

AUTOMATIC ELECTRIC COMPANY

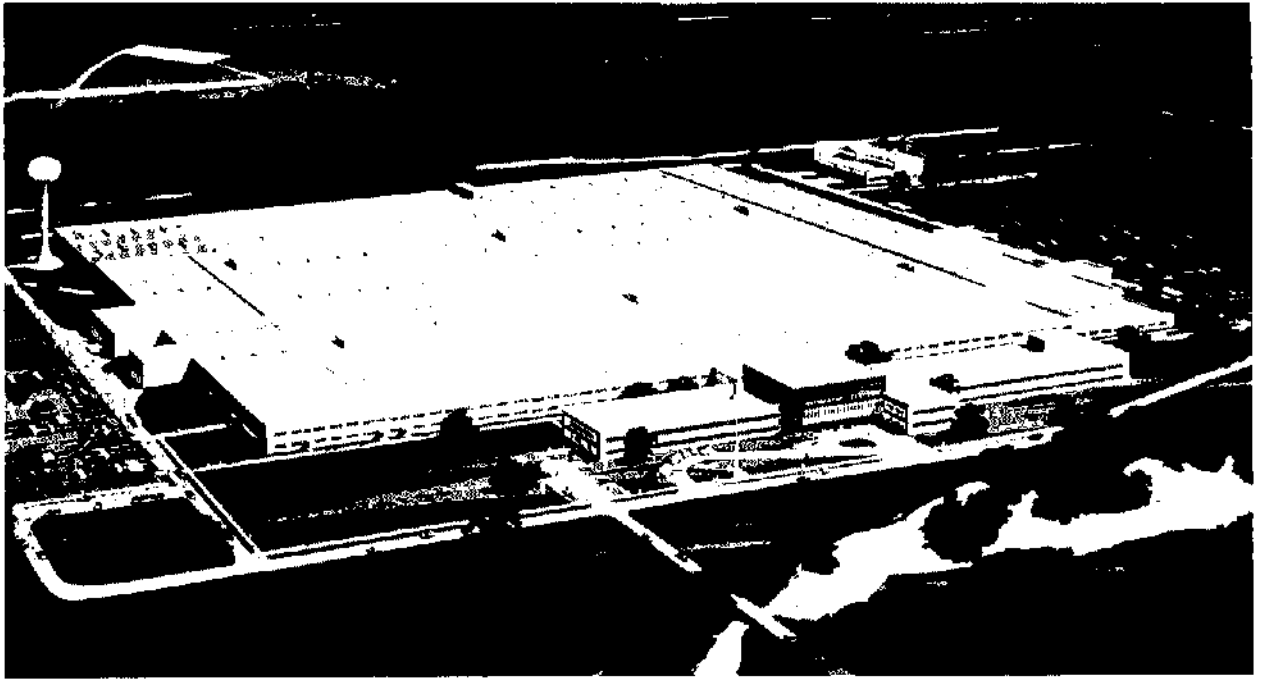
HAND TEST TELEPHONES

Type 800

Type L-965

Technical
Bulletin **100-930**

AUTOMATIC ELECTRIC
SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS **GTE**



Automatic Electric Company General Offices, Laboratories and principal manufacturing facilities are located in this new 37 acre plant in Northlake, Illinois, a suburb of Chicago. Branch factories are located in Genoa, Illinois and Waukesha, Wisconsin.

These modern facilities are devoted exclusively to the manufacture of a complete line of automatic telephone equipment, electrical control components and systems.

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DESCRIPTION

A. E. CO. TYPE 800 HAND TEST TELEPHONE

1. GENERAL

1.01 This section describes the Type 800 Hand Test Telephone. Often referred to as a "butt-in", the instrument is a self-contained portable dial-handset intended for use by installers, repairmen, linemen, switchmen and other authorized employees for test or temporary communication use. Such usage is covered in Section 100-202-500.

1.02 Avoid the use of chlorinated hydrocarbon solvents (trichlorethylene or 1, 1, 1-trichloroethane, for example), benzine, gasoline or methanol (denatured or wood alcohol) when cleaning the housing of the hand test telephone. Ethanol (grain alcohol), or naphtha are safe for use on the plastic material of the housing.

2. DESCRIPTION

2.01 The housing of the Type 800 Hand Test Telephone (see Fig. 1) is a lightweight, impact-resistant structure molded of bright red non-conductive polycarbonate resin and fastened together with four thread-cutting screws. The principal half of the shell contains the transmitter contacts at one end, an inductor and three-position slide switch in the handle, and a Type 51A dial at the opposite end, as well as a resistor and capacitor. A mating half houses a standard Type 810 receiver (varistor protected) at the dial end and serves to retain a Type 810 transmitter at the other. A chrome-plated brass finger wheel provides resistance to corrosion, wear and impact.

