

## LOCAL TEST CABINET NO. 3 OPERATING AND TESTING METHODS

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**1. GENERAL**

**1.01** This section describes the method of operation of the local test cabinet No. 3 (J94709) for making tests of the subscriber line and trunk plant.

**1.02** This section is reissued for the following reasons:

- (a) Connecting to a busy line. **CAUTIONS** added.
- (b) To include new connecting cords. Table A added.
- (c) Key access to a test trunk.
- (d) Use of receiver off-hook (ROH) tone.
- (e) Line identification of unigauge and nonunigauge lines.
- (f) Testing subscriber lines equipped with pole-mounted message and signal repeaters (J98619A).
- (g) Testing subscriber lines in No. 5 crossbar offices arranged for service with uniform gauge exchange cable plant (unigauge).
- (h) Testing subscriber lines connected to the U1 Carrier System (subscriber loop carrier).
- (i) Testing subscriber lines equipped with the 1A range extender or DK1 circuit pack.
- (j) Testing coin telephone stations modified for dial tone first (DTF).

Changes or additions in the body of tables are indicated by shaded areas.

**1.03** The various locations of the cabinet and the arrangements of the keys and jacks in the cabinet are covered in Section 662-202-100 on the description of equipment of the local test cabinet No. 3.

**2. METHOD OF CONNECTING BATTERY, RINGING AND COIN CONTROL SUPPLY TO LOCAL TEST CABINET**

**2.01** *When Test Cabinet Is Permanently Located:* Permanent wiring is installed for supplying test battery, central office battery, coin control current and ringing current. The talking line and test trunks are also permanently wired in.

**2.02 When Test Cabinet Is Portable:** Make connections using patching cords from the jacks in the cabinet to similarly designated jacks on the distributing frames (see Table A). In certain cases where supply jacks are not provided they will have to be wired temporarily.

#### Connection of Jacks

**2.03** Connect the jacks as follows:

JACKS	CONNECT TO
T BAT	20V, 100V and 200V test battery supply.
24V	24-volt supply in manual offices (except No. 12 offices) and in panel offices in which 24-volt talking battery is supplied by the district selector.
48V	48-volt supply in step-by-step, crossbar and manual No. 12 offices and in panel offices in which 48-volt talking battery is supplied by the district selector.
72V	72-volt supply in No. 5 crossbar offices arranged for unigauge testing.
RR—	Ringling supply in semiselective ringling offices or negative superimposed ringling supply in full selective ringling offices.
R+	Positive superimposed ringling current supply in full selective ringling offices.
CT	Coin collect and coin return supply.

### 3. METHOD OF ESTABLISHING TEST CONNECTIONS (SEE TABLE A)

**CAUTION:** When establishing a connection to a line which is already busy, do not operate the RCCI key. To do so could cause the +48-volt talking battery from the local office to meet the -24- or -48-volt battery from the local test cabinet. This could result in abnormally high current

through the winding of the local office trunk circuit supervisory relay.

#### Test Cabinet—Portable

**3.01 General:** Make connections from the jacks in the cabinet with patching cords to the subscriber line at the distributing frame protectors or jacks, to terminal strip lugs at the distributing frame, to a test connector or to a switchboard jack according to the following paragraphs. The telephone set in all cases is plugged into the TEL jacks.

**3.02 Test Cabinet Used at MDF:** Connect to the line at the protector with the proper MDF test cord. Insert the 289-type plug into the MDF T and R jacks with the clamping bar toward the bottom of the cabinet. The test circuit is normally connected to the cable conductors and the central office side of the circuit is disconnected. To test the subscriber line circuit operate the IN key. This connects the test circuit to the subscriber line circuit and disconnects the cable conductors. To test the line without opening it patch the No. 2W24A cord to the MDF T and R jacks. The IN key is not used on a connection of this type.

**3.03 Used at Test Connectors in Step-by-Step Offices:** Plug the No. 240C plug of the No. 6P4A cord into the jack of the test connector. Plug the cord with the red plug into the LINE jack and the cord with the black plug into the TC-B jack of the cabinet. Operate the TD key to the "dial" position (first operated position) and dial the tens and units digits, thus causing the test connector to select the line. To release the telephone circuit operate the TD key to the "hold" position (second operated position). This will also hold the test connector on the line (see Fig. 1).

**3.04** To advance the test connector to another line on the same level operate the TD key to the "dial" position and dial the digit corresponding to the number of steps the test connector is to be advanced.

**Note:** A 10-party terminal per line divided-code ringling connector cannot be advanced by the above method. Release the connection by restoring the TD key to normal for a few seconds. Then operate the key to the "dial" position and dial the desired number.

◆ TABLE A ◆

A. CORDS REQUIRED FOR PORTABLE TEST CABINET						
NO. REQ	CODE	COLOR	LENGTH	EQUIPPED WITH	USE	HOW USED
2	3P7A	Slate	6 Ft	310 Plugs	Swbd	At Swbd E/W 49 Jacks
2	3P12E	Slate	6 Ft	309 Plug 310 Plug	Swbd	At Swbd E/W 92 Jacks
1	3P7A	Slate	6 Ft	310 Plug	Bat.	Bat. Supply
1	3P7A	Slate	6 Ft	310 Plug	Bat.	Test Bat.
1	3P7A	Slate	6 Ft	310 Plug	Bat.	Coin Supply
1	3P18B	Black	19.5 Ft	310 Plug 234 Plug	Patch	IDF
1	4W6A	Green	12 Ft	289B Plug 252A Plug 252B Plug	MDF	MDF E/W Other Than 121-Type Protectors or 300-Type Connectors
1	4W11A	Green	12 Ft	289B Plug 412A Plug 412B Plug	MDF	MDF E/W 121-Type Protectors or 300-Type Connectors
1	4W7A	Green	12 Ft	289B Plug 310A Plug	MDF	MDF E/W 444-Type Jacks
1	2W24A	Green	9.5 Ft	289B Plug 2-59 Cord Tips	MDF	MDF Protectors Where Required to Test the Line Without Opening it
1	6P4A	Slate	10 Ft	240 Plug 310 Plug 310 Plug	Conn	At Test Connector in Step-By-Step Office
1	W4BK	Black	16 Ft	396A Plug 431A Plug	Prot	No. 1 ESS Protector Frame-In and Out Tests
1	W2FM	Black	16 Ft	396A Plug 2-P15A864 (Chuck)	Prot	No. 1 ESS Protector Frame Bridging Tests
B. CORDS REQUIRED WHEN TEST CABINET IS PERMANENTLY MOUNTED AT A NON-NO. 1 ESS MDF OR WALL MOUNTED						
NO. REQ	CODE	COLOR	LENGTH	EQUIPPED WITH	USE	HOW USED
1	4W6A	Green	12 Ft	289B Plug 252A Plug 252B Plug	MDF	MDF E/W Other Than 121-Type Protectors or 300-Type Connectors
1	4W11A	Green	12 Ft	289B Plug 412A Plug 412B Plug	MDF	MDF E/W 121-Type Protectors or 300-Type Connectors

TABLE A (Cont)

B. CORDS REQUIRED WHEN TEST CABINET IS PERMANENTLY MOUNTED AT A NON-NO. 1 ESS MFD OR WALL MOUNTED (Cont)						
NO. REQ	CODE	COLOR	LENGTH	EQUIPPED WITH	USE	HOW USED
1	4W7A	Green	12 Ft	289B Plug 301A Plug	MDF	MDF E/W 444-Type Jacks
1	2W24A	Green	9.5 Ft	289B Plug 2-59 Cord Tips	MDF	MDF Protectors Where Required to Test the Line Without Opening It
1	W4BK	Black	16 Ft	396A Plug 431A Plug	Prot	No. 1 Ess Protector Frame In and Out Tests
1	W2FM	Black	16 Ft	396A Plug 2-P15A864 (Chuck)	Prot	No. 1 ESS Protector Frame Bridging Tests
C. CORDS REQUIRED WHEN TEST CABINET IS PERMANENTLY MOUNTED ON DESK WITH ASSOCIATED JACK PANEL						
NO. REQ	CODE	COLOR	LENGTH	EQUIPPED WITH	USE	HOW USED
1	3P7D	Slate	2 Ft	310 Plug	Patch	For Patching from T or ROHT Jack in Jack Panel to Test Trunk Jacks
1	4P18A	Slate	2 Ft	327A Plug	Patch	For Patching from the TST DIST L&T Jacks (or ROHT L&T jacks) to the Jacks of the Test Dist Test Trunk in the Jack Panel
1	No. 52S Head Telephone Set					Tel Set

**3.05 Test Cabinet Used at Switchboard:** Connect the TST jack to the jack of the line or trunk at the switchboard with a switchboard patching cord.

