

**STROMBERG-CARLSON**  
**WIRE CHIEF'S TEST BOX**  
**TYPE B**

*Operating Instructions*

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MDO



CDO

Figure 1. Typical Type B Test Boxes for MDO and CDO.

## 1. PURPOSE

The Type B Wire Chief's Test Box is used as an aid to maintenance and repair of inside and outside plant equipment of telephone offices.

## 2. FUNCTIONS

The individual requirements and specifications for the office to be supplied determine the functional circuits incorporated in 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. Five-frequency, Code, or Superimposed Ringing.
- f. Howler with Automatic Cut-off Restoring to Service of Subscribers Line upon Hang-up of Off-hook Receiver.
- g. Test In and Test Out Via MDF Protectors.
- h. Reversal of Test Leads.
- i. Dial In.
- j. Out Talk.
- k. MDO or CDO Test Selector Access.
- l. Remote Office Access to Test Selector (CDO).
- m. Two Test Pairs to Remote Office (CDO Optional).
- n. Ringing on Permanent Line with Ringer Connected from One Side to Ground (Generator Ground Cut-off).

## 3. MODELS

Note. In addition to the models listed below which are typical for use with 100-point MDO and 20-point CDO test selectors (fig. 1A and 1B) other models can be supplied to meet the specific requirements of the facility for which they are needed. The principle of operation is generally similar for all models with any dissimilarities being covered in the specifications supplied with the special equipment.

For MDO (100-Point Test Selector)		
Model	Stock Number	Equipped
B-1	491727-000	With internal howler; without test box dial
B-2	491281-000	With internal howler; with test box dial
B-3	493960-000	For external howler; with test box dial

For CDO (20-Point Test Selector)		
Model	Stock Number	Equipped
B-1	490037-000	With internal howler; without test box dial
B-2	490036-000	With internal howler; with test box dial
B-3	492814-000	For external howler; with test box dial
B-4	492370-000	For external howler; without test box dial

#### 4. SYSTEM APPLICATION

Figure 2 is a block diagram of the application of the Test Box in a typical dial central office. The following subparagraphs describe the application of the Test Box and the means it has for testing inside and outside plant.

##### a. Switching Equipment.

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

##### b. Test Switching Equipment.

The test switch train consists of a test selector and a test connector. The test switch train is seized directly from the Test Box. Normally, there is only one test switch train in offices that use the Test Box. However, a local demand or future expansion may require an additional test switch train.

##### c. Test Shoe.

The Test Box is provided with a test shoe circuit. The test shoe permits the testing, without going through the dial equipment, of all lines and trunks that terminate on the protector blocks of the MDF. The test shoe must be manually inserted into the protector of the line or trunk to be tested.

d. Power, Ringing, and Supervisory Equipment.

The power, ringing, and supervisory equipment supplies the battery, ringing, and supervisory leads necessary for the operation of the Test Box.

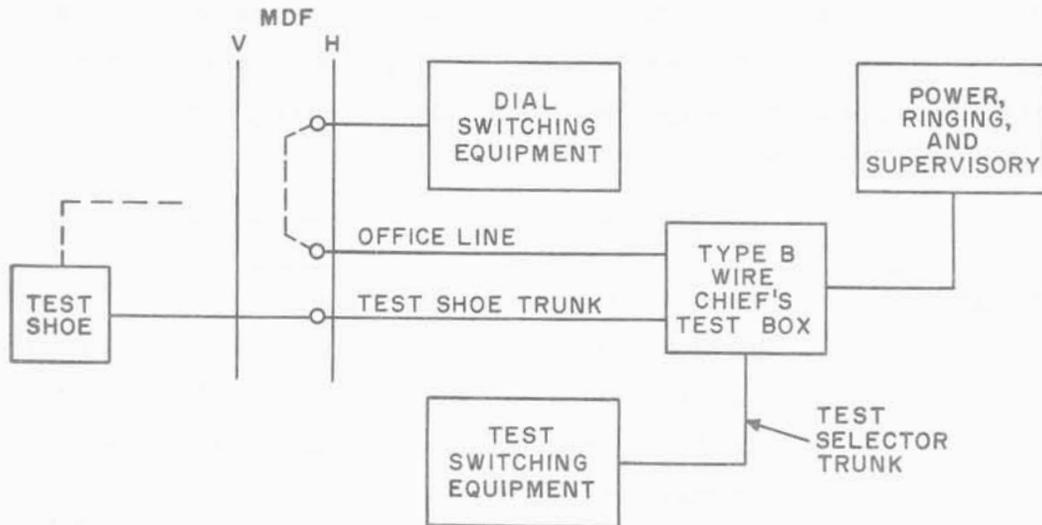


Figure 2. Typical Application Diagram for Type B Test Box.

e. Technical Characteristics.

