types of station phones when off-hook. |
| TEST IN–TEST OUT | TEST IN (locking) position–permits testing of inside plant equipment through test shoe.<br><br>TEST OUT (locking) position–permits testing of outside plant equipment through test shoe. |
| HOWLER–RING | HOWLER (locking) position–extends howler tone to line being tested.<br><br>RING (nonlocking) position–applies ringing current to line being tested. |
| CO CONTROL–CONN RELEASE (MDO ONLY) | CO CONTROL (locking) position–releases CO relay and connects LR relay of line being tested through the test switch train.<br><br>CONN RELEASE (nonlocking) position–permits release of test connector without releasing test selector. |
| IN TEST–RLS PERM (MDO ONLY) | IN TEST (locking) position–connects dial to test selector.<br><br>RELS PERM (locking) position–permits release of a permanently held CO line relay. |

**c. Indicators:** Indicators and their functions are described in Table C.

**d. Calibration Controls:** The controls described in Table D are used to calibrate the meter. Except for the ZERO ADJ control on the hinged front panel, all others are located on the back of the panel. For more detailed calibration instructions, refer to CTSP 405-110-328, paragraph 5.03.

**TABLE B. Selector Switch Functions**

| *CARD DESIGNATION* | *SWITCH POSITION* | *FUNCTION* |
|---|---|---|
| OFF | OFF | Disconnects meter circuit from testing circuit. [1] |
| ZERO ADJ | 1 | Provides circuit for zero set of meter before each resistance measurement. |
| BAT ON TIP (TST RVSE KEY NORM) | 2 | Permits testing for battery on tip side of line when TEST REVERSE–CAP READ key is in normal (center) position. |
| BAT ON RING (TST RVSE KEY OPER) | 2 | Permits testing for battery on tip side of line when TEST REVERSE–CAP READ key is operated to TEST REVERSE position. |
| +BOOSTER VOLTAGE ON TIP | 3 | Permits testing for high voltage (+60 V) on tip side of line. |
| LINE BAT | 4 | Permits measurement of potential on line loop. |
| TIP GRD | 5 | Permits testing for ground on tip side of line. |
| RING GRD | 6 | Permits testing for ground on ring side of line. |
| LOOP | 7 | Permits measurement of line loop resistance. |
| TIP CAP | 8 | Permits capacitance measurement between tip side of line and ground.<br><br>Starts operation of howler circuit when HOWLER-RING key is operated to HOWLER position. |
| RING CAP | 9 | Permits capacitance measurements between ring side of line and ground. |
| LOOP CAP | 10 | Permits measurements of line loop capacitance. |
| Text | 1 thru 10 | Connects correct ringing condition for party lines when HOWLER-RING key is operated to RING position. |

**TABLE C. Indicator Functions**

| *INDICATOR* | *FUNCTION* |
|---|---|
| Volt-Ohmmeter | Upper scale indicates resistance from 0 to infinity.<br>Lower scale indicates DC volts from 0 to 150. |
| Lamp SR | When lighted, with TEST SELECTOR switch not operated, indicates that test selector is busy and switch should not be operated to TEST SELECTOR position. With switch operated to TEST SELECTOR and last four digits of line number dialed, the condition of the supervisory lamp indicates the following:<br><br>Lighted steady—line busy (CDO only)<br>120 IPM flashing—line busy (MDO only)<br><br>*Note: The following flashing indications are for automatic line test which is a special application. The condition of the supervisory lamp indicates the following:*<br><br>Lighted steady—line busy.<br>1 Flash—Battery on line.<br>2 Flashes—Ground on line.<br>3 Flashes—Low loop leakage resistance.<br>4 Flashes—No fault on line. |

**TABLE D. Calibration Control Functions**

| *CONTROL* | *FUNCTION* |
|---|---|
| ZERO ADJ (RH1) | Used to calibrate meter for 0 ohms before each resistance measurement. |
| RH2 | Used in overall calibrations with RH1 to obtain correct relationship between 0 ohms indication and midscale (50,000 ohms) deflection. |
| RH3 | Used to calibrate meter for 150 volts full scale deflection. |
| R4, R5, R11 | With R11 at midpoint, R4 and R5 are adjusted alternately to obtain 0 ohms (full-scale deflection) and 500 ohms (midscale deflection) when DIAL IN-LOW OHMS key is operated to LOW OHMS position. |

**e. Terminals, Fuse, and Dial:** Table E describes the function of the components listed.

## 4. OFFICE LINE TEST PROCEDURES

**4.01** To place or receive a call on the office line allocated to the test set, the operator can use either a hand test telephone jacked into the test set or the regular station test telephone wired externally to the test set.