**3.06 Test Cabinet Used at IDF or Other Distributing Frame:** Connect the No. 234 plug of the No. 3P18B cord to the terminal strip lugs at the IDF or other distributing frame. In manual offices, connect the No. 310 plug of the cord to the TST jack. In step-by-step offices connect the No. 310 plug of the cord to the TC-B jack to provide the proper sleeve condition.

**3.07 Test Cabinet Used at ESS Protector Frame:** If in and out tests are required, connect the protector frame to the test cabinet with a W4BK cord. The 396-type plug is inserted into the MDF T and R jacks with the clamping bar toward the bottom of the cabinet. The protector unit is removed from the line under test and replaced with the 431-type plug of the test cord. When test cabinet is to be bridged to the line without opening the connection, a W2FM cord is used. The 396-type plug is inserted in the MDF T and R jacks and the chuck end of test cord is placed over tip and ring test pins located at top and bottom of protector frame.♦

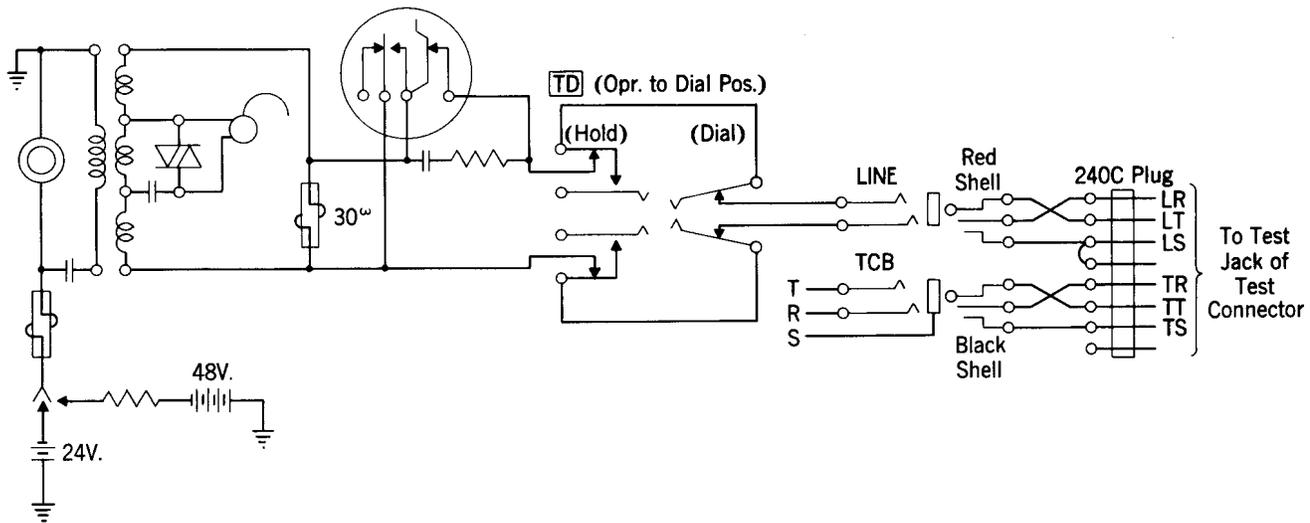


Fig. 1—Connection to Test Connector

### Test Cabinet Permanently Mounted without Jack Panel

**3.08 To Establish a Test Connection at the MDF:** When the main frame test cord is long enough to reach from the test cabinet to the line protectors or jacks, connect at the MDF as covered in 3.02. If the cabinet is too far from the protectors, jacks are provided at the MDF and wired directly to the test cabinet. In this case, plug the main frame test cord into the test jacks provided at the main frame. Insert the No. 289A plug with the clamping bar to the left.

**3.09 To Establish a Test Connection Through a Switchboard:** To connect to a line or trunk at the switchboard use the call circuit to the switchboard operator to order up the test cords at the switchboard.

**3.10 To Establish a Test Connection by Way of the Test Distributor:** Operate the TD key to the "dial" position and dial the line number. To hold the test distributor and release the telephone circuit operate the TD key to the "hold" position.

**3.11 To Establish a Test Connection at ESS Protector Frame:** Connection is established as if cabinet were portable as in 3.07. If cabinet is too far from protector frame, jacks must be provided as in 3.08. Use the W4BK cord for in

and out tests and the W2FM cord for bridging tests as in 3.07.♦

### ♦Key Access to Test Trunk (See Fig. 2)

**3.12** A test cabinet may be modified to provide key access to a test trunk circuit. This provision is provided for use with ESS No. 2 and may be required for other applications. When key access is provided, the test cabinet is equipped with a SUPV lamp and the TD (test distributor) key is replaced with the TTRK (test trunk) key. When the TTRK key is operated to the first (connect) position the test cabinet circuit is transferred from the TST jack to the test trunk circuit. When the TTRK key is operated to the second (hold) position, the test cabinet circuit is transferred from the test trunk circuit to the TST jack and the test trunk circuit is placed on hold. If a customer should attempt to place a call over the line under test while the test trunk is being held at the test cabinet, the SUPV lamp lights with a flashing signal.♦

### Test Cabinet Mounted on Desk with Jack Panel—Test Trunks with Lamp Signals

**3.13 Steady Lamp Incoming Signal:** On an incoming call both the red and the white lamps light steadily. When the call is answered by plugging into the associated test trunk jack

TABLE B

VOLTMETER READING ON 120-VOLT SCALE WITH +STA KEY OR -STA KEY OPERATED	VOLTMETER READING ON 120-VOLT SCALE - ALL KEYS NORMAL	INDICATION OF READING WITH +STA KEY OR -STA KEY OPERATED
Less than 17 volts	67 volts or more (line insulation resistance 50,000 ohms or less)	Test ineffective (See Note)
17-24 volts	Less than 67 volts (line insulation resistance more than 50,000 ohms)	Station tested for not on line
17-24 volts	45-67 volts (line insulation resistance between 50,000 and 125,000 ohms)	Readings insignificant
24 volts or over	Less than 45 volts (line insulation resistance greater than 125,000 ohms)	Station tested for is on line
	45-67 volts (line insulation resistance 50,000 to 125,000 ohms)	Station tested for is on line

**Note:** Where, due to low line insulation resistance, the checks for this equipment are not significant, the test deskman can resort to the use of ringing current of the proper type in an attempt to call the subscriber.