(1) Operating requirements.

Battery voltage 44 to 54 volts dc

Dial Characteristics:

Percent make  $38.5 \pm 2\%$

Speed 8 to 12 pps

Ringing voltage as required

(2) Volt-ohmmeter.

Full scale deflection current .00075 ampere

Internal resistance 200 ohms maximum

Scales:

Dc voltage (lower scale) 0 to 150

Ohms (upper scale) 0 to infinity

## 5. CONTROLS AND THEIR FUNCTIONS

The accompanying charts list the Text Box controls, indicators, and terminals. A description of the function of each is included.

### a. Test Key Switches.

(1) Three-position, lever-types key switches are used to obtain the desired operating condition. The mid-position is off (normal). The operating position is either locking or non-locking (spring-loaded return to mid-position upon release) as indicated in the chart. Note that some positions may not be equipped depending on model number, options, and whether application is for CDO or MDO.

Switch	Function
HOWLER-RING	Three position, locking-nonlocking: HOWLER (locking) position -- with selector switch, it extends howler tone to line being tested. RING (nonlocking) position -- applies ringing current to line being tested.
HEAT COIL LISTEN-TEST SELECTOR	Three position, locking: HEAT COIL LISTEN position -- used to test heat coils and to monitor on the MDF trunk circuit. TEST SELECTOR position -- seizes test selector.
OFFICE LINE-OUT TALK	Three position, locking: OFFICE LINE position -- connects test telephone to line equipment. OUT TALK position -- connects transmission battery to line being tested.
TEST REVERSE-CAP READ	Three position, locking-nonlocking: TEST REVERSE (locking) position -- reverses tip and ring of line being tested. CAP READ (nonlocking) position -- permits capacitance tests to be made on line being tested.

Switch	Function
DIAL IN-LOW OHMS/ GEN GRD CO	<p>Three position, locking:</p> <p>DIAL IN position -- permits test telephone to step XY dial equipment through MDF trunk or test selector trunk.</p> <p>LOW OHMS position -- permits meter to make low resistance measurements.</p> <p>GEN GRD CO position -- permits ringing on permanent line with ringer connected from one side to ground.</p>
TEST IN-TEST OUT	<p>Three position, locking:</p> <p>TEST IN position -- permits testing of inside plant equipment through test shoe.</p> <p>TEST OUT position -- permits testing of outside plant equipment through test shoe.</p>
CO CONTROL- CONN RELEASE	<p>Three position, locking-nonlocking:</p> <p>CO CONTROL (locking) position -- seizes line equipment of line being tested through the test switch train.</p> <p>CONN RELEASE (nonlocking) position -- permits release of test connector without releasing test selector.</p>
IN TEST RELS PERM (MDO only)	<p>Three position, locking:</p> <p>IN TEST position -- connects dial to test selector.</p> <p>RELS PERM position -- permits release of held battery feed relay (permanent).</p>
TEST PAIR-TEST PAIR (CDO only)	<p>Three position, locking:</p> <p>Permits testing of local office from remote office.</p> <p><u>Note.</u> Either one or two positions may be equipped. Additional switch positions can be equipped on special application.</p>

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 counter-clockwise) is the OFF position. THE SWITCH FOR THE MDO TEST BOX IS MARKED FROM 0 TO 10 WHILE THAT FOR THE CDO TEST BOX IS MARKED FROM 1 TO 11. THEREFORE, REFERENCES TO MDO POSITION NUMBERS MUST BE INCREASED BY ONE WHEN THE CDO TEST BOX IS USED. IN THE FOLLOWING CHART, MDO NUMBERS ARE USED WITH CDO NUMBERS IN PARENTHESES.

Card Designation	Switch Position	Function
OFF	0 (1)	Disconnects meter circuit from testing circuit.
ZERO ADJ	1 (2)	Provides circuit for zero set of meter before each resistance measurement.
TIP BAT	2 (3)	Permits foreign battery test on tip side of line.
RING BAT	3 (4)	Permits foreign battery test on ring side of line.
TIP GRD	4 (5)	Permits testing for ground on tip side of line.
RING GRD	5 (6)	Permits testing for ground on ring side of line.
LOOP	6 (7)	Permits measurement of line loop resistance.
TIP CAP	7 (8)	Permits capacitance measurements between tip side of line and ground. Also see switch position 7 (8) below.
RING CAP	8 (9)	Permits capacitance measurements between ring side of line and ground. Also see switch position 8 (9) below.
LOOP CAP	9 (10)	Permits measurements of line loop capacitance. Also see switch position 9 (10) below.
Text	7 (8)	Starts operation of howler circuit when key switch is operated to HOWLER position, and subscriber line is switched through for control by HL relay.
Text	8 (9)	Permits application of howler to line.
Text	9 (10)	Increases level of howler tone.
Text	10 (11)	Increases level of howler tone.

c. Indicators.