**TABLE E. Miscellaneous Components**

| *COMPONENT* | *FUNCTION* |
|---|---|
| TST POST, T and R | Test binding posts—permits connection of components to test set for testing purposes. Also permits connection of test equipment (Wheatstone bridge, dial speed test set, etc.) to expand capabilities of test set. |
| TEST TEL Jack | Switchboard—type jack—permits connection of hand test telephone to test set for answering, monitoring, or placing calls over office line. |
| Fuse | Protects test set against current overload. |
| Dial | Permits stepping of test train through test selector trunk. |

**4.02 Placing a Call with the Hand Test Telephone:**

**a.** Operate the OFFICE LINE key.

**b.** Insert the plug of the hand test telephone into the TEST TEL jack.

**c.** Listen to the receiver of the hand test telephone.

**d.** When dial tone is heard, dial the desired number, using the dial on the hand test telephone.

**e.** When the call is completed:

(1) To place another call immediately, operate the C button on the hand test telephone; then release the button, listen for dial tone, and dial the desired number.

(2) If further calls are not desired, remove the hand test telephone plug from the TEST TEL jack and restore the OFFICE LINE key to normal.

**4.03 Placing a Call Using the Station Test Telephone:**

**a.** Operate the OFFICE LINE key.

**b.** Remove the handset of the station test telephone and listen to the receiver.

**c.** When dial tone is heard, dial the desired number, using the dial on the test telephone.

**d.** When the call is completed:

(1) To place another call immediately, depress the hookswitch on the test telephone. Release the hookswitch, listen for dial tone, and dial the desired number.

(2) If further calls are not desired, restore the handset of the test telephone and restore the OFFICE LINE key to normal.

**4.04 Answering An Incoming Call:** When the extension ringer sounds, it indicates an incoming call. To answer the call:

**a.** Operate the OFFICE LINE key.

**b.** Insert the plug of the hand test telephone into the TEST TEL jack, or remove the handset of the station test telephone and talk to the calling party.

**c.** When the call is completed:

(1) Restore the OFFICE LINE key.

(2) Remove the plug of the hand test telephone from the TEST TEL jack, or restore the handset of the station test telephone.

## 5. TEST SHOE TEST PROCEDURES

**5.01 Test Connection:** Tests can be made from the test set on all lines and trunks that are connected at the protector blocks of the main distributing frame (MDF) by using the test shoe. To connect the test set to a line or trunk, first ensure that all keys on the test set are normal; then insert the test shoe into the protector block of the line or trunk. If the test set MDF trunk is terminated in a jack field instead of a test shoe, the line to be tested must be patched to the jack field.

**5.02 Preliminary (Monitoring) Test:** Before making any test on a line or trunk, monitor from the test set to determine if the line or trunk is in use, as follows:

**a.** Go off-hook with the test telephone by inserting the plug of the hand test telephone (with the R switch operated) into the TEST TEL jack; or removing the handset from the station test telephone.

**b.** Operate the HEAT COIL LISTEN key and listen to the receiver.

c. If the line or trunk is busy, restore the HEAT COIL LISTEN key and go on-hook with the test telephone by removing the hand test telephone from the TEST TEL jack (or operating the C switch); or, if the station telephone was used in this test, replacing the handset on the cradle.

d. If the line or trunk is idle, proceed as instructed in paragraphs 5.03 through 5.10 for the type of test required.

**5.03 Testing Outside Plant:**

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the TEST OUT key.

d. Refer to paragraphs 8 through 17 and perform the required tests as instructed.

e. When testing is completed, restore all keys to normal and remove the test shoe.

**5.04 Testing Inside Plant Bypassing Heat Coils:**

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Operate the TEST IN key.

c. Refer to paragraphs 8 through 17 and perform the required tests as instructed.

d. When testing is completed, restore all keys to normal and remove the test shoe.