2.02 A choice of cords, provided separately from the set, permits adapting the hand test telephone to various applications (see Fig. 2):

- (a) Cord assembly D-542349-A, 4 feet in length, is terminated in a switch-board-type plug for use in tests of central office and PBX equipment accessed by line or patching jacks and the like.
- (b) Cord assembly D-543142-A provides the same service as indicated in (a), above, but has a retractile cord which extends to 54 inches from a normal length of 13 inches.
- (c) Cord assembly D-542725-A, 3 feet in length, is terminated in a 4-contact plug for use in tests of central office equipment accessed by switch test jacks. A push button on the plug permits momentary closure of a loop terminated on two contacts of the jack for circuit seizure.
- (d) Cord assembly D-542725-C is similar to the D-542725-A, but has a cord six feet in length. It is standard for use on the Leich series of finder-connector PABX's.
- (e) Cord assembly D-541777-B, 5 feet in length, provides the same service as indicated in (c), above, except that

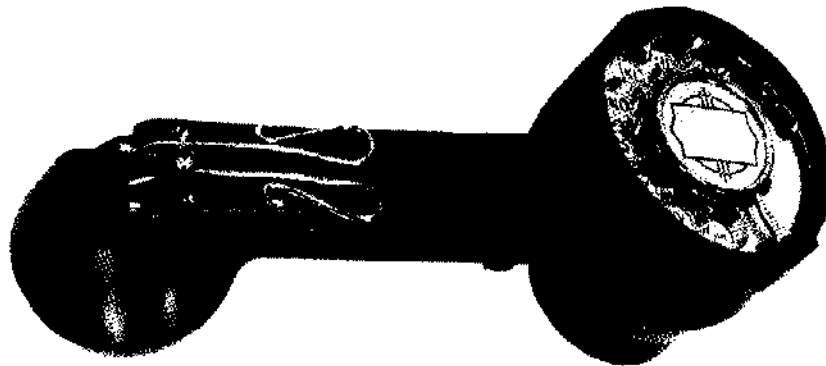
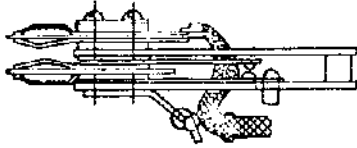


Figure 1. Type 800 Hand Test Telephone

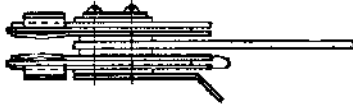
D-542349-A
D-543142-A



D-542725-A



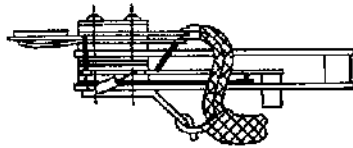
D-541777-B



D-543044-A
D-543044-B



D-543392-A



D-543395-A

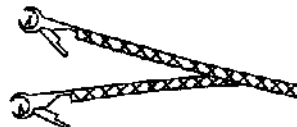


Figure 2. Cord Assemblies for Hand Test Telephone

two contacts of the plug are permanently wired in common and no push button is furnished.

- (f) Cord assemblies D-543044-A and -B, 3 feet and 6 feet long, respectively, are terminated in a 2-contact plug for use in tests of PABX and switching equipment accessed by switch test jacks. The plug may be inserted in either contact pair of a 4-contact jack.

- (g) Cord assembly D-543392-A, 3 feet in length, is similar in application to those described in (f), above, but is intended for use in offices involved in MTWX or data transmission. A push button on the plug permits temporary insertion of a 100K Ω resistor in series with the hand test telephone during placement of the plug into the jack. This reduces the charging current of the capacitor in the set to a value which does not cause garbling of data transmission or produce clicks on a voice circuit.

- (h) Cord assembly D-543395-A, 4 feet in length, is split over a portion of its length into separate conductors bound together by two slidible fiber sleeves and terminated in spring clips with insulation-piercing needles. It is intended for use by installers, repairmen, linemen and others who must connect to line, drop or station wires, cross-connect, protector or block terminals, etc.

2.03 Each of the cord assemblies is terminated at the set end in two phone tips which are inserted behind the transmitter and secured by terminal screws.

2.04 A formed-wire belt clip is attached behind the transmitter of the hand test telephone to simplify its being carried by field personnel. When the set is in use the clip may be retracted against the handset handle, where it snaps over the head of a thread-cutting screw mounted near the transmitter end. For central office use the clip may be detached from the set, which can then be suspended from the hole in a housing web from which the clip was removed. Mounting plate D-780869-A (see Fig. 3) is available separately for attachment to distributing frames or switching equipment support structures and provides a hook for such indoor storage.

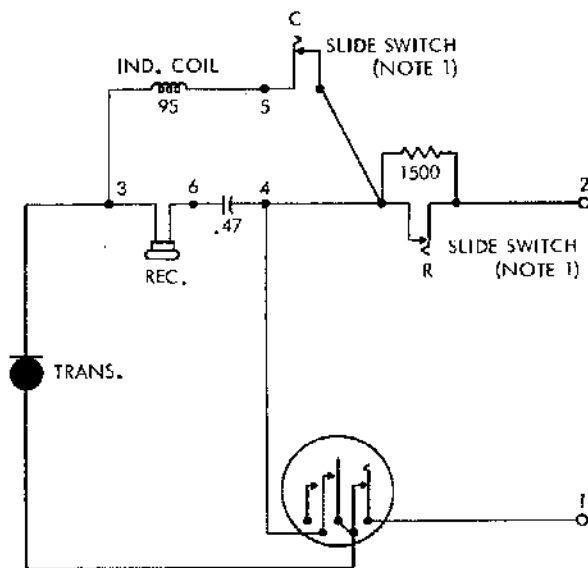


Figure 3. D-780869-A Mounting Plate

2.05 The slide switch provided in the handset handle has three positions:

- (a) With the switch in its unmarked center or neutral position, a talk path exists from terminal 1 (see Fig. 4) over the dial pulse springs, transmitter, 95 \sim inductor and the C and R contacts of the switch to terminal 2. The receiver is connected in series with a .47 ufd capacitor across the potential drop created by the inductor. When the dial is used, two of its off-normal springs shunt both the receiver and the transmitter, leaving only the pulse springs connected across the line terminals.
- (b) With the switch moved toward the receiver to its C position, the C contacts open the d-c path through the transmitter and inductor, leaving the receiver capacitively connected in a monitor circuit.
- (c) With the switch moved toward the transmitter to its R position, a loop

test 1500 \sim resistor is inserted in series with the normal circuit as its shunting contacts (R) open. This permits simulating a long loop for tests of switching equipment.