Indicators and their functions are described in the following chart.

Indicator	Function
Volt-Ohmmeter	Upper scale indicates resistance from 0 to infinity. Lower scale indicates volts in dc from 0 to 150. <u>Note.</u> Meter is protected from excessive current by shunt relay MS.
Test Selector supervisory lamp (Equipped on Models B2 and B3 only)	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: Lighted steady - line busy. 1 Flash - Battery on line. 2 Flashes - Ground on line. 3 Flashes - Low loop leakage resistance. 4 Flashes - No fault on line. <u>Note.</u> Flashing indications are for automatic line test which is a special application.
Fuse	Protects against current overflow.

d. Calibration Controls.

The following controls are used for calibrating the meter. Except for the ZERO ADJ control on the hinged front panel, all others are located on the back of the panel.

Control	Function
ZERO ADJ (RHI)	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 no deflection and 500 ohms midscale deflection when LOW OHMS test key switch is operated.

e. Terminals, Ringer, and Dial.

The following chart describes the function of the listed components.

Component	Function
T and R binding posts	Test binding posts -- permits connection of external equipment to test box for testing purposes.
Test telephone jack	Switchboard-type jack -- permits connection of hand test (or regular dial) telephone to test box for answering, monitoring, or placing calls over office line.
Ringer	Telephone ringer -- indicates incoming call on assigned office line, externally connected as required.
Dial	Permits stepping of XY equipment through use of text selector.

6. GENERAL OPERATING INSTRUCTIONS

The following paragraphs provide detailed operating instructions for the Test Box. This includes the procedures for answering incoming calls, originating out-going calls, adjustments, and all tests that can be performed from the Test Box.

7. METER CALIBRATION OPERATIONAL CHECK

Although the meter is calibrated before leaving the factory, it is recommended that an operational check be made prior to initial use and thereafter as often as deemed necessary. Further, when making resistance measurements, the meter should be zero set before each measurement in order to ensure accuracy of the check. Procedures for zero-setting the meter are described in a(1) through a(3), or b(1) through b(3) below.

Office battery and ground must be connected to the Text Box via the terminal block terminals 37 and 39, respectively. Telephone assigned to Test Box line must be on hook and hand test telephone plug removed from jack on front panel of Test Box.

Note. If proper indications for resistance checks, are not obtained, proceed to paragraph 8 and calibrate meter as prescribed therein. Voltage check calibration is included in c of this paragraph.

a. Low Resistance Check.

(1) Rotate selector switch to position 1 for MDO Test Box or to position 2 for CDO Test Box (ZERO ADJ on placard).

- (2) Operate test key to LOW OHMS position.
- (3) Adjust ZERO ADJ control for 0 indication on meter.
- (4) Connect a known-accurate 500-ohm resistor across the T and R binding posts.
- (5) Rotate selector switch to position 6 for MDO Test Box or position 7 on CDO test box (LOOP on placard).
- (6) A mid-scale deflection of 50,000 should be indicated on the resistance scale of the meter. With the LOW OHMS test key operated, the scale indication is divided by 100 to obtain the resistance value ( $50,000 \div 100 = 500$  ohms).

(7) Remove 500-ohm resistance from T and R, and return LOW OHMS test key to normal position. Rotate selector switch to 0 for MDO Test Box or 1 for CDO Test Box (OFF on placard).

b. High Resistance Check.

- (1) Rotate selector switch to position 1 for MDO Test Box or to position 2 for CDO Test Box (ZERO ADJ on placard).
- (2) Check that all test keys are in normal position.
- (3) Adjust ZERO ADJ control for 0 indication on meter.
- (4) Connect a known-accurate 50,000 resistor across T and R binding posts.
- (5) Rotate selector switch to position 6 for MDO Test Box or position 7 on CDO Test Box (LOOP on placard).
- (6) A mid-scale deflection of 50,000 ohms should be indicated on meter resistance scale.
- (7) Remove 50,000-ohm resistor from T and R, and rotate selector switch to 0 for MDO Test Box or 1 for CDO Test Box (OFF on placard).

Note. A resistance decade box is recommended for above two checks.

c. Voltage Check and Calibration.

- (1) Check that all test keys are in normal position.
- (2) Connect a vacuum-tube voltmeter (VTVM), set to proper dc scale, across terminal 37 (-48 v) and terminal 39 (+ ground) of Test Box terminal block.
- (3) Rotate selector switch to position 3 on MDO Test Box or position 4 on CDO Test Box (RING BAT. on placard).
- (4) Connect or wire between terminal 37 (-48 v) on terminal block and R binding post on front panel of Test Box.
- (5) The indications on the Test Box meter and on the VTVM should be identical. If not, adjust RH3 on back of Test Box panel until the Test Box meter indication matches that of the VTVM. Lock RH3 adjustment with light touch of glyptal, or equivalent.