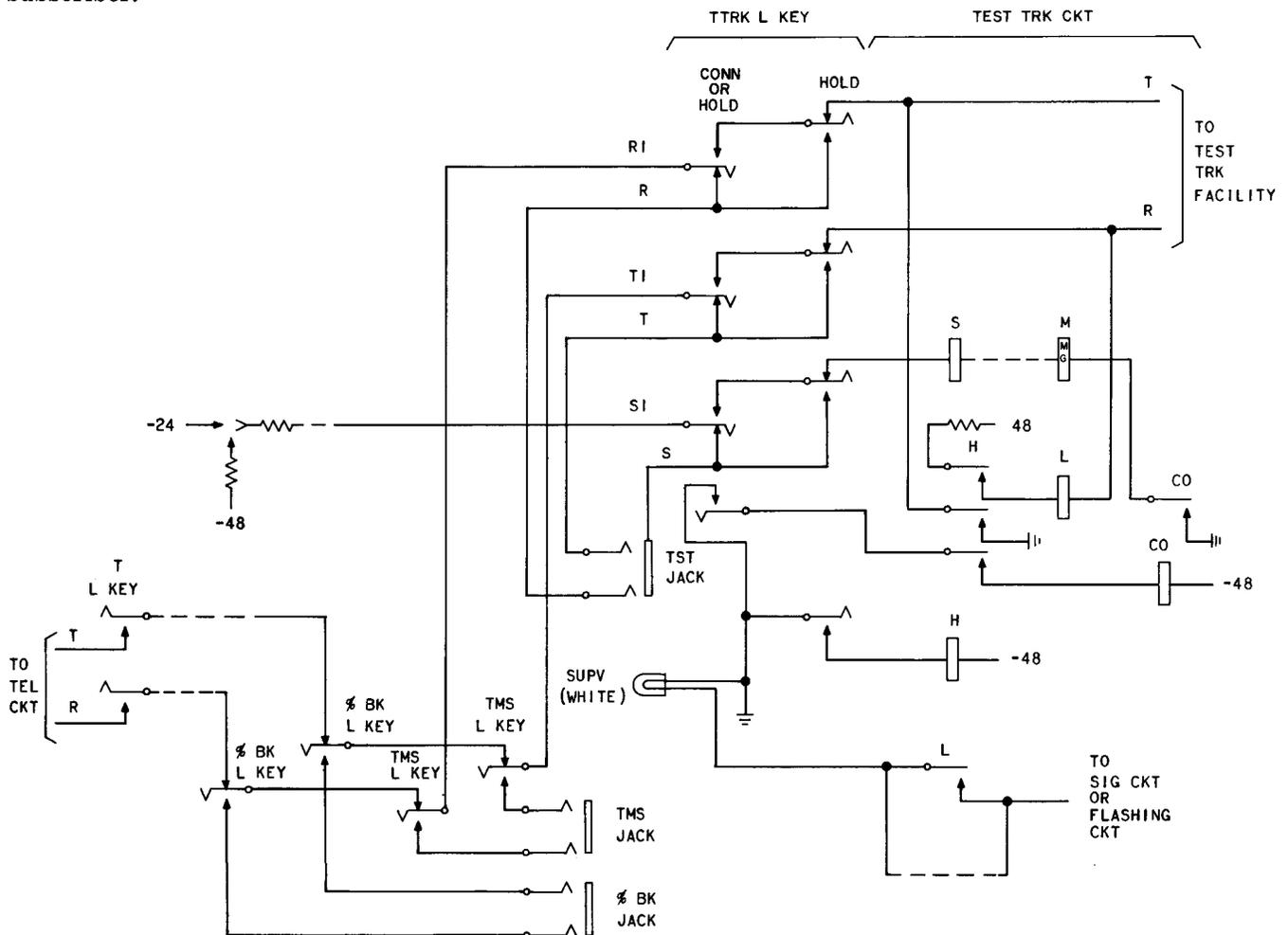


Fig. 2—Key and Jacks for Connecting External Test Sets to Test Trunk and Key, Jack and Lamp Circuit for Key Access to Test Trunk

the white lamp goes out and the red lamp remains lighted. If the HOLD key is operated and the plug is removed from the test trunk jack, a steady white light will indicate that the employee is signaling. The lighted red lamp, in all cases, indicates a busy test trunk.

**Exceptions:** On an incoming call a white lamp signal does not appear if there is no bridge across the line. If the test trunk is connected to a line with no sleeve (eg, a magneto line) the red lamp does not appear as an incoming signal but does appear as soon as the plug is inserted into the test trunk jack.

**3.14 Flashing Lamp Incoming Signal:** On an incoming call the signals are the same as those obtained with steady lamps except that the red lamp flashes until the plug has been inserted into the test trunk and then remains steadily lighted until disconnection takes place.

**3.15 On an Outgoing Call:** The red lamp lights steadily when the plug is inserted into the test trunk jack. The white light remains out. If the HOLD key is operated and the plug is removed from the jack, a bridge across the line causes the white lamp to appear either flashing or steady.

**Note:** When the test connections are established under conditions where no busy test is made, the testing employee should not place any condition on the line which would interfere with a conversation or the progress of a call until after the line condition has been verified.

**3.16 Test Connection Through a Common Group of Test Desk Trunks Used for More Than One Off Premises Office:** Using the No. 3P7D cord patch to an idle test trunk in the common group and operate the DIAL key. Dial the digit corresponding to the level on which test trunks to the desired central office appear. Where subsequent operations do not require its use, restore the DIAL key. Proceed as covered in the appropriate paragraph (3.16 through 3.30), covering the particular type of incoming test trunk circuit selected, except that the test cord connection and operation of the DIAL key, where required, has already been accomplished.

**3.17 Completing Connection Through Test Trunk to Switchboard and Plugging Up**

**Line Panel:** Patch the T jack to the test trunk jack of an idle trunk to the switchboard or plugging up line panel, using a No. 3P7D cord. Operate the call circuit key C-CKT or use the other talking circuit facilities to establish a connection to the switchboard operator or employee and request connection to the desired circuit. Operate the HOLD key to hold the test trunk if the cord is to be disconnected from the trunk jack.

**3.18 Completing Test Connection Through Test Distributor in Step-by-Step Offices:**

Patch the (TST DIST) L and T test circuit jacks to the jacks of the test distributor trunk using a No. 4P18A cord. Operate the TD key to the "dial" position and dial the line number. To hold the test distributor and free the telephone circuit operate the TD key to the "hold" position. If it is desired to remove the plug from the trunk jacks without disconnecting, operate the HOLD key of the trunk before removing the plug.

**3.19 Test Connection Through Test Distributor Control Circuit (Step-by-Step Office):**

(This arrangement may be used on some local test cabinet installations where the test distributors are located in a distant office.) Using the No. 3P7D cord, patch to an idle trunk and operate the DIAL key. Dial the desired line number. Restore the DIAL key before making tests. Operate the HOLD key to hold the test trunk if the cord is to be removed from the trunk jack.

**3.20 Test Cabinet Control of Automatic Line Insulation Testing Equipment (Step-by-Step Office):**

Operation of the test frame in the local office or in a distant office is controlled by use of the regular test distributor trunks or test distributor control circuit trunks and their associated test distributors.

**3.21** To start the line insulation test frame, establish connection to the test trunk serving the office in which the test is to be made as covered in 3.17 or 3.18 depending on the type of test trunk provided. Dial the digit or digits required to connect to the automatic line insulation test control equipment, followed by the number of the test desired. See Table H. Restore the DIAL key, or operate TD key to the "hold" position, as required, and operate the T key. Momentarily connect ringing voltage to the tip of the test connection. Low tone will be heard over the test connection to indicate that the test frame is operating. The

test trunk connection may now be released. While the test frame is operating the BY lamp associated with the test trunk will be lighted.

**3.22** To determine whether the test frame is operating, proceed as in 3.20 except that, instead of dialing the test number after dialing the digit necessary to connect to the line insulation test control circuit, dial "0" which will connect the circuit to the monitoring-and-stop terminal "0". Do not apply ringing voltage to the test circuit. If the test frame is operating, a low tone is heard. If the frame has stopped because of trouble in the test frame circuit, a ringing induction tone is heard. No tone is heard if the test frame is not operating.

**3.23** If the test frame is operating and it is desired to check what test is being made, proceed as in 3.20 except that after dialing the digit necessary to connect to the line insulation test control circuit, dial digit "1". If tone is heard test number 1 is being made. If no tone is heard dial digit "1" again to advance the selector to the next terminal. Continue dialing digit "1" until low tone is heard. Number of test being made is indicated by the number of digits dialed.

**3.24** To restore the test circuit to normal before completion of a test cycle, to change to a different test range, or to stop tests, proceed as in 3.21 and momentarily connect ringing voltage to the tip side of the test connection. Removal of tone from the circuit indicates that the test frame has restored to normal.

**3.25** *The SS (sleeve switching) key*, when provided, is used in its normal position to supply the sleeve condition required for test trunks to switchboards in the same building. When operated it supplies the sleeve condition required for MDF and toll testboard trunks and test trunks to crossbar and panel offices in the same building with the test cabinet. This key is ineffective when the DO key is operated.

**3.26** *Completing Test Connections in Crossbar and Panel Offices by Dialing:* Using the No. 3P7D cord patch to the test trunk and operate the DIAL key, also the SS key if provided unless the DO key is operated. The voltmeter will deflect to the left. When the voltmeter deflects to the right, dial the required line number. During dialing the voltmeter reading will decrease and the needle

will flutter with the dial pulses. The connection is ready for testing when the tones (see Note below) are removed and the DIAL key is restored. To avoid interrupting any call that may be in progress, operate the MON key instead of the T key before restoring the DIAL key.

**Note:** If continuous low tone is heard when DIAL key is restored to normal it indicates that the selection of the line has not been completed. An interrupted tone indicates an overflow condition. If the line is busy, busy tone will be heard if the selector is not equipped with the "no-test" feature. If the "no-test" feature is provided, connection will be established even if the line to be tested is busy.