NOTE 1. SLIDE SWITCH SHOWN IN CENTER OR TALK POSITION.

Figure 4. Schematic Diagram

DESCRIPTION

A. E. CO. L-965 HAND TEST TELEPHONE

1. GENERAL

1.01 This section describes the L-965 Hand Test Telephone. Often referred to as a "butt-in", the instrument is a self-contained, portable dial-handset intended for use by installers, repairmen, linemen, switchmen and other authorized employees for test or temporary communication use. Its manufacture has been discontinued and superseded by the Type 800 set described in Section 100-201-100. Usage of both is covered in Section 100-202-500.

2. DESCRIPTION

2.01 The housing of the L-965 Hand Test Telephone (see Fig. 1) consists of four separate aluminum parts fastened together by four flat head screws. One half of the shell contains a Type 4C transmitter at one end, two push-button switches in the handle, and a single-pole receiver at the opposite end. A mating half houses a resistor at the transmitter end, an inductor and capacitor in the handle, and encloses the springs of a Type 51A dial behind the receiver. The third and fourth parts of the aluminum housing consist of a dial guard which surrounds the finger wheel, and a clamping ring which is threaded onto the receiver cavity and serves to retain the diaphragm and receiver cap.

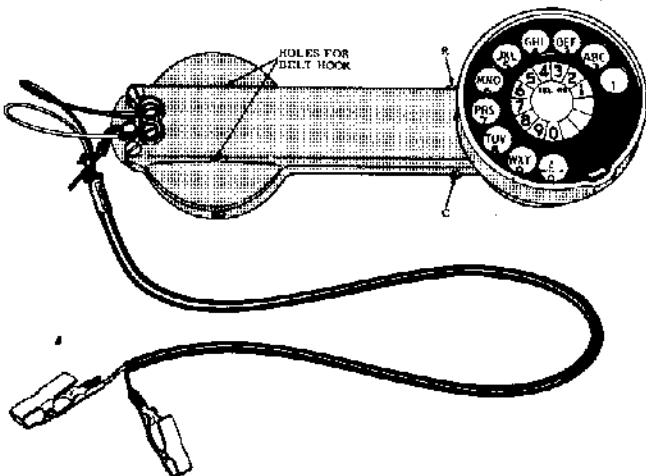


Figure 1. L-965 Hand Test Telephone

2.02 Various models of the hand test telephone are offered in order to provide a choice of test cords (see Fig. 2):

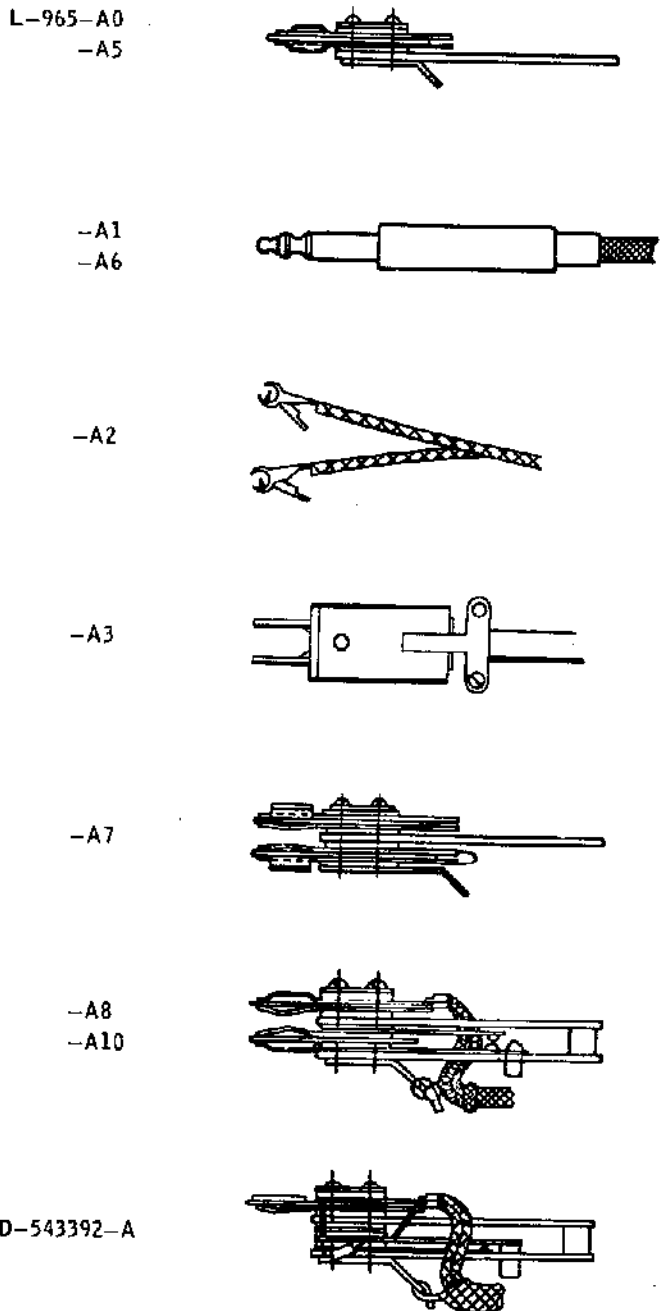


Figure 2. Variations in Cord Assembly for Various Models of Hand Test Telephone

- (a) L-965-B4 consists of the set alone, less dial and with no cord. Intended primarily for factory stocking purposes, it may also be included in field supplies for replacement use.
- (b) L-965-A9 consists of the set alone, with dial but without cord.
- (c) L-965-A0 is equipped with cord assembly D-543044-A, three feet in length and terminated in a 2-contact plug for use in tests of PABX and switching equipment accessed by switch test jacks. The plug may be inserted in either contact pair of a 4-contact jack.
- (d) L-965-A1 is equipped with cord assembly D-543142-A, terminated in a switch-board-type plug for use in tests of central office and PBX equipment accessed by line or patching jacks and the like. The cord is retractile, extending to 54 inches from a normal length of 13 inches.
- (e) L-965-A2 is equipped with cord assembly D-543395-A (or an earlier equivalent), which is split over a portion of its 4-foot (3-foot, in earlier versions) length into separate conductors bound together by two slidable fiber sleeves and terminated in spring clips with insulation-piercing needles (no sleeves or needles on former type). It is intended for use by installers, repairmen, linemen and others who must connect to line, drop or station wires, cross-connect, protector or block terminals, etc.