**5.05 Testing Inside Plant Through Heat Coils:**

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Refer to paragraphs 8 through 17 and perform the required tests as instructed.

c. When testing is completed, restore all keys to normal and remove the test shoe.

**5.06 Outgoing Call Through Outside Plant:**

a. Monitor the line as instructed in paragraph 5.02; then go on-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the TEST OUT key.

d. Set the selector switch to the number corresponding to the ringing digit of the party to be called.

e. Operate the RING key. (Operate the key momentarily, or operate the key intermittently to produce the desired ringing code.)

f. After about 3 seconds, momentarily reoperate the RING key; or repeat the ringing code.

g. Go off-hook with the test telephone.

h. Operate the HEAT COIL LISTEN key and monitor the line to determine if the called party has answered.

i. When the called party answers, restore the HEAT COIL LISTEN key to normal.

j. On lines that require transmission battery, operate the OUT TALK key.

k. Proceed with the conversation.

l. When the conversation is finished, restore all keys to normal.

m. Go on-hook with the test telephone.

n. Remove the test shoe.

**5.07 Originating Calls Through Dial Equipment—Regular Lines or Trunks:**

a. Monitor the line as instructed in paragraph 5.02 and stay off-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the DIAL IN key.

d. Dial the desired number using the dial on the test telephone.

e. When dialing is completed, the dial equipment rings the called party.

f. When the called party answers, the dial equipment supplies transmission battery to the test set telephone and to the called telephone.

g. Proceed with the conversation.

h. When the conversation is finished, restore all keys to normal.

i. Go on-hook with the test telephone.

j. Remove the test shoe.

**5.08 Originating Calls to PBX Lines or Special Lines:** When testing a PBX line circuit (or any other circuit that does not furnish ground on the tip side of the line), proceed as follows:

a. Connect ground to the R terminal of the TST POST.

b. Go off-hook with the test telephone.

c. Operate the DIAL IN key.

d. Operate the TEST IN key.

e. When dial tone is heard, restore the TEST IN key to normal.

f. Operate the TEST OUT key.

g. Proceed as instructed in paragraph 5.07, steps d. through j.

h. Remove ground from the R terminal.

**5.09 Originating Calls Through Incoming Ringdown Trunks:**

a. Monitor the trunk as instructed in paragraph 5.02; then go on-hook.

b. Restore the HEAT COIL LISTEN key.

c. Operate the TEST IN key.

d. Momentarily operate the RING key.

e. Go off-hook with the test telephone.

f. When the switchboard operator answers, proceed with the conversation.

g. When the conversation is finished, restore all keys to normal.

h. Go on-hook with the test telephone.

i. Remove the test shoe.

**5.10 Originating Calls Through Incoming Common Battery Trunks:**

a. Restore the HEAT COIL LISTEN key.

b. Operate the TEST IN key.

c. Operate the DIAL IN key.

d. When the switchboard operator answers, proceed with the conversation.

e. When the conversation is finished, restore all keys to normal.

f. Go on-hook with the test telephone.

g. Remove the test shoe.

## 6. TEST SELECTOR—MDO TEST PROCEDURES

**6.01** Tests can be made on any line or trunk terminated on selector or connector banks in the MDO by using the test selector trunk from the MDO test set. The supervisory lamp (SR) on the front panel lights when the test selector is seized from the test set or the operator's switchboard. Testing should not be attempted when the test selector is already seized from the operator's switchboard.

**6.02 Connecting to the Line:**

a. Turn the selector switch to the OFF position.

b. Operate the TEST SELECTOR key. The supervisory lamp lights, indicating that the test selector is ready to receive dial pulses.

c. Use the test set to dial the last four digits of the desired number. If the supervisory lamp flashes at 120 IPM, the line is busy; if the lamp remains lighted, the test connector is busy; if the lamp extinguishes, the line is free for testing.

d. If the line is busy (120 IPM flashes), monitor the line to determine whether conversation is in progress or whether a fault condition is holding the line circuit. Monitor as follows:

(1) Operate the DIAL IN and TEST IN keys.