**3.27** *Completing Test Connections in Crossbar and Panel Offices Through the "B" Boards:*

Using the No. 3P7D cord, patch to the test trunk and operate the T and RCCI keys. This establishes a talking connection with the "B" operator on a straightforward basis. When the order tone is heard pass the number of the desired line. Continuous low tone will be returned to the test desk during selection in a panel office but not in crossbar offices. To avoid interrupting a call that may be in progress restore the T and RCCI keys and operate the MON key to monitor on the line before testing.

**3.28** *Test Connection Through Test Trunk to a Directory Number in a Crossbar Office Equipped with Incoming Test Trunks Which Operate with Multifrequency Key Pulsing Senders or Registers:*

The MF keyset may be connected to the test cord to furnish multifrequency pulses to the terminating equipment to control the selection of the called number. With VM REV key normal, the plug of the No. 3P7D cord patch is inserted in an idle test trunk and the KP key in the MF keyset circuit is operated. The MF keyset circuit functions in conjunction with the test trunk terminating equipment to summon and attach a sender or register and MF receiver. Lamp S of the MF keyset circuit is lighted when the terminating equipment is prepared to receive numerical pulses. By the operation of numerical keys, corresponding to the number of the called subscriber line (including an office digit when required), numerical pulses are transmitted to the MF receiver which operates relays in the sender or register to control the selection of the called number. After numerical

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pulsing is completed, the KP key is restored and connection is established to the called subscriber line. In the event an overflow or busy line condition, on calls that are not no-test, is encountered, an interrupted tone will be received as an indication upon the release of the KP key.

**3.29 *Completing Test Connection in Crossbar Offices to an Extra Number:*** In an office without a "B" board operate the VM REV key and proceed as in 3.25 and 3.27. In an office equipped with a "B" board operate the REV key and proceed as in 3.26.

**3.30 *When testing subscriber lines in crossbar offices,*** test connections to a line are always made along the same testing path no matter which party telephone number is dialed, keyed or passed to the operator. Therefore, in contrast to other dial offices, when a test connection is established by calling a tip party telephone number, the ring side of the test circuit will be connected to the ring side of the line the same as if the test connection were established by calling a ring party telephone number.

**3.31 *Test trunks to crossbar offices*** are of two types, "regular" and "no-test." The "regular" test trunk is used as first choice to connect to the required line except when a particular line of a PBX hunting group is desired. If the line to be tested is busy, a busy tone will be sent back to the test desk and the test connection will not be made. When the "no-test" trunk is used to connect to an idle subscriber line the connection will be established in the same way as when using the "regular" trunk. However, if the line to be tested is busy, the connection will be established through the "no-test" vertical on the line link frame. When the line becomes idle the connection will be released and alternate high and low tone sent back as an indication which necessitates the re-establishment of the test connection. Since there are two "no-test" access paths on each line link frame, one path serving the horizontal groups 0-4 and the other path serving the horizontal groups 5-9, only two connections may be established at the same time to lines on the same line link frame, one in group 0-4 and one in group 5-9. Attempts to route another test call through a busy "no-test" access path will result in interrupted low tone being sent back to the test desk and no connection being made.

**Note:** If it is desired to check whether or not a line is up on a no-test basis, operate the T or MON and 3WO keys. Steady high tone indicates that the line is up on a no-test basis while the absence of tone indicates a regular connection.

**Test Cabinet Mounted on Desk with Jack Panel—Test Trunks Without Lamp Signals (Test Trunks to MDF, or Toll Testboard)**

**3.32 *General:*** Make connection at the MDF with an IN-OUT cord using the talking channels provided where necessary.

**3.33 *Testing IN and OUT—Two-Jack Test Trunk:*** Using a No. 3P7D cord, patch the T jack to the IN or OUT jack of the test trunk depending upon whether it is desired to test inside or outside the office. Plugging into the IN jack connects the test circuit to the central office side of the subscriber line circuit and disconnects the cable conductors. Plugging into the OUT jack connects the test circuit to the cable conductors and disconnects the central office line circuit.

**3.34 *Bridging Tests*** are made when the circuit under test is not to be opened. In this case the connection at the main frame is made with the No. 2W24A cord and the T jack is connected to the OUT trunk jack.

**3.35 *Testing IN and OUT—Single Jack Test Trunk:*** If the DO key is normal, operate the SS key as required, if provided. Using the No. 3P7D cord, patch the T jack to the test trunk jack and operate the IN key for testing "in" with the line conductors disconnected.

**3.36 *Bridging Test:*** If the DO key is normal and the SS key operated as required, if provided, operate the 3WO key which opens the sleeve of the test circuit to prevent operation of the sleeve relays, thereby causing the tip and ring of the test trunk to be bridged to the tip and ring of the line without the line being opened.

**◆Connection to Receiver Off-Hook Tone (ROHT) or Howler (HLR)◆**

**3.37** When test connection has been established to a line on which a permanent signal is reported, remove the ring heat coil momentarily

or employ some other means to release the equipment being held by the "permanent" line condition.

**3.38** Determine the cause of the permanent signal.

If it appears that the receiver is off the hook, operate the HOLD key of the test trunk to hold the test connection and remove the test cord from the test trunk jack.

**3.39** If the test trunk has a double jack connect the double L and T jacks of the receiver off-hook tone connector circuit to the test trunk jacks with a No. 4P18A patching cord.

**3.40** If the test trunk has a single jack, connect the single HLR or ROHT jack to the test trunk jack using a No. 3P7D cord.

**3.41** If the patching cord is left connected to the L and T jacks or to the single HLR or ROHT jacks of the receiver off-hook tone connector circuit, the green lamp remains lighted even though the other end of the cord is free. It is therefore suggested that the howler cords be kept in a desk drawer when the howler is not being used.

#### **4. METHOD OF USING TALKING LINES AND CALL CIRCUIT**

##### **Test Cabinet Permanently Mounted Without Jack Panel**

**4.01** To answer an incoming call, or to make an outgoing call, operate the TRK key of the test cabinet to the "talk" position to connect the telephone circuit and dial to the talking line. When answering an incoming machine ringing call, operate the TRK key to the "hold" position to trip the ringing and then restore the key to the "talk" position (see Fig. 3). To hold the talking line and release the telephone circuit for use with the test circuit, operate the TRK key to the "hold" position. The call circuit key, C-CKT, is used to talk with the operator.

##### **Test Cabinet Permanently Mounted With Jack Panel**

**4.02** The call circuit key, C-CKT, is used to talk with the operator. When the cabinet is mounted on a desk with a jack panel, each talking trunk terminates in a lever-type key and an associated lamp. On an incoming call the lamp lights either flashing or steady. The call is answered

by the operation of the key associated with the lamp. If the lamp was originally flashing it changes to steady when the TALK key is operated. If the lamp was steady it is extinguished when the TALK key is operated.

#### **5. METHOD OF PERFORMING TESTS**

##### **Use of DO Key**

**5.01** Use the DO key when testing offices which are not in the building where the test cabinet is located. The test trunks to outside offices may be compensated so that they all have approximately the same transmission equivalents. Where 1500-ohm range test trunks are used, compensation of test trunks is discontinued. The advantage gained in the accuracy of testing by keeping the resistance in the testing path as low as possible, more than offsets the advantage of uniform test trunk resistance. In any tests involving measurements of resistance and capacitance, allowance shall be made for the resistance and capacitance of the test trunk. On tests of a noncoin subscriber line circuit, or on transmission tests, the operation of the DO key compensates for the effect of the test trunk.

##### **Checking the Test Battery Voltages**

**5.02** To check the 100-volt test battery operate the VM REV key (see Fig. 4). The meter should indicate a voltage between 99 and 101 volts. If only five batteries are in use, add the sixth when required. To check the 20-volt tap operate the 20,000 and the VM REV keys. The voltage should not be greater than 21 volts. Restore the 20,000 key and operate the 1000 key. The voltage should not be less than 19 volts after 10 seconds drain. Make adjustments as required with the taps on the battery.

**5.03** To check the voltage of the test batteries associated with the +STA and -STA keys, operate the VM REV key and the +STA or -STA key to check the associated positive or negative battery, respectively. The battery voltages should be within the limits of 116 and 120 volts.