- (f) L-965-A3 is equipped with cord assembly D-543217-A, four feet in length and terminated in a two-prong plug for use in four-wire toll-switching offices.
- (g) L-965-A5 is similar to the -A0 set, but has a cord six feet in length, coded D-543044-B.
- (h) L-965-A6 is similar to the -A1 set, but has a straight cord four feet in length, coded D-542349-A.
- (i) L-965-A7 is equipped with cord assembly D-541777-B, five feet in length and terminated in a 4-contact plug for use in tests of central office equipment accessed by switch test jacks. Two contacts of the plug are permanently wired in common for circuit seizure upon insertion.

- (j) L-965-A8 is similar to the -A7 set, but has a cord three feet in length, coded D-542725-A. This provides the same service as indicated in (i), above, except that a push button on the plug provides only a momentary path between the two contacts used for circuit seizure.
- (k) L-965-A10 is similar to the -A8 set, but has a cord six feet in length, coded D-542725-C. It is standard on the Leich series of finder-connector PABX's.

2.03 An additional test cord assembly is offered separately and coded D-543392-A. Three feet in length, it is similar to that provided on the L-965-A0, but is intended for use in offices involved in MTWX or data transmission. A push button on the plug permits temporary insertion of a 100K Ω resistor in series with the hand test telephone during placement of the plug into the jack. This reduces the charging current of the capacitor in the set to a value which does not cause garbling of data transmission or produce clicks on a voice circuit.

2.04 Each of the cord assemblies is terminated at the set end in two phone tips which are inserted in a block at the transmitter end and secured from the rear by terminal screws.

2.05 A formed-wire belt clip (Fig. 3), offered separately and coded D-62117-A, may be attached behind the transmitter of the hand test telephone to simplify its being carried by field personnel.

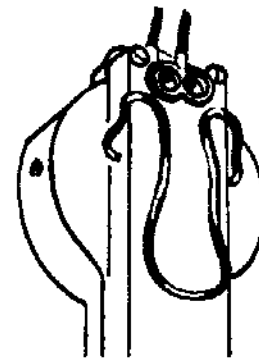


Figure 3. Belt Clip

2.06 The push buttons provided in the handset handle provide four possible circuit conditions:

(a) With both buttons in the released, or neutral position, a talk path exists from one cord terminal (see Fig. 4) over the dial pulse springs, transmitter, 95 Ω inductor and the C and R push button con-

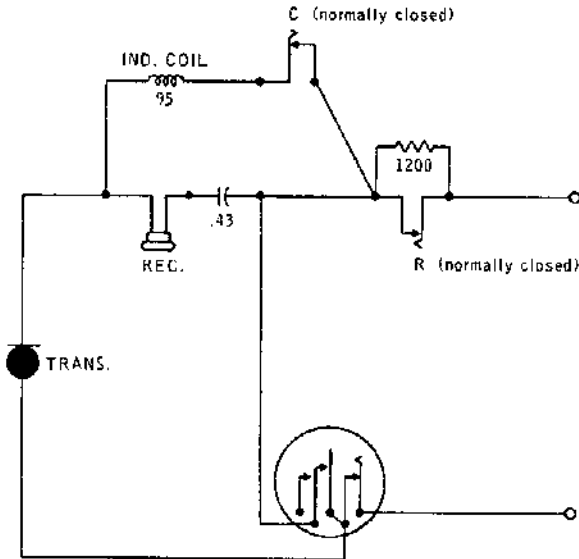


Figure 4. Schematic Diagram

tacts to the other cord terminal. The receiver is connected in series with a .43 μ fd capacitor across the potential drop created by the inductor. When the dial is used, two of its off-normal springs shunt both the receiver and the transmitter, leaving only its pulse springs connected across the line terminals.