(2) Go off-hook with the test telephone and listen to the receiver.

e. If the test connector is busy (lamp remains lighted), restore the TEST SELECTOR key and try again later.

f. If the line is idle (supervisory lamp extinguishes), apply tests by operating the appropriate keys on the test set.

**6.03 Stepping to the Next Line or Level:** After completing the tests on a line, the connector can be stepped to the next line by dialing the digit 1 with the test set dial while the DIAL IN and TEST IN keys are operated.

**6.04 Releasing the Test Connector:** The test set can be connected for testing on a line within a different level (tens group) by releasing the test connector without releasing the test selector. To do this, operate the CONN RLS key, then dial the last two digits of the desired number. The supervisory lamp indications and test functions are as described in paragraph 6.02. To access lines within a different hundreds connector group, both the test selector and test connector must be released. To do this, restore the TEST SELECTOR key to normal and repeat the procedures described in paragraph 6.02.

**6.05 Release Permanent:** If the supervisory lamp on the test set is lighted after a line has been restored to normal, momentarily operate the RLS PERM key. This releases the battery feed relay so that tests can be made on the T and R leads.

**6.06 Inward Test—Regular Lines and Trunks:**

a. Operate the TEST SELECTOR key and use the test set dial to dial the desired number.

b. After the supervisory lamp extinguishes (indicating that the test selector has stepped to the desired line):

(1) Operate the IN TEST key and then the CO CONT key.

(2) Go off-hook with the test telephone.

(3) Operate the DIAL IN and TEST IN keys.

(4) Restore the IN TEST key to normal.

(5) Dial the desired line number, using the test telephone dial.

c. Operate the appropriate keys for the desired test.

d. To release from the inward test, the following sequence of operation must be observed to prevent locking up the switchtrain connection:

(1) Go on-hook with the test telephone.

(2) Restore the TEST IN key to normal.

(3) Restore the CO CONT key to normal.

**6.07 Inward Test—PBX and Special Lines:** When testing PBX lines (or any other circuit that does not furnish ground on tip), use the following procedure:

a. Connect ground to the R binding post of the test set.

b. Go off-hook with the test telephone.

c. Operate the DIAL IN and TEST IN keys.

d. Operate the CO CONT key.

e. When dial tone is heard, remove the ground connection from the R binding post.

f. Use the dial on the test telephone to dial the digits of the desired line number.

g. Operate the appropriate keys for the desired test.

h. To release from the test connection, go on-hook with the test telephone; then restore the CO CONT key to the normal position.

## 7. TEST SELECTOR—CDO TEST PROCEDURES

**7.01** Tests can be made on any line or trunk terminated on the selector or connector banks in the CDO by using the test selector trunk from the CDO test set. The supervisory lamp (SR) on the front panel lights when the test selector is seized from the test set or the operator's switchboard. Testing procedures should not be attempted when the test selector is already seized from the operator's switchboard.

**7.02 Connection to a Line:**

a. Turn the selector switch to the OFF position.

b. Operate the TEST SELECTOR key. The supervisory lamp lights, indicating that the test selector is ready to receive dial pulses.

*NOTE: The dial on the test set controls the test train only and should not be used in an attempt to control the regular central office dial equipment for inward tests.*

c. Use the test set dial to dial the last four digits of the desired line number. If the supervisory lamp remains lighted, the line is busy; if the supervisory lamp extinguishes, the line is free for testing.

d. If the line is busy, monitor to determine whether conversation is in progress or whether a fault condition is holding the line circuit. Monitor the line as follows:

(1) Operate the DIAL IN and TEST IN keys.

(2) Go off-hook with the test telephone and listen to the receiver.

e. If the line is free, go on-hook with the test telephone and make tests by operating the appropriate keys on the test set.

## 8. BINDING POSTS TEST PROCEDURES

**8.01** The binding posts, designated TST POST T and R (see Figure 2), can be used for two different purposes:

a. Components or equipment to be tested can be connected to the binding posts so that tests may be applied from the test set.

b. External test equipment (e.g., Wheatstone bridge, dial speed test set, etc.) can be connected to the binding posts to increase the capability of the test for testing lines and equipment through the test shoe or test selector train.

**8.02** When the test set is used for testing components connected to the binding posts, the following particular type of test condition is applied:

**a. Potential Tests:**

(1) Connect the equipment to be tested to the binding posts.