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

## 8. CALIBRATION OF METER FOR RESISTANCE

Calibration of the meter should not be necessary unless the operational check requirements set forth in paragraph 7 cannot be met.

### a. Low Resistance (LOW OHMS) Calibration.

(1) Perform steps a(1) through a(6) in paragraph 7, except in step a(3), adjust ZERO ADJ control to approximately mid-position of its range regardless of meter indication.

(2) Check that R11 on back of panel is adjusted to mid-position of its range. If factory seal is not disturbed, no adjustment is necessary; if seal is broken, adjust R11 to mid-position.

(3) On back of panel, alternately adjust R4 and R5 for 50,000 ohms and 0 ohms indication, respectively. Selector switch must be in position 6 for MDO Test Box or position 7 for CDO Test Box (LOOP) when adjusting R4, and switched to position 1 for MDO Test Box or position 2 for CDO Test Box (ZERO ADJ) when adjusting R5 for 0. Repeat adjustments until both indications are accurate. Lock R4, and R11 with a light touch of glyptal, or equivalent.

(4) Perform step a(7) of paragraph 7.

### b. High Resistance Calibration.

(1) Refer to paragraph 7 and perform steps b(1) through b(5) except in step 5(3) adjust ZERO ADJ control to approximately mid-position of its range.

(2) On back of panel, alternately adjust R2 for 50,000 ohm indication on meter and RH2 for 0 indication. Selector switch must be in position 6 for MDO Test Box or position 7 for CDO Test Box (LOOP) while adjusting R2, and in position 1 (MDO) or position 2 (CDO) (ZERO ADJ) when adjusting RH2. Repeat adjustments until both indications are accurate. Lock R2 and RH2 with a light touch of glyptal, or equivalent.

(3) Perform step b(7) of paragraph 7.

## 9. USING THE OFFICE LINE

To place or receive a call on the office line of the Test Box, the operator must use either a hand test telephone (a below) or, if there is a telephone set connected to the Test Box, this phone can be used (b below).

a. Placing a Call With Hand Test Telephone.

- (1) Operate the OFFICE LINE key.
- (2) Insert the plug of the hand test telephone into the test telephone jack.
- (3) Listen to the receiver of the hand test telephone.
- (4) When dial tone is heard, dial the desired number using the dial on the hand test telephone.
- (5) When the call is completed.
  - (a) 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 new number.
  - (b) If further calls are not desired, remove the hand test telephone plug from the test telephone jack and restore the OFFICE LINE key.

b. Placing a Call Using Test Telephone.

- (1) Operate the OFFICE LINE key.
- (2) Remove the handset of the test telephone and listen to the receiver.
- (3) When dial tone is heard, dial the desired number using the dial on the test telephone.
- (4) When the call is completed:
  - (a) To place another call immediately, depress the hookswitch on the test telephone. Release the hookswitch, listen for dial tone, and dial the new number.
  - (b) If further calls are not desired, restore the handset of the test telephone and restore the OFFICE LINE key to normal.

c. Answering Incoming Call.

When the extension ringer sounds, it indicates an incoming call. To answer the call:

- (1) Operate the OFFICE LINE key.
- (2) Insert the plug of the hand test telephone into the test telephone jack or remove the handset of the test telephone and talk to the calling party.
- (3) When the call is completed, disconnect as described below.
  - (a) Remove the plug of the hand test telephone from the test telephone jack, or restore the handset of the test telephone.
  - (b) Restore the OFFICE LINE key.

## 10. TEST CONNECTIONS USING TEST SHOE

Tests can be made on all lines or trunks that are extended through the protector blocks of the main distributing frame (MDF) by using the test shoe. To connect to a line or trunk, insert the test shoe into the protector block of the line or trunk. If the test shoe is terminated in a jack field instead of a test shoe, the line to be tested must be patched to the jack field. After connecting to the line, proceed as described below.

### a. Monitoring Through Test Shoe.

When tests or calls are to be made on a line or trunk, monitor the line to determine if the line or trunk is in use. To monitor the line:

(1) Operate the HEAT COIL LISTEN key.

(2) Insert the plug of the hand test telephone into the test telephone jack, or remove the handset of the test telephone.

(3) Listen to the receiver.

(a) If the line or trunk is busy, disconnect by restoring the HEAT COIL LISTEN key and removing the test plug or replacing the handset.

(b) If the line or trunk is idle, proceed as described in b, c, d, e, f, g, or h below depending upon the type of operation desired.

### b. Testing Outside Plant.

(1) Remove the test plug or replace the handset.