- (b) With the C button depressed, the C contacts open the d-c path through the transmitter and inductor, leaving the receiver capacitively connected in a monitor circuit.
- (c) With the R button depressed, a loop test 1200 Ω resistor is inserted in series with the normal circuit as its shunting R contacts open. This permits simulating a long loop for tests of switching equipment.
- (d) With both the C and the R buttons depressed, the hand test telephone is not only in the on-hook condition mentioned in (b), but has the 1200 Ω resistance inserted, as well. This prepares the set for seizure tests of switching equipment into which it may be plugged, since release of the C button reestablishes the d-c path with the series resistance included.

TESTS
USE OF HAND TEST TELEPHONES

1. GENERAL

1.01 This section covers the use and care of hand test telephones. An instrument of this type, often referred to as a "butt-in", is a self-contained portable dial-handset intended for use by installers, repairmen, linemen, switchmen and other authorized employees for test or temporary communication use. The A. E. Co. Type L-965 Hand Test Telephone is described in Section 100-200-100, and the A. E. Co. Type 800 Hand Test Telephone in Section 100-201-100.

1.02 The L-965 and the 800 sets are fundamentally similar in design. The L-965 has two momentary-action pushbuttons near the dial end of its handgrip. Marked C and R, these buttons correspond to the C and R positions of a 3-position, locking-type slide switch similarly located in the handgrip of the 800 set. The two types differ in the style of receiver and transmitter units used, and in value of the receiver-coupling capacitor. These differences do not affect the manner of operation of the hand test telephones. However, the value of resistance inserted by pressing the R button of the L-965 is 1200 Ω , while operation of the switch in the 800 to its R position inserts 1500 Ω .

2. USE WITH SWITCHING EQUIPMENT

2.01 For use in central office, PBX and PABX work, the hand test telephone is usually equipped with one of several types of cord assembly terminated in various styles of plugs. These assemblies are interchangeable between the two sets and are covered in the Sections describing each type.

2.02 Before connecting the hand test telephone to a circuit which is not known to be idle, the slide switch should be pushed toward the receiver end to its C position (800), or the C button should be depressed (L-965). In the latter case, it will be necessary to hold the button down, whereas the 800 permits "hands-free" use if the handset is propped between shoulder and ear. The C position connects the receiver in a capacitive circuit for monitoring.

2.03 In a central office known to be involved in data transmission, care should be taken to use only the D-543392-A cord assembly designed for this service. This assembly includes a D-57158-A two-contact plug equipped with a break pushbutton. Before inserting the plug in a switch jack, depress the pushbutton on the plug to place 100 K Ω in series with the hand test telephone. Since the latter is in the Monitor mode by virtue of its operated C button or switch, this will limit the charging current of the capacitor in the set so that the teletypewriter or data transmission will not be garbled.

2.04 In Strowger switching equipment, the two plug contacts which provide the path to the hand test telephone should in most cases be inserted in the pair of jack springs nearest the mounting end of the test jack on the switch to be tested. If a four-contact plug is used, the path between the third and fourth contacts provided by a wire strap or a make pushbutton may be necessary for circuit seizure and holding. For more complex circuits, consult the manufacturer's drawing to determine the correct jack springs to use, keeping in mind that the spring numbers are counted from the mounting end of the jack.

2.05 In Leich switching equipment, a four-contact plug is most often inserted with its pushbutton or wire-strap contacts toward the left, or C-side, of the jack. On trunk circuits, both pairs of jack contacts may be used to provide circuit access in either direction. The talking-path contacts of the plug are then inserted toward the left (coil side of the relay bar) or right (spring side of the bar) in accordance with the C or S designation of the jack contact pair shown on the manufacturer's circuit drawing.

2.06 Once the plug of the D-543392-A cord assembly has been inserted into the test jack, its pushbutton may be released, closing the contacts to shunt its 100 K Ω series resistance.

2.07 If, after monitoring, the circuit is found to be idle, the slide switch (800) may be restored to its neutral or center position, or

the C button (L-965) released. This establishes a dc path in the hand test telephone, energizing the transmitter in series with an inductor. The circuit is thus seized for tests. (In some cases, it may be necessary to operate a make push-button on the plug of the cord assembly, or to operate a relay manually in order to seize the switching circuit.)

2.08 When the fingerwheel of the dial is drawn back, its off-normal springs shunt the transmitter and receiver, leaving only the dial pulse springs in the circuit. To simulate a long loop, the slide switch (800) may be pushed toward the transmitter end of the handset to its R position, or the R button (L-965) depressed and held. This inserts resistance in series with the dial pulse springs.

NOTE: Be certain that the hand test telephone being used inserts the correct resistance for the circuit being tested. See Paragraph 1.02 and the manufacturer's circuit specification.

3. USE WITH STATION APPARATUS

3.01 For use on customer premises, the hand test telephone is usually equipped with a D-543395-A cord assembly terminated in spring clips with insulation-piercing needles. The jaws of the clips are also adapted to terminal screw attachment.

3.02 Before connecting the hand test telephone to a line which is not known to be idle, the slide switch should be pushed toward the receiver end to its C position (800), or the C button should be depressed (L-965). In the latter case, it will be necessary to hold the button down, whereas the 800 permits "hands-free" use if the handset is propped between shoulder and ear. The C position connects the receiver in a capacitive circuit for monitoring.

3.03 Connection to the line under test may be made by snapping the clips of the cord assembly over the terminal screws of the desired line at the line cord block, protector or cross-connect block.