##### **Voltmeter Test**

**5.04** Set up the connection to the subscriber line. Fig. 5 shows the connection for the voltmeter test. (In case the subscriber line is known to be equipped with one or more tube-type subscriber

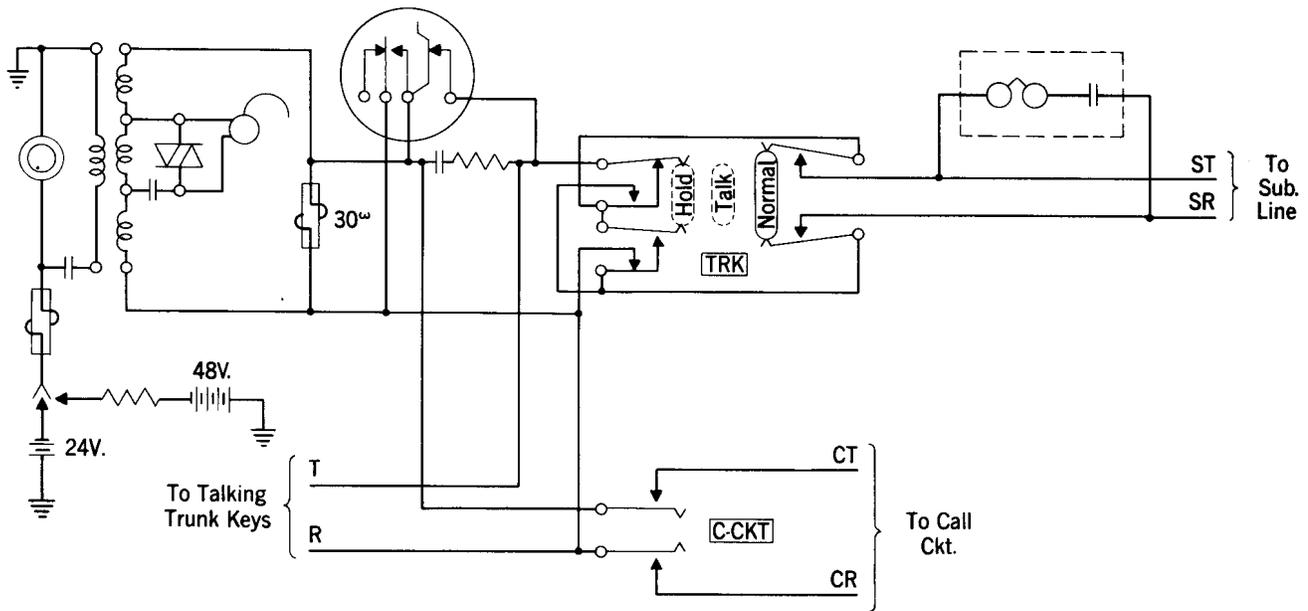


Fig. 3—Telephone, Talking and Call Circuit

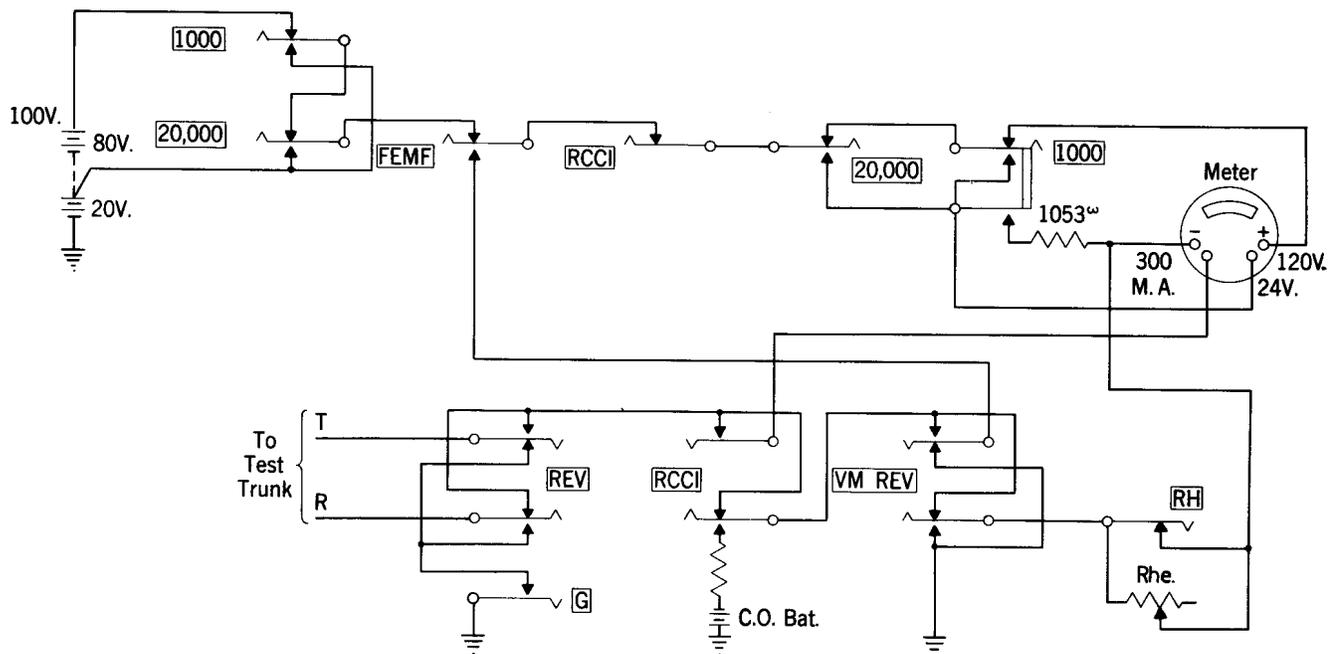


Fig. 4—Test Connections With Volt-Milliammeter

sets, 21-type indicators or 103A key equipment, a ballistic test cannot be made. To check the line insulation resistance of this equipment, operate the 20,000 key, since the presence of the tube on the line will probably affect the results if the 100-volt test battery is used. The presence of this equipment on the line can be checked for as outlined in 5.27 through 5.33). No test should be made until the needle of the instrument comes to rest. To make a voltmeter test, proceed as follows:

- (a) **Operate the G Key:** Disregard any throw (ballistic deflection) of the voltmeter needle. Also, disregard any steady deflection within the prescribed limits.
- (b) **Operate the REV Key:** Observe the throw and the steady deflection (if any). The steady deflection indicates the insulation resistance of the tip side of the line and should be within the limits prescribed locally. The insulation resistance may be obtained from Table C or D.
- (c) **Restore the REV Key:** Observe the throw and the steady deflection (if any). The steady deflection indicates the insulation resistance of the ring side of the line and should be within the limits prescribed locally. The insulation resistance for various steady deflections may be obtained from Table C or D.

**Note:** Where the subscriber equipment has a visual indicator having cold cathode tubes (such as the 21-type indicator) a reading of between 12.5 and 45 volts will be obtained on the voltmeter. The ballistic deflection obtained when the REV key is restored will be the same as if the steady deflection had been caused by line insulation resistance. Obtain from Table C the line insulation resistance value which the steady deflection indicates. However, to determine whether the steady deflection was due to line insulation resistance or to the presence of the tube on the line, operate the 20,000 key. If any reading is obtained with the 20,000 key operated it indicates a leak on the line. If no leak is indicated with the 20,000 key operated then the reading obtained on the 100,000-ohm scale was an indication that a tube is on the line.

- (d) **Restore the G Key:** When the proper throw is obtained and the steady deflection

is within the limits prescribed locally, the line is O.K. It should be noted in this connection that the ballistic deflection is dependent upon the insulation resistance of the line.

**5.05** The throw associated with the operation and restoration of the REV key depends upon the type of circuit under test. The following is a description of the action which should take place under various circuit conditions.

- (a) **Capacitor Across Tip and Ring (See Fig. 5):** The operation of the G key connects ground to the tip side of the line and allows current to flow from the test battery through the winding of the voltmeter to charge the capacitor. The momentary flow of current causes a momentary deflection, or "throw" of the voltmeter needle. The operation of the REV key reverses the line causing the capacitor to discharge in series with the test battery and voltmeter, and immediately recharge with a polarity opposite to the original charge. This operation causes a "throw" of the needle approximately twice as great as when the G key was operated at the beginning of the test. The increased "throw" is due to the combined effort of the test battery and the charged capacitor. The restoration or any subsequent operation of the REV key results in like manner in the same increased deflection. The extent of the "throw" is proportional to the capacitance of the capacitor.
- (b) **Capacitor Connected Between the Ring Side of the Line and Ground (See Fig. 5):** When the test circuit is connected to the line, current flows through the winding of the volt-milliammeter and charges the capacitor. As previously stated, however, no attention should be paid to any deflection of the volt-milliammeter incident to establishing the testing connection. The operation of the G key has no effect on the circuit. The operation of the REV key with the G key operated connects ground to the ring side of the line and discharges the capacitor. This action is not indicated by the volt-milliammeter. The restoration of the REV key causes current to again flow through the winding of the volt-milliammeter and recharge the capacitor. The recharge of the capacitor is indicated by a momentary deflection of the voltmeter needle. The extent of the deflection is proportional to the capacitance connected between the ring side of the line and ground.