(2) Refer to paragraphs 11 through 16 and select the test to be performed.

(3) Disconnect the equipment from the binding posts when testing is completed.

**b. Ringing:**

(1) Turn the selector switch to the required ringing digit (see paragraph 5.06).

(2) Connect the equipment to be tested to the binding posts.

(3) Operate the RING key to apply the required ringing frequency to the equipment connected to the binding posts.

(4) Restore the RING key to remove the ringing.

(5) Disconnect the equipment from the binding posts when testing is completed.

**c. Transmission Battery:**

(1) Connect the equipment to be tested to the binding posts.

(2) Go off-hook with the test telephone.

(3) Operate the OUT TALK key to connect battery and ground to the component by way of the R and T binding posts, respectively.

(4) Restore the OUT TALK key to disconnect the transmission battery supply.

(5) When testing is completed, go on-hook with the test telephone.

(6) Disconnect the equipment from the binding posts.

**d. Dialing:**

(1) Connect the equipment to be dial pulsed to the binding posts.

(2) Go off-hook with the test telephone.

(3) Operate the DIAL IN key.

(4) Operate the TEST IN key.

(5) Dial the desired number on the test telephone dial to apply dial pulses to the equipment connected to the binding posts.

(6) When the pulsing test is completed, go on-hook with the test telephone.

(7) Restore all keys to normal.

(8) Disconnect the equipment from the binding posts.

**8.03** Auxiliary test equipment is connected to the binding posts after the preliminary test path has been set up through the test shoe (see paragraph 5) or through the test selector train (see paragraph 6 or 7). When using the test selector train, the TEST OUT key must be operated to connect the auxiliary test equipment to the test train.

## 9. HEAT COIL TEST PROCEDURES

**9.01** To check the condition of the heat coils, proceed as follows:

**a.** Position the selector switch to the OFF position.

**b.** Go off-hook with the test telephone.

**c.** Operate the HEAT COIL LISTEN key and listen to the receiver. If the line is busy, try again later.

**d.** If there is no conversation on the line, operate the TEST OUT and OUT TALK keys.

**e.** If dial tone is heard in the receiver, the heat coils are not open.

## 10. METER CALIBRATION

**10.01** Before making a resistance test, zero set the meter in accordance with the following steps to ensure accuracy of the readings. (If the proper indications are not obtained, refer to CTSP 405-110-328, paragraph 5.03 for more detailed calibrating procedures.)

**a.** Rotate the selector switch to position 1 (ZERO ADJ).

**b.** If a resistance below 5000Ω is to be measured, operate the LOW OHMS key.

**c.** Adjust the ZERO ADJ control so that the meter needle indicates 0 on the resistance scale.

## 11. TESTING FOR NEGATIVE BATTERY ON THE TIP OR RING LEAD

*CAUTION: If the meter needle moves off-scale (left) during the following procedures, disconnect immediately from the line being tested.*

**11.01 Proceed as follows:**

**a.** For testing on the tip lead, rotate the selector switch to position 2. For testing on the ring lead, rotate the selector switch to position 2 and operate the TEST REVERSE key.

**b.** Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

**c.** If there is a negative battery potential on the lead, the meter needle will indicate the voltage value on the lower scale of the meter.

**d.** If the meter needle does not move, the lead is either open or free of battery potential.

**e.** Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

## 12. TESTING FOR + BOOSTER VOLTAGE ON THE TIP

*CAUTION: If the meter needle moves off-scale (left) during the following procedures, disconnect immediately from the line being tested.*

**12.01** Proceed as follows:

**a.** Rotate the selector switch to position 3.

**b.** Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

**c.** If there is a positive battery potential on the tip lead, the meter needle will indicate the voltage value on the lower scale of the meter.

**d.** If the meter needle does not move, the lead is either open or free of battery potential.

**e.** Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

## 13. MEASURING LINE BATTERY VOLTAGE

**13.01** To measure the battery voltage around the T and R loop of a line, rotate the selector switch to position 4 and follow the same testing procedures described in paragraph 12. With the selector switch in position 4, the meter reading shows the battery voltage on the line loop.