3.04 If, after monitoring, the line is found to be idle, the slide switch (800) may be restored to its neutral or center position, or the C button (L-965) released. This establishes a dc path in the hand test telephone, energizing

the transmitter in series with an inductor. The line is thus seized for test or other use.

3.05 When the fingerwheel of the dial is drawn back, its off-normal springs shunt the transmitter and receiver, leaving only the dial pulse springs in the circuit.

3.06 At customer stations, the hand test telephone may be used not only for line testing and communication purposes, but also to make checks of station apparatus to locate faults which are beyond the scope of the duties of personnel at the testboard.

3.07 To check the ringer capacitor or transmission capacitor for possible defect, disconnect the questionable instrument from one side of the line, and proceed as follows while listening for clicks in the receiver of the hand test telephone.

- (1) Place the set in the neutral position (no C or R switch or button operated) and connect it for a moment across the capacitor to be tested. A good or leaky capacitor may cause a click, but an open or shorted capacitor will not.
- (2) Disconnect the hand test telephone from the capacitor. Remove or restore the handset as necessary to place the switch in the proper position to complete a path to the capacitor under test. Reconnect the instrument to the line in series with the hand test telephone. A good, leaky or shorted capacitor will cause a strong click, but an open capacitor will not.
- (3) Disconnect from the line for a few moments and then reconnect. A good or open capacitor will cause no click, a leaky capacitor may cause a weak click, and a shorted capacitor will cause a strong click.
- (4) Disconnect the hand test telephone from A good capacitor will cause a strong click,

both the line and the set, and connect it across the doubtful capacitor again.

a leaky capacitor will cause a weak click, but an open or shorted capacitor will cause no click.

their original polarity.

NOTE: If the ringer coil is completely shorted, the clicks will be quite loud, and no armature movement will take place. If the armature fails to move but the clicks are muted, the ringer magnet may be weak, or the armature spaced too far from the magnet. If the ringer coil is partially shorted, diagnosis is beyond the scope of this test procedure. In case of doubt, replace the ringer or use an ohmmeter to detect the fault.

- (5) Disconnect the hand test telephone from the capacitor and reconnect the instrument directly to the line.

3.08 To check a ringer for suspected fault, lift the handset of the associated instrument to disconnect the ringer from the line if possible, and proceed as follows while listening for clicks in the receiver of the hand test telephone.

- (1) Place the set in the neutral position (no C or R switch or button operated) and connect it across the ringer capacitor.

As noted in 3.07, (1) above, a click may be heard.

- (2) Restore the handset of the instrument under test, so that its switch completes a path to the ringer.

A good ringer will cause a muted click (the line will remain seized, with dial tone audible in an automatic exchange) and will move its armature to one side and hold it there. A ringer with an open coil will cause no click and no armature movement.

- (3) Disconnect the instrument at the line cord, reverse the line leads and reconnect.

A good ringer will cause a muted click (again, with line seizure) and will move its armature to the opposite side and hold it there. A ringer with an open coil will cause no click and no armature movement.

- (4) Disconnect the hand test telephone from the ringer capacitor, and restore the line leads to

3.09 To determine line polarity at divided-ringing party-line stations, subscriber stations in toll ticketing offices, and paystations, place the hand test telephone in the neutral position (no C or R switch or button operated), connect one of its leads to a known ground, and touch the clip of the other lead first to one line conductor and then to the other. Touching the negative (-) (ring) conductor produces a louder click in the receiver (and may cause line seizure with accompanying dial tone) than touching the positive (+) (tip) conductor.

4. USE WITH OUTSIDE PLANT

4.01 For outside plant use, the hand test telephone is usually equipped with a D-543395-A cord assembly terminated in spring clips with insulation-piercing needles. The jaws of the clips are also adapted to terminal screw attachment.

4.02 Before connecting the hand test telephone to a line or circuit which is not known to be idle, the slide switch should be pushed toward the receiver end to its C position (800), or the C button should be depressed (L-965). In the latter case, it will be necessary to hold the button down, whereas the 800 permits "hands-free" use if the handset is propped between shoulder and ear. The C position connects the receiver in a capacitive circuit for monitoring.

4.03 Connection to the line under test is usually made by piercing the insulation of line, drop or station wire with the needles of the spring clips on the cord assembly. At cross-connect blocks or protectors, the clips may be snapped over the terminal screws of the desired line or circuit.

NOTE: Do not pierce insulation for test purposes in highly corrosive atmospheres.

4.04 If, after monitoring, the circuit is found to be idle, the slide switch (800) may be restored to its neutral or center position, or the C button (L-965) released. This establishes a dc path in the hand test telephone, energizing the transmitter in series with an inductor. The circuit is thus seized for tests.

4.05 When the fingerwheel of the dial is drawn back, its off-normal springs shunt the transmitter and receiver, leaving only the dial pulse springs in the circuit.

4.06 The hand test telephone can be used on common battery circuits to make electrical tests on drop or block wire lines to locate faults. Since it is necessary to open the line at various points to make such tests, select points where disconnections can readily be made (i.e., binding posts, bridging connectors). No wires should be cut until tests have isolated the fault between two adjacent test points. If further tests are required for fault location, following the preliminary inspection, one conductor of the wire may be cut to make the test.