In testing a capacitor connected between the ring side of the line and ground, the important operation is the restoration of the REV key.

(c) **Capacitor Connected Between the Tip Side of the Line and Ground:** The action is the same as when the capacitor is connected between the ring side of the line and ground except that the capacitor is charged through the meter when the REV key is operated and discharged to ground when the REV key is restored.

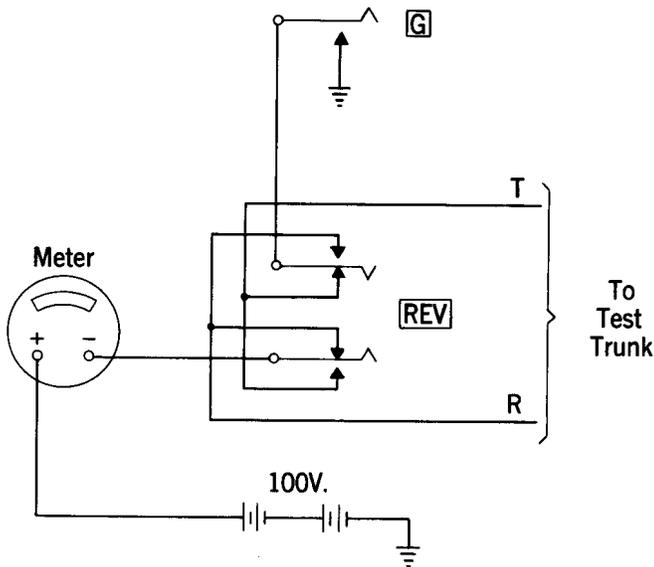


Fig. 5—Ballistic Test Using the Voltmeter

#### 5.06 Test of One Side of the Line to Ground or Test of a Bridge Across the Line Using the RCCI Key.

(a) **Capacitor Connected between the Ring Side of the Line and Ground:** A capacitor connected between the ring side of the line and ground may, in addition to the method outlined in 5.05(b), also be tested by the RCCI method. This method is particularly useful in determining the degree of capacitance unbalance to ground on a cable pair since it gives relatively large ballistic indications, and since the effect of the mutual capacitance between conductors is minimized. Operate the RCCI key, thereby permitting a current flow from the central office 48- (or 24-) volt negative battery through the

winding of the milliammeter to the ring side of the line charging the capacitor to a negative potential of 48 (or 24) volts. Restore the RCCI key. This operation connects 100-volt positive battery to the capacitor in series with the 100,000-ohm winding of the voltmeter, discharging the capacitor and immediately recharging it to a potential of 100 volts. The extent of the voltmeter throw is proportional to the capacitance of the capacitor. This method results in a larger deflection than the method outlined in 5.05(b) because of the combined action of the 48- (or 24-) volt negative charge in the capacitor and the 100-volt positive potential of the test battery. In testing a capacitor between one side of the line to ground, the important operation is the restoration of the RCCI key.

(b) **Capacitor Connected Between the Tip Side of the Line and Ground:** The action is the same as when the capacitor is connected between the ring side of the line and ground except that the REV key should be operated first. The capacitor is charged through the meter when the RCCI key is operated and discharged when the RCCI key is restored.

(c) **Capacitor across Tip and Ring:** The operation of the G key connects ground to the tip side of the line and permits testing of capacitors bridged across the tip and ring of the line using the RCCI method. Operation and restoration of the RCCI key results in ballistic deflections as described for capacitors bridged between the ring side of the line and ground.

5.07 If during operations (a) to (d) in 5.04, the steady deflection of the voltmeter needle does not come within the prescribed limits, proceed as follows:

(a) **Restore All Keys to Normal (See Fig. 5):**

If the steady deflection is obtained with all keys normal, a ring ground is indicated. Current flows through the winding of the volt-milliammeter to the ring side of the line to ground.

(b) **Operate the REV Key (See Fig. 5):** If a steady deflection is obtained, a tip ground is indicated. Current flows through the winding of the volt-milliammeter to the tip side of the line to ground.

(c) **Operate the G Key (See Fig. 5):** If a steady deflection is obtained, a tip and ring short circuit is indicated. Current flows through the winding of the volt-milliammeter to the tip side of the line, through the cross to the ring side of the line to ground at the G key.

#### Resistance Measurements With Volt-Milliammeter

**5.08** With no keys operated, 100-volt battery through 100,000 ohms and the meter is connected to the ring side of the test circuit (see Fig. 4). Operate the REV key to connect to the tip side.

#### Method of Measuring Resistances

**5.09** The resistance measurement of a ground or a tip and ring cross is most accurate when made with the winding of the volt-milliammeter which is most nearly equal in resistance to the unknown resistance. When connection is made to the line, note the reading of the meter with the scale change and RCCI keys normal. Operate and restore successively the 20,000, 1000 and RCCI keys, noting in each case the deflection obtained (see Fig. 4). Use the connection which gives nearest to one-half the full deflection. The conditions of the test circuit are as follows:

KEY OPERATED	METER SCALE	METER RESISTANCE	BATTERY VOLTAGE
None	0-120	100,000 ohms	100 volts
20,000	0-24	20,000 ohms	20 volts
1,000	0-24	1,000 ohms	20 volts

After the proper scale of the meter has been selected, the actual resistance in ohms can be determined from the meter reading by consulting Tables C to G.

**5.10** When making resistance measurements using the 100-volt test battery on lines containing one or more cold cathode tubes (such as those contained in 4-party full selective tube-type subsets, No. 21 type visual indicator or No. 103A key equipment) readings of less than 45 volts should

not be considered as they may be affected by the current flowing through the tube. Ordinarily, satisfactory measurements can be made using the 20-volt test battery and the 20,000-ohm scale.

**5.11** Resistance measurements with the voltmeter are affected by foreign potentials, especially when the 20-volt test battery is used. To obtain a more accurate reading if there is any potential on the conductor, note the first reading with the voltmeter as E1. Then operate the FEMF key (also the VM REV key if the needle moves to the left). If the VM REV key is normal, note the second reading as -E2, if the key is operated, as +E2 (all readings to be on same scale). Then  $E1 \pm E2$  is the value of "Meter Reading" to be used for determining the resistance from the tables.

#### Cross With Central Office Battery, Foreign Potential or Earth Potential

**5.12** If during the operations outlined in 5.07 a voltmeter reading in excess of the test battery voltage is obtained, a cross with central office battery, foreign potential or earth potential is indicated. A deflection of less than the test battery voltage may also indicate a cross with foreign potential but usually it indicates a leakage to ground or between conductors.

**5.13** To determine whether a potential exists on a circuit, operate the FEMF key, which connects the test circuit through the meter to ground instead of to the test battery (see Fig. 4). If the foreign potential is negative the voltmeter needle will be deflected to the right. If it is positive, the needle will tend to deflect to the left of zero. In this case, operate the VM REV key to reverse the connections of the voltmeter to obtain a reading to the right of zero. The 20,000 and 1000 keys can also be used with the FEMF key for foreign potentials of less than 24 volts.