## 14. TESTING FOR GROUND ON TIP OR RING

**14.01** Proceed as follows:

**a.** Zero set the meter as described in paragraph 10.

**b.** Rotate the selector switch to position 5 for measuring ground on the tip lead, or to position 6 for measuring ground on the ring lead.

**c.** Connect to the line or trunk by using the test show or test selector train. Refer to paragraph 5, 6, or 7.

**d.** If there is a ground on the line, the resistance to ground will be indicated on the upper scale of the meter.

**e.** If the meter needle does not move, it indicates that the lead is either open or not grounded.

**f.** Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

## 15. MEASURING LINE LOOP RESISTANCE AND LEAKAGE

**15.01** Proceed as follows:

**a.** Rotate the selector switch to position 7.

**b.** Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

**c.** With the telephone at the far end **on-hook**, the meter reading indicates the leakage resistance of the line.

**d.** Compare this reading with the resistance shown on the line record card to determine if the line is faulty.

**e.** With the telephone at the far end **off-hook**, the meter reading indicates the loop resistance of the line. If the meter needle indicates 5000Ω or less, operate the LOW OHMS key and divide the meter indication by 100 to obtain the actual loop resistance.

**f.** Compare this reading with the resistance shown on the line record card to determine if the line is faulty.

**g.** Upon completion of the test, restore all keys to normal and disconnect the test shoe or test selector train.

## 16. MEASURING LINE CAPACITY

**16.01** When testing the capacity of a line, the telephone at the far end should be **on-hook**. Proceed as follows:

**a. Tip to Ground Capacitance:**

(1) Rotate the selector switch to position 8.

(2) Connect to the line or trunk by using the test shoe or test selector train. Refer to paragraph 5, 6, or 7.

(3) Rapidly operate and restore the CAP READ key several times.

(4) While performing step (3), observe the meter needle and record the maximum reading observed on the lower scale of the meter.

(5) Restore the CAP READ key.

(6) Compare the recorded reading with the DEFLECTION column in Table F to obtain the capacitance reading (CAPACITY column).

(7) Upon completion of this test, either proceed with other tests or restore all keys to normal.

**b. Ring to Ground Capacitance:** The procedures for measuring ring capacitance are identical to those for measuring tip capacitance (a. above), except that the selector switch is turned to position 9 on the test set.

**c. Loop Capacitance:**

(1) Rotate the selector switch to position 10.

(2) Rapidly operate and restore the CAP READ key several times.

(3) While performing step (2), observe the meter needle and record the maximum reading observed on the lower scale of the meter.

(4) Restore the CAP READ key.

(5) Subtract the tip capacity reading (obtained in paragraph 16.01, a.) from the loop capacitance reading obtained in step (3) above. The result is the loop capacity.

(6) Compare the recorded reading with the DEFLECTION column in Table F to obtain the capacitance reading (CAPACITY column).

(7) Upon completion of this test, either proceed with other tests or restore all keys to normal.

**d. Converting Meter Deflections to Capacitance:** Table F lists typical readings

**TABLE F. 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 |

obtained on the lower scale of the meter and the approximate capacitance in microfarads to which they are equal.

## 17. GENERATOR GROUND CUT-OFF

**17.01** The test key which controls generator ground cut-off is the same key that controls application of the circuits to obtain LOW OHMS. However, the circuits for each function are different and separate. Generator ground cut-off is used on lines having subsets which do not remove ringers from the line when the phone is off-hook, or on lines having telephones equipped with varistors connected across the receiver.

**17.02** To signal a customer who has left his telephone off-hook, the usual howler method would be ineffective. To signal such a customer, the LOW OHMS key is operated and ringing is applied to the line by operation of the RING key. Operation of the LOW OHMS key removes the shunt across the ringer of the off-hook telephone so that the telephone can be rung without ringing current damaging the receiver.

## 18. HOWLER

**18.01** Except as noted in paragraph 17, the howler is used to try to alert a customer whose telephone is off-hook. Either an internal howler or an external howler is supplied. Generally, the internal howler is adequate for smaller offices, and the external howler is used when many lines must be covered. Both howlers are automatic to the extent that the rising and falling tone will continue until the telephone is placed on-hook; then howler operation will cease automatically.

**18.02** If the telephone is not placed on-hook, the testman should stop howler operation by restoring the HOWLER key and recheck at a later time.