(2) Restore the HEAT COIL LISTEN key.

(3) Operate the TEST OUT key.

(4) Perform the desired tests as described in paragraphs 17 through 22.

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

### c. Testing Inside Plant By-Passing Heat Coils.

(1) Remove the plug from the test telephone jack or restore the handset of the telephone.

(2) Operate the TEST IN key.

(3) Perform the desired tests as instructed in paragraphs 17 through 22.

(4) When testing is completed, restore all switches to normal and remove the test shoe.

### d. Testing Inside Plant Through Heat Coils.

(1) Remove the plug from the test telephone jack or restore the handset of the telephone.

(2) Perform the desired tests as instructed in paragraphs 17 through 22.

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

e. Outgoing Call Through Outside Plant.

- (1) Remove the plug from the test telephone jack or restore the handset of the telephone.
- (2) Restore the HEAT COIL LISTEN key.
- (3) Operate the TEST OUT key.
- (4) To ring the called party:
  - (a) On the MDO Test Box, set selector switch to number corresponding to the ringing digit of the party to be called. On the CDO Test Box, set selector switch to number which is one higher than that of the ringing digit.
  - (b) Operate the RING key. Operate the key momentarily or operate the key intermittently to produce the desired ringing code.
  - (c) After about three seconds, momentarily reoperate the RING key, or repeat the ringing code.
  - (d) After each two rings ((b) and (c) above), listen to the line (a above) to determine if the called party has answered.
- (5) To complete the transmission circuit:
  - (a) Insert the plug of the hand test telephone into the test telephone jack or remove the handset of the test telephone.
  - (b) On lines requiring transmission battery, operate the OUT TALK key.
  - (c) Proceed with the conversation.
- (6) When transmission is completed, disconnect by:
  - (a) Restoring all keys to normal.
  - (b) Removing the plug of the hand test telephone from the test telephone jack or by replacing the handset of the test telephone.
  - (c) Removing the test shoe.

Note. No provision is made to dial on outside plant equipment.

f. Originating Calls Through Dial Equipment.

- (1) Restore the HEAT COIL LISTEN key.
- (2) Operate the DIAL IN key.
- (3) Dial the desired number using the dial on the hand test telephone or the test telephone.
- (4) When dialing is completed, the dial equipment rings the called party.
- (5) When the called party answers, the dial equipment supplies transmission battery to the Test Box telephone and to the called telephone.

(6) When transmission is completed, disconnect by:

- (a) Restoring all keys to normal.
- (b) Removing the plug of the hand test telephone or replacing the handset of the test telephone.

- (c) Removing the test shoe.

(7) If the line circuit (usually a PBX line) does not furnish ground on the tip side of the line:

- (a) Connect ground to the R binding post.

- (b) Operate the DIAL IN key.

- (c) Operate the TEST IN key.

- (d) When dial tone is heard, restore the TEST IN key.

- (e) Operate the TEST OUT key.

- (f) Proceed as described in (4) through (6) above.

g. Originating Calls Through Incoming Ringdown Trunks.

(1) Remove the plug from the test telephone jack or restore the handset of the test telephone.

(2) Restore the HEAT COIL LISTEN key.

(3) Operate the TEST IN key.

(4) Momentarily operate the RING key.

(5) Insert the plug of the hand test telephone into the test telephone jack or remove the handset of the test telephone.

(6) When the switchboard operator answers, proceed with the conversation.

(7) When transmission is completed, disconnect by:

- (a) Restoring all keys to normal.

- (b) Removing the plug of the hand test telephone from the test telephone jack or by replacing the handset of the test telephone.

- (c) Removing the test shoe.

h. Originating Call Through Incoming Common Battery Trunks.

(1) Restore the HEAT COIL LISTEN key.

(2) Operate the TEST IN key.

(3) Operate the DIAL IN key.

(4) When the switchboard operator answers, proceed with the conversation.

(5) When transmission is completed, disconnect by:

- (a) Restoring all keys to normal.

(b) Removing the plug of the hand test telephone from the test telephone jack or by replacing the handset of the test telephone.

(c) Removing the test shoe.

## 11. TEST CONNECTIONS USING BINDING POSTS

The binding posts are used to connect the testing circuits to components to be tested.

### a. Testing.

- (1) Connect the equipment to be tested to the binding posts.
- (2) Perform the desired tests as instructed in paragraphs 17 through 22.
- (3) Disconnect the equipment from the binding posts when testing is completed.

### b. Ring ing.

- (1) Turn selector switch S1 to the required number (see par. 10e(4)(a)).
- (2) Connect the equipment to be tested to the binding posts.
- (3) Operate the RING key.
- (4) Restore the RING key to stop 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) Insert the plug of the hand test telephone into the test telephone jack, or remove the handset of the test telephone.