4.07 The specific types of faults to be investigated in a line are: grounds, opens, short circuits, and crosses.

4.08 The two types of grounds encountered in drop and block wire plant are low resistance and high resistance. To check for low resistance grounds, first determine which side of the line is grounded. This is done by visual examination or by test. The faulty section of wire is located by the following procedure:

- (1) Disconnect all drop or block wires bridged to the grounded line from the cable terminal binding posts.
- (2) If the grounded side has been identified, disconnect only the wires on that side of the line.
- (3) Connect one clip of the test set to a suitable ground, such as the terminal case or suspension strand, and touch the other clip to the binding post on which battery would normally be found (see Figure 1).

- (4) If no battery click is heard, touch the other binding post. If a click still is not heard, there is another problem in the line which must be identified and corrected before proceeding with the low resistance ground test.

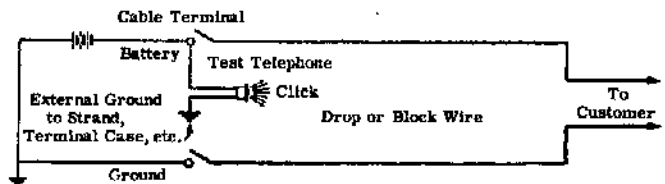


Figure 1. Test To Determine Battery Side of Line

- (5) When a battery click is heard, connect the clip to the binding post carrying battery and remove the other clip from the external ground. Touch this clip to the drop wire conductors. A click will be heard when the grounded wire is touched (see Figures 2a and 2b).

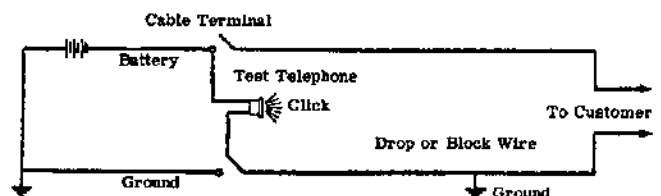


Figure 2a. Ground Side Grounded

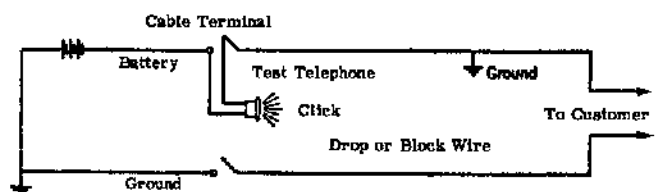


Figure 2b. Battery Side Grounded

- (6) Before reconnecting wires, test each wire separately to make sure it is clear.
- (7) After the fault has been isolated to a particular wire, visually inspect the wire for obvious defects. If an inspection does not reveal the fault, further testing is required.

- (8) If the ground is on the battery side of the line (Figure 3), open that side of the line. Attach one clip to the binding post on the central office side of the open. Touch the end of the wire that leads away from the central office with the other clip.

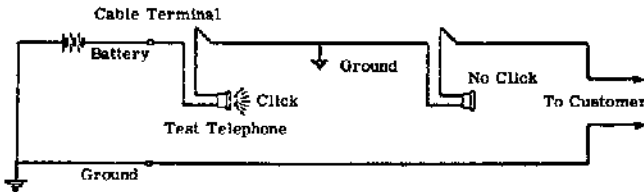


Figure 3. Battery Side Grounded

- (9) If the external ground is on the ground side of the line (Figure 4), open that side and establish contact with the battery side. Touch the exposed end of the wire leading away from the central office with the other clip.

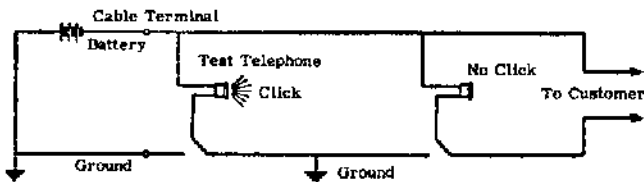


Figure 4. Ground Side Grounded

- (10) A click indicates that the ground is in the section of line toward the station. The absence of a click means that it is located in the direction of the central office.
- (11) On a party line, the click signifies that the ground is in the wire section being tested. The absence of a click indicates that the ground is toward the central office, or in a section of the wire not affected by the test.
- (12) To locate grounds on party lines, start at a point where the circuits to all parties are common and are carried on a single pair of conductors. Test the wires to each individual party until the faulty wire is found.

4.09 It is difficult to obtain positive indications of high resistance grounds with the hand

test telephone. First, determine that the fault is not located toward the central office by disconnecting the wire at the cable terminals and having the circuit tested from the central office. On a party line, the disconnection may reduce the leak to ground but will not clear the line. In this event, leave the wires disconnected until similar tests can be made on wires bridged to the line. If the initial disconnection clears the line, reconnect the wires immediately. After the wires containing or contributing to the fault have been determined, the fault can usually be found by visual inspection.

4.10 Opens in drop and block wire are of three types: complete opens, intermittent opens, and high resistance connections.

4.11 To locate complete opens, isolate the fault by making successive tests at different points in the line with the hand test telephone

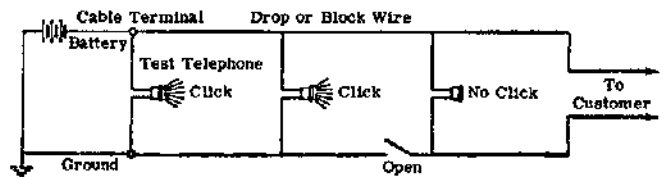


Figure 5. Test For Locating An Open

(Figure 5). Bridge the test set across the line. If a click is heard when the contact makes and breaks, the open is in the line facing away from the central office. If no clicks are heard, it is situated toward the central office. A click at one test point and no click at the next, indicates a fault between the two test points. When the fault has been isolated, inspect the section carefully, lowering the wire if necessary. If the fault cannot be found by inspection, replace the wire in that section.