#### Breakdown Test of Line Insulation

**5.14** To check the insulation between both sides of the line and ground for potential breakdown operate the BT key. With this key operated,

**TABLE C**  
**100,000-OHM WINDING — 120-VOLT SCALE**

METER READING (VOLTS)	RESISTANCE			METER READING (VOLTS)	RESISTANCE		
	TEST BATTERY VOLTAGE				TEST BATTERY VOLTAGE		
	99	100	101		99	100	101
101			0	50	98,000	100,000	102,000
100		0	1,000	49	102,000	104,100	106,100
99	0	1,010	2,020	48	106,300	108,300	110,400
98	1,020	2,040	3,061	47	110,600	112,800	114,900
97	2,061	3,092	4,123	46	115,200	117,400	119,600
96	3,125	4,166	5,208	45	120,000	122,200	124,400
95	4,210	5,263	6,315	44	125,000	127,300	129,500
94	5,319	6,382	7,446	43	130,200	132,600	134,900
93	6,451	7,526	8,602	42	135,700	138,100	140,500
92	7,608	8,695	9,782	41	141,500	143,900	146,300
91	8,791	9,890	10,990	40	147,500	150,000	152,500
90	10,000	11,110	12,220	39	153,800	156,400	159,000
89	11,240	12,360	13,480	38	160,500	163,200	165,800
88	12,500	13,640	14,770	37	167,600	170,300	173,000
87	13,790	14,940	16,090	36	175,000	177,800	180,600
86	15,120	16,280	17,440	35	182,900	185,700	188,600
85	16,470	17,650	18,820	34	191,200	194,100	197,100
84	17,860	19,050	20,240	33	200,000	203,000	206,100
83	19,280	20,480	21,690	32	209,400	212,500	215,600
82	20,730	21,950	23,170	31	219,400	222,600	225,800
81	22,220	23,460	24,690	30	230,000	233,300	236,700
80	23,750	25,000	26,250	29	241,400	244,800	248,300
79	25,320	26,580	27,850	28	253,600	257,100	260,700
78	26,920	28,210	29,490	27	266,700	270,400	274,100
77	28,570	29,870	31,170	26	280,800	284,600	288,500
76	30,260	31,580	32,890	25	296,000	300,000	304,000
75	32,000	33,330	34,670	24	312,500	316,700	320,800
74	33,780	35,140	36,490	23	330,400	334,800	339,100
73	35,620	36,990	38,360	22	350,000	354,600	359,100
72	37,500	38,890	40,280	21	371,400	376,200	381,000
71	39,440	40,850	42,250	20	395,000	400,000	405,000
70	41,430	42,860	44,290	19	421,100	426,300	431,600
69	43,480	44,930	46,380	18	450,000	455,600	461,100
68	45,590	47,060	48,530	17	482,400	488,200	494,100
67	47,760	49,250	50,750	16	518,800	525,000	531,300
66	50,000	51,520	53,030	15	560,000	566,700	573,300
65	52,310	53,850	55,380	14	607,100	614,300	621,400
64	54,690	56,250	57,810	13	661,500	669,200	676,900
63	57,140	58,730	60,320	12	725,000	733,300	741,700
62	59,680	61,290	62,900	11	800,000	809,100	818,200
61	62,300	63,930	65,570	10	890,000	900,000	910,000
60	65,000	66,670	68,330	9	1,000,000	1,011,000	1,022,000
59	67,800	69,490	71,190	8	1,138,000	1,150,000	1,163,000
58	70,690	72,410	74,140	7	1,314,000	1,329,000	1,343,000
57	73,680	75,440	77,190	6	1,550,000	1,567,000	1,583,000
56	76,790	78,570	80,360	5	1,880,000	1,900,000	1,920,000
55	80,000	81,820	83,640	4	2,375,000	2,400,000	2,425,000
54	83,330	85,190	87,040	3	3,200,000	3,233,000	3,267,000
53	86,790	88,680	90,570	2	4,850,000	4,900,000	4,950,000
52	90,380	92,310	94,230	1	9,800,000	9,900,000	10,000,000
51	94,120	96,080	98,040				

**Note:** On subscriber lines with 4-party full selective tube-type subsets, or visual indicators or key equipment with cold cathode tubes (such as No. 21 type visual indicator or No. 103A key equipment) readings of between 25 and 45 volts should not be considered. See 5.10.

**TABLE D**  
**20,000-OHM WINDING — 24-VOLT SCALE**

METER READING (VOLTS)	RESISTANCE			METER READING (VOLTS)	RESISTANCE		
	TEST BATTERY VOLTAGE				TEST BATTERY VOLTAGE		
	19.4	20	20.6		19.4	20	20.6
20.6			0	10.2	18,040	19,220	20,390
20.4			196	10.0	18,800	20,000	21,200
20.2			396	9.8	19,590	20,820	22,040
20.0		0	600	9.6	20,420	21,670	22,920
19.8		202	808	9.4	21,280	22,550	23,830
19.6		408	1,020	9.2	22,170	23,480	24,780
19.4	0	618	1,238	9.0	23,110	24,440	25,780
19.2	208	833	1,458	8.8	24,090	25,450	26,820
19.0	421	1,052	1,684	8.6	25,120	26,510	27,910
18.8	638	1,276	1,914	8.4	26,190	27,620	29,050
18.6	860	1,505	2,150	8.2	27,320	28,780	30,240
18.4	1,086	1,739	2,392	8.0	28,500	30,000	31,500
18.2	1,318	1,978	2,638	7.8	29,740	31,280	32,820
18.0	1,556	2,222	2,888	7.6	31,050	32,630	34,210
17.8	1,798	2,471	3,152	7.4	32,430	34,050	35,680
17.6	2,046	2,727	3,410	7.2	33,890	35,560	37,220
17.4	2,298	2,988	3,678	7.0	35,430	37,140	38,860
17.2	2,558	3,255	3,954	6.8	37,060	38,820	40,590
17.0	2,824	3,529	4,234	6.6	38,790	40,616	42,430
16.8	3,096	3,809	4,524	6.4	40,620	42,500	44,380
16.6	3,374	4,096	4,820	6.2	42,580	44,520	46,450
16.4	3,658	4,390	5,122	6.0	44,670	46,670	48,670
16.2	3,950	4,691	5,432	5.8	46,900	48,970	51,040
16.0	4,250	5,000	5,750	5.6	49,290	51,430	53,570
15.8	4,556	5,316	6,076	5.4	51,850	54,070	56,300
15.6	4,872	5,641	6,410	5.2	54,620	56,920	59,230
15.4	5,194	5,974	6,754	5.0	57,600	60,000	62,400
15.2	5,526	6,315	7,106	4.8	60,830	63,330	65,830
15.0	5,866	6,666	7,466	4.6	64,350	66,960	69,570
14.8	6,236	7,027	7,838	4.4	68,180	70,910	73,640
14.6	6,576	7,397	8,220	4.2	72,380	75,240	78,100
14.4	6,944	7,777	8,612	4.0	77,000	80,000	83,000
14.2	7,324	8,069	9,014	3.8	82,110	85,260	88,420
14.0	7,714	8,571	9,428	3.6	87,780	91,110	94,450
13.8	8,116	8,985	9,856	3.4	94,120	97,650	101,200
13.6	8,530	9,411	10,290	3.2	101,200	105,000	108,800
13.4	8,956	9,850	10,750	3.0	109,300	113,300	117,300
13.2	9,394	10,300	11,210	2.8	118,600	122,900	127,100
13.0	9,846	10,770	11,690	2.6	129,200	133,800	138,500
12.8	10,310	11,250	12,260	2.4	141,700	146,700	151,700
12.6	10,790	11,750	12,700	2.2	156,400	161,800	167,300
12.4	11,290	12,260	13,230	2.0	174,000	180,000	186,000
12.2	11,800	12,790	13,770	1.8	195,600	202,200	208,900
12.0	12,330	13,330	14,330	1.6	222,500	230,000	237,500
11.8	12,880	13,900	14,920	1.4	257,100	265,700	274,300
11.6	13,450	14,480	15,520	1.2	303,300	313,300	323,300
11.4	14,040	15,090	16,140	1.0	368,000	380,000	392,000
11.2	14,640	15,710	16,790	.8	465,000	480,000	495,000
11.0	15,270	16,360	17,450	.6	626,700	646,700	666,700
10.8	15,930	17,040	18,150	.4	950,000	980,000	1,010,000
10.6	16,600	17,740	18,870	.2	1,920,000	1,980,000	2,040,000
10.4	17,310	18,460	19,620				