- (3) Operate the OUT TALK key.
- (4) Restore the OUT TALK key to disconnect the transmission battery supply.
- (5) When testing is completed, disconnect by:
  - (a) Removing the plug of the hand test telephone from the test telephone jack or replacing the handset of the test telephone.

(b) Disconnecting the equipment being tested from the binding posts.

### d. Dialing.

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

(2) Insert the plug of the hand test telephone into the test telephone jack, or remove the handset of the test telephone.

- (3) Operate the DIAL IN key.
- (4) Operate the TEST IN key.
- (5) Dial the desired number.
- (6) When dialing is completed disconnect by:

(a) Removing the plug of the hand test telephone from the test telephone jack or replacing the handset of the test telephone.

(b) Restoring all keys to normal.

(c) Disconnecting the equipment from the binding posts.

## 12. TEST SWITCH TRAIN (MDO TEST BOX)

To test a line, the Test Box operator can connect to the line through the test switch train. When lighted, the supervisory lamp on the front panel of the Test Box indicates that the test selector is in use. Testing procedures should not be attempted until lamp is extinguished.

### a. Connecting to Line.

(1) On Test Box, operate test key to TEST SELECTOR position. Supervisory lamp lights indicating test selector has been seized and is ready for dialing.

(2) On Test Box, dial the last four digits of the line. If the supervisory lamp flashes at 120 impulses per minute (IPM), the line is busy; if lamp remains lighted, the test connector is busy.

(3) If a line busy (120 IPM flashes) is encountered, the testman can monitor whether conversation is on line or whether a fault is indicated as follows:

(a) Operate test keys to DIAL IN and TEST IN.

(b) Remove testman's telephone (off-hook) and monitor line.

(4) If line is idle, supervisory lamp extinguishes. Testman can now connect meter to line or ring on it.

(5) Upon conclusion of check in step (4), the digit 1 can be dialed to step the test connector to the succeeding line (using Test Box dial). This line can be checked as described in (2) through (4) above.

(6) The testman can perform tests on a line within a different level (tens group) by releasing the test connector without releasing the test selector. To do so, operate CONN RLS test key, and dial last two digits of the line number. Supervisory lamp indications and test functions are as described in (2), (3), and (4) above.

(7) To perform tests on lines within a different connector, both the test selector and test connector must be released by restoring TEST SELECTOR test key to normal.

### b. Release Permanent.

If the supervisory lamp on the Test Box panel is lighted after a line has been restored to normal, momentarily operate RLS PERM test key. Do not hold key operated for any appreciable length of time. This should drop off the battery feed relay across T and R so that meter tests can be made.

c. Inward Test Via Test Selector.

(1) An inward test connection is made by operating the test key to TEST SELECTOR and dialing desired number on Test Box dial.

(2) After supervisory lamp extinguishes to denote that test selector has stepped to the desired line, operate IN TEST test key and then CO CONT test key. Remove the handset of the test telephone or insert plug of test handset into jack on front panel of test box. Operate DIAL IN and TEST IN test keys. Restore IN TEST key to normal, and then dial desired line number on test telephone or test handset, as applicable.

(3) To release from inward test, replace testman's telephone on-hook or remove test handset plug from test jack on Test Box panel. Restore TEST IN key to normal and then the CO CONT test key. This sequence of operation must be observed to prevent locking-up the switch train connection.

d. Inward Test for Special Line Circuits.

(1) For tests on lines not furnishing ground on tip as is common with many PBX offices, connect a ground to the R binding post of the Test Box. Lift test telephone (with dial) off-hook and operate test keys of Test Box to DIAL IN and TEST IN. The CO CONT test key should then be operated resulting in seizure of a selector and return of dial tone to the test telephone.

(2) Upon receipt of dial tone, remove ground connection from R binding post. Dial desired number.

(3) To release from test connection, restore test telephone to on-hook condition and then CO CONT test key to normal position.

13. TEST SWITCH TRAIN (CDO TEST BOX)

Connection can be made through the test switch train to test a line when the lamp on the front panel of the Test Box is lighted, the test selector is busy, and no attempt should be made to connect to a line until the lamp is extinguished.

a. Connecting to a Line.

(1) When the lamp on the front panel of the Test Box is not lighted (indicating an idle test selector), operate test key to TEST SELECTOR position.

(2) Using TEST BOX, dial the last four digits of the line number. If line is busy, lamp will be lighted and busy tone will be heard in the receiver of test telephone or hand test set. The busy line can be monitored by using test shoe connection as described in paragraph 10a.

(3) If line is not busy, dial the digit 3 on Test Box dial. Meter, ring, or howler can be connected to line. Test telephone must be on-hook and test handset not plugged in.

b. Inward Test Via Test Selector.