4.12 Intermittent opens are difficult to locate by inspection, so testing is always required. The wires facing the central office should be moved at knobs or other supporting fixtures. Shake the wire in that span. A succession of clicks or fluttering noises indicates that the open is near the point of movement. Check all connections at binding posts and bridging connectors to be sure they are tight.

4.13 High resistance connections are indicated by noise, and occasionally by cutouts.

This type of open is located by bridging the test set across the section of line away from the battery source, and listening for noise. Remove and clean all wires at the faulty connecting point. If the fault is not pin-pointed at a definite connection, remove, clean, and replace the wires at all binding posts or bridging connectors. If the trouble is located at the binding posts of a cable terminal, remove the bolt flaring from the top of the post with a binding post cutter. If nuts and washers are dirty or corroded, replace them before reestablishing the connection.

4.14 Short circuits in drop and block wire are of two types: low resistance and high resistance. Low resistance breakdowns are complete. High resistance types are less severe and may result in only partial breakdowns.

4.15 To locate a low resistance short, isolate the fault to a particular section of the wire. Connect the hand test telephone in the line as shown in Figure 6, then proceed to test as described in 4.11.

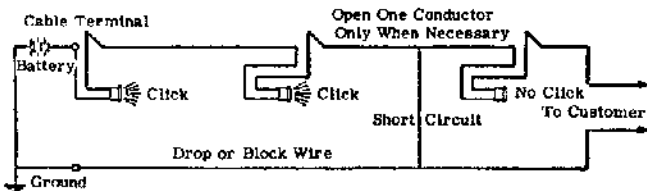


Figure 6. Tests To Locate Short Circuits

4.16 High resistance short circuits are similar to high resistance grounds in that they are hard to locate. Follow the procedure outlined in 4.09.

4.17 To locate and isolate crosses, follow the procedure described below and illustrated in Figure 7.

- (1) Disconnect all wires of one line from the binding posts or bridging connectors.

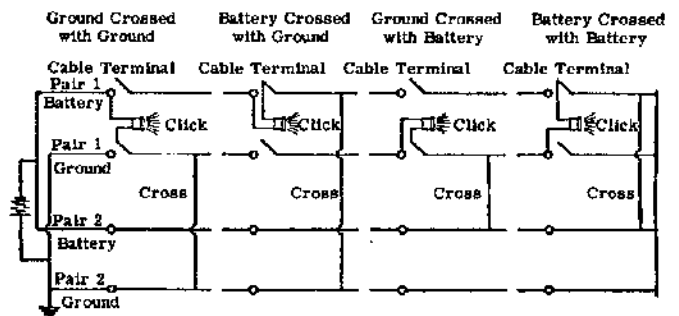


Figure 7. Tests To Locate Crosses

- (2) Attach one clip of the hand test telephone to one of the pair of binding posts from which the wires were disconnected. With the other clip, touch each of the disconnected wires.
- (3) If no click is heard on the make and break of any of the contacts, transfer the clip on the binding post to the other binding post of the same pair and repeat the test.
- (4) If clicks are heard, the wire being tested is crossed with another line and the cross is in that section of wire.
- (5) On party lines, the test should be made at every point where a drop or block wire is bridged to the circuit until the fault is isolated to the individual customer's line. Test as described above. To make certain the inside station wiring is not crossed with another line, repeat the test at the protector or connecting block.
- (6) Visually inspect the wires and repeat the test procedure, as required, to locate and repair the fault.

4.18 High resistance crosses, like high resistance grounds and short circuits, are difficult to isolate. Use the procedure outlined in 4.09.

TESTS

MONITORING OF WORKING LINES

1. GENERAL

1.01 This section contains procedures to be followed by all employees when their work involves the monitoring of working telephone lines.

1.02 Working lines referred to in this section are those lines other than special service lines. Special service lines require individual treatment.

2. TEST SETS

2.01 Use only a standard hand test telephone (A. E. Co. 800 or L965) equipped with an approved monitoring device to monitor working lines.

3. MONITORING OPERATION

3.01 Work forces must monitor all working lines before opening, short circuiting, crossing, grounding, placing trouble clearing equipment or applying tone for identification. Circuits must test idle before such work is undertaken.

Busy Circuit

3.02 If circuit tests busy, employee shall immediately disconnect hand test telephone from circuit and continue with work assignment. After a reasonable period of time, remonitor circuit.

Continued Busy Circuit

3.03-a If above mentioned circuit is still busy upon second or third test (provided a reasonable time has expired) and no other work has been prescribed at this location, or where it is otherwise necessary to interrupt conversation; employee should proceed as follows:

- (1) Politely excuse himself.
- (2) Identify himself as a telephone company employee.
- (3) Explain the necessity for service interruption.
- (4) Request permission to perform work on this line.
- (5) Whether permission is granted or not, thank the parties involved for their inconvenience before connection with the talking party is broken.
- (6) Be sure that parties have hung up before proceeding with work, if permission is granted.

3.03-b If either party should refuse to grant permission, employee shall disconnect hand test telephone from the line and, after a reasonable length of time, remonitor.

4. SECRECY OF COMMUNICATIONS

4.01 Employees monitoring working lines must be familiar with the Communications Act of 1934 which protects secrecy of communication.

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