(1) To test inward it is necessary to make the test selector drop the cut-off line circuit relay. To accomplish this, the digit 2 is dialed on the Test Box dial.

(2) Remove test telephone from on-hook or plug in test handset.

(3) On Test Box, operate test keys to DIAL IN position and TEST IN position.

Note. On inward tests, the dial on the test telephone is used to control the central-office dial equipment. The dial on the Test Box controls the test train only and should not be used in an attempt to control the central-office dial equipment.

(4) If test is being made on a PBX line circuit associated with a combination trunk, ground connection must be made to the R binding post on the Test Box.

(5) Lift test telephone off-hook. Operate test keys to DIAL IN and TEST IN. When dial tone is heard, remove ground from R binding post and use test telephone to dial desired line number.

c. Remote Office Test Connection.

When equipped, the local office can have tests made from a remote office. The local test train is controlled over a regular inter-office trunk, and a separate metallic pair back to the remote office is used for meter tests, ringing, or howl application.

It is possible to test two or more offices. Operation of the proper TEST PAIR test key will connect the Test Box to the selected office.

d. External Test Equipment.

There are two ways by which external test equipment (wheatstone bridge, dial speed and percent make test devices, etc.) can be connected to the T and R binding posts on the Test Box front panel. External test equipment should be connected after either step (1) or (2) has been performed.

(1) Operate TEST OUT test key, check that selector switch is at position 1 (OFF), and that test telephone is on-hook. The T-OUT and R-OUT pair from the test shoe appear on the T and R binding posts.

(2) If the test selector is used, all test keys should be normal except previously operated TEST SELECTOR. After sequence of tests described in paragraph 13a(1) through (3), dial the digit 3 (Test Box dial). External equipment can now be connected to the T and R binding posts.

#### 14. GENERATOR GROUND CUT-OFF

The test key which controls generator ground cut-off is the same key that controls application of the circuits to obtain LOW OHMS. The circuits for each function, however, are different and separate. Generator ground cut-off is used on lines having sub-sets 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.

To signal a subscriber who has left his telephone off-hook, the usual howler method would be ineffective. To signal such a subscriber, the LOW OHMS/GEN GRD CUT OFF test key is operated and ringing is applied to the line by operation of the RING test key. Operation of the GEN GRD CUT OFF test 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.

#### 15. HEAT COIL TEST

a. Check that selector switch is in OFF position (0 for MDO or 1 for CDO). Use test phone inserted into test jack on Test Box or test telephone in off-hook condition. Operate HEAT COIL LISTEN test key and monitor the line.

b. If line is free, operate TEST OUT test key and OUT TALK test key. If heat coils are not open, dial tone will be received.

#### 16. TEST REVERSE

When it is desired to reverse the conductors under test into the test position, operate the TEST REVERSE test key.

#### 17. HOWLER

Except as noted in paragraph 14, the howler is used in an attempt to alert a subscriber whose telephone is off-hook. Either an internal howler or external howler is supplied. In general, the internal howler is adequate for smaller offices, while the external howler is used when many lines must be covered. Either howler is automatic to the extent that the rising and falling tone will continue until the telephone is replaced on-hook, and then howler operation will cease automatically. If the telephone is not replaced on-hook, the testman should stop howler operation by restoring the HOWLER test key and recheck at a later time.

#### 18. TESTING FOR FOREIGN BATTERY ON TIP SIDE OF LINE

Connect to the line or trunk via the test shoe or switch train as described in paragraph 10, or 12 or 13, as applicable. After connection is made, rotate selector switch to position 2 on MDO Test Box or position 3 on CDO Test Box (TIP BAT. ).

- a. If there is a foreign negative battery on the tip side of the line, the meter needle will indicate the voltage of the foreign battery on the lower scale of the meter.
- b. If the meter needle does not move, the tip is either open or free of foreign potentials.
- c. If the meter needle moves off scale (left), disconnect from the line being tested.
- d. Upon completion of this test, either proceed with other tests or restore all keys to normal.

#### 19. TESTING FOR FOREIGN BATTERY ON RING SIDE OF LINE

If tests are being performed sequentially, rotate selector switch to position 3 on MDO Test Box or position 4 on CDO Test Box (RING BAT. ). If this is a separate test, connect to line (par. 10, or 12 or 13) and then rotate selector switch.

- a. If there is a foreign negative battery on the ring side of the line, the meter needle will indicate the voltage of the foreign battery on the lower scale of the meter.
- b. If the meter needle does not move, the ring is either open or free of foreign potentials.
- c. If the meter needle moves off scale (left), disconnect from the line being tested.
- d. Upon completion of this test, either proceed with other tests or restore all keys to normal.

#### 20. TESTING FOR GROUND ON TIP SIDE OF LINE

If tests are being performed sequentially, proceed to step a below. If this is a separate test, connect to line (par. 10, or 12 or 13) first.

- a. Rotate selector switch to position 1 on MDO Test Box or 2 on CDO Test Box (ZERO ADJ).
- b. Adjust ZERO ADJ control for 0 indication on upper scale of meter.
- c. Rotate selector switch to position 4 on MDO Test Box or position 5 on CDO Test Box (TIP GRD).
- d. If there is a ground on the tip side of line, the resistance to ground will be indicated on the upper side of the meter.
- e. If the meter needle does not move, it indicates that the tip is either open or not grounded.

f. If the meter indicates 5000 ohms or less, operate the LOW OHMS key. Divide the meter indication by 100 to obtain the actual resistance. Restore LOW OHMS key to normal position.

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

## 21. TESTING FOR GROUND ON RING SIDE OF LINE

If tests are being performed sequentially, proceed to step a below. If this is a separate test, connect to line (par. 10, or 12 or 13) first.

a. Zero set meter as described in paragraph 20a and b.

b. Rotate selector switch to position 5 on MDO Test Box or position 6 on CDO Test Box (RING GRD).

c. If there is a ground on the ring side of the line, the meter will indicate the resistance of the ground on the upper scale of the meter.

d. If the meter needle does not move, it indicates that the tip is either open or not grounded.

e. If the meter indicates 5000 ohms or less, operate the LOW OHMS key. Divide the meter indication by 100 to obtain the actual resistance. Restore LOW OHMS key to normal position.

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

## 22. TESTING FOR LOOP RESISTANCE AND LEAKAGE

This test is used to determine whether the loop of the line being tested is completed or open, and to determine the leakage or the loop resistance of the line. If test is being performed sequentially, proceed to step a below. If this is a separate test, connect to line first (par. 10, or 12 or 13).

a. When checking leakage resistance, line must be open at distant end.

b. When checking loop resistance, the telephone at the distant end must be off-hook, or, if not equipped with telephone, distant T and R ends must be connected together.

c. Zero set meter as described in paragraph 20a and b.

d. Rotate selector switch to position 6 on MDO Test Box or position 7 on CDO Test Box (LOOP).

e. Observe the meter.

(1) Meter needle does not deflect.

If the meter needle does not deflect, it indicates that the loop of the line being tested is open (or of infinite resistance). In this case the line may be faulty. Either proceed with other tests or restore all keys to normal.

(2) Meter needle indicates more than 5000 ohms.

If the meter needle indicates more than 5000 ohms, record the reading observed. Compare this reading with the resistance reading on the line record card of the line being tested. The indications of the condition of the line are described in (a) through (c) below.

(a) If the loop resistance is much higher than it should be, it is an indication that equipment other than that assigned to the line being tested is connected to the loop, or that the line is faulty.

(b) If the loop resistance is much lower than it should be, it is an indication that the line being tested is either leaky or shorted, and therefore, is faulty.

(c) If the loop resistance is approximately the same as it should be, it is an indication that the loop of the line being tested is not faulty.

(3) Meter needle indicates 5000 ohms or less.

If the meter needle indicates 5000 ohms or less, operate the LOW OHMS key. Divide the meter indication by 100 to obtain the actual resistance. Compare this reading with the resistance reading on the line record card of the line being tested. The indications of the condition of the line are the same as that described in (2)(a) through (c) above. Restore the LOW OHMS test key to normal position.

### 23. TESTING FOR LINE CAPACITANCE

This test is used to determine the capacitance between the tip and ring conductors of a line and ground. If test is being performed sequentially, proceed to a below. If test is being performed separately, connect to line as described in paragraph 10, or 12 or 13, as applicable.

Note. These readings are intended as a guide and are not to be considered as accurate capacitance readings.

a. Tip to Ground Capacitance.

(1) Rotate selector switch to position 7 on MDO Test Box or position 8 on CDO Test Box (TR CAP).

(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) Compare the recorded reading with the chart in d below (deflection column) to obtain the capacitance reading (capacity column).

(6) 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 selector switch is turned to step 8 on the MDO Test Box or step 9 on the CDO Test Box (RING CAP).

c. Loop Capacitance.

(1) Rotate selector switch to position 9 on MDO Test Box or position 10 on CDO Test Box (LOOP CAP).

(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 (a above) from the capacitance reading. The result is the loop capacity.

(6) Compare the recorded reading with the chart in d below (deflection column) 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.

The chart below lists the readings obtained on the lower scale of the meter and the approximate capacitance in microfarads to which they are equal.

Deflection	Capacity in $\mu f$	Deflection	Capacity in $\mu f$	Deflection	Capacity in $\mu f$
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

T-1047 ISSUE 3 WIRE CHIEF'S TEST BOX, TYPE B

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