**TABLE E**  
**1000-OHM WINDING — 24-VOLT SCALE**

METER READING (VOLTS)	RESISTANCE			METER READING (VOLTS)	RESISTANCE		
	TEST BATTERY VOLTAGE				TEST BATTERY VOLTAGE		
	19.4	20	20.6		19.4	20	20.6
20.6			0	10.2	902	961	1,020
20.4			10	10.0	940	1,000	1,060
20.2			20	9.8	980	1,041	1,102
20.0		0	30	9.6	1,021	1,083	1,146
19.8		10	40	9.4	1,064	1,128	1,192
19.6		20	51	9.2	1,109	1,174	1,239
19.4	0	31	62	9.0	1,156	1,222	1,289
19.2	10	42	73	8.8	1,205	1,273	1,341
19.0	21	52	84	8.6	1,256	1,326	1,395
18.8	32	63	96	8.4	1,310	1,381	1,452
18.6	43	75	108	8.2	1,366	1,439	1,512
18.4	54	87	120	8.0	1,425	1,500	1,575
18.2	66	99	132	7.8	1,487	1,564	1,641
18.0	78	111	144	7.6	1,553	1,632	1,711
17.8	90	124	158	7.4	1,622	1,702	1,784
17.6	102	136	171	7.2	1,694	1,778	1,861
17.4	115	149	184	7.0	1,771	1,857	1,943
17.2	128	163	198	6.8	1,853	1,941	2,029
17.0	141	176	212	6.6	1,939	2,030	2,121
16.8	155	190	226	6.4	2,031	2,125	2,219
16.6	169	205	241	6.2	2,129	2,226	2,323
16.4	183	220	256	6.0	2,233	2,333	2,433
16.2	198	235	272	5.8	2,345	2,448	2,552
16.0	213	250	288	5.6	2,464	2,571	2,679
15.8	228	266	304	5.4	2,593	2,704	2,815
15.6	244	282	321	5.2	2,731	2,846	2,962
15.4	260	299	338	5.0	2,880	3,000	3,120
15.2	276	316	355	4.8	3,042	3,167	3,292
15.0	293	333	373	4.6	3,217	3,348	3,478
14.8	312	351	392	4.4	3,409	3,545	3,682
14.6	329	370	411	4.2	3,619	3,762	3,905
14.4	347	389	431	4.0	3,850	4,000	4,150
14.2	366	408	451	3.8	4,105	4,263	4,421
14.0	386	428	471	3.6	4,389	4,556	4,722
13.8	406	449	493	3.4	4,706	4,882	5,059
13.6	427	471	515	3.2	5,062	5,250	5,438
13.4	448	493	537	3.0	5,467	5,667	5,867
13.2	470	515	561	2.8	5,929	6,143	6,357
13.0	492	538	585	2.6	6,462	6,692	6,923
12.8	516	563	613	2.4	7,083	7,333	7,583
12.6	540	587	635	2.2	7,818	8,091	8,364
12.4	565	613	661	2.0	8,700	9,000	9,300
12.2	590	639	689	1.8	9,778	10,110	10,440
12.0	617	667	717	1.6	11,130	11,500	11,880
11.8	644	695	746	1.4	12,860	13,290	13,710
11.6	672	724	776	1.2	15,170	15,670	16,170
11.4	702	754	807	1.0	18,400	19,000	19,600
11.2	732	786	839	.8	23,250	24,000	24,750
11.0	764	818	873	.6	31,330	32,330	33,330
10.8	796	852	907	.4	47,500	49,000	50,500
10.6	830	887	943	.2	96,000	99,000	102,000
10.4	865	923	981				

TABLE F

MILLIAMMETER SCALE  
24-VOLT OFFICE BATTERY  
(68 OHMS CIRCUIT RESISTANCE)

METER READING (MILLI- AMPERES)	RESISTANCE		
	CENTRAL OFFICE BATTERY VOLTAGE		
	22	24	26
300	5	12	19
295	6	13	20
290	8	15	22
285	9	16	23
280	10	18	25
275	12	19	27
270	13	21	28
265	15	23	30
260	17	24	32
255	18	26	34
250	20	28	36
245	22	30	38
240	24	32	40
235	26	34	43
230	28	36	45
225	30	39	48
220	32	41	50
215	34	44	53
210	37	46	56
205	40	49	59
200	42	52	62
195	45	55	65
190	48	57	69
185	51	61	73
180	54	65	77
175	58	69	81
170	61	72	85
165	65	77	90
160	70	82	95
155	74	87	100
150	79	92	105
145	84	97	111
140	90	103	118
135	95	110	125
130	101	117	132
125	108	124	140
120	115	132	149
115	123	141	158
110	132	150	168
105	141	160	180
100	152	172	190
95	164	184	206
90	176	198	220
85	191	214	238
80	207	232	257
75	225	252	278
70	246	274	303
65	270	301	332
60	299	332	365
55	332	368	405
50	372	412	452
45	421	455	509
40	482	532	572
35	562	617	675
30	665	732	799
25	812	892	972
20	1,032	1,132	1,232
15	1,402	1,534	1,667
10	2,132	2,332	2,532
5	4,332	4,732	5,132

TABLE G

MILLIAMMETER SCALE  
48-VOLT OFFICE BATTERY  
(203 OHMS CIRCUIT RESISTANCE)

METER READING (MILLI- AMPERES)	RESISTANCE		
	CENTRAL OFFICE BATTERY VOLTAGE		
	47.5	48.5	49.5
300			
295			
290			
285			
280			
275			
270			
265			
260			
255			
250			
245			0
240		0	3
235	0	4	8
230	4	8	12
225	8	13	17
220	13	18	22
215	18	23	28
210	23	28	33
205	29	34	39
200	35	39	45
195	41	46	51
190	47	53	58
185	54	59	65
180	61	67	72
175	68	74	80
170	77	82	89
165	85	91	97
160	95	100	107
155	103	110	116
150	114	121	127
145	125	132	139
140	136	144	151
135	149	156	164
130	162	170	178
125	177	185	193
120	193	201	210
115	210	219	228
110	229	239	247
105	249	262	269
100	272	282	292
95	297	308	318
90	325	336	347
85	356	368	379
80	390	404	415
75	430	444	457
70	475	490	504
65	527	544	559
60	590	606	622
55	660	679	697
50	747	767	787
45	852	876	897
40	987	1,010	1,034
35	1,115	1,184	1,211
30	1,382	1,414	1,447
25	1,697	1,737	1,759
20	2,172	2,222	2,272
15	2,965	3,032	3,097
10	4,547	4,647	4,747
5	9,297	9,497	9,697

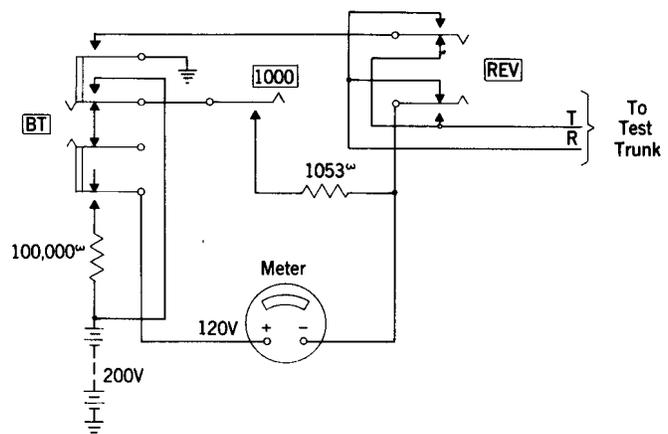
**TABLE H**  
**TEST NUMBERS, RANGES AND RESISTANCE LIMITS**

RANGE	BANDS - 1000 OHMS			CROSS CONNECTION	SHORT AND RING GRD.	TEST NUMBERS*	
	LOW-0**	MEDIUM-1**	HIGH-2**			TIP AND RING GRD.	FOREIGN EMF
A	0-20	20-40	40-80	Option	1	4	Not Used
	0-40	40-80	80-160	Normal			
	0-80	80-160	160-320	Option			
B	0-80	80-160	160-320	Option	2	5	7
	0-160	160-320	320-640	Normal			
	0-320	320-640	640-1250	Option			
C	0-320	320-640	640-1250	Option	3	6	8
	0-640	640-1250	1250-2500	Normal			
	0-1250	1250-2500	2500-5000	Option			
D	0-640	640-1250	1250-2500	Option	Not Used	Not Used	9
	0-1250	1250-2500	2500-5000	Normal			
	0-2500	2500-5000	5000-10,000	Option			

\* Test number to be dialed after connection to line insulation test equipment has been established.

\*\* These code numbers are used on the teletypewriter record. When a retest is made following a failure, 3 means that the insulation resistance for the retest condition is outside the test range.

200-volt battery is connected through 100,000 ohms and the 120-volt winding of the voltmeter to the ring side of the line and ground is connected to the tip. To prevent bell tapping allow a few seconds to elapse to permit the line to be charged through this resistance and then operate the 1000 key. This applies the 200-volt condition to the line through 1053 ohms in parallel with the voltmeter and the 100,000-ohm resistor. Observe the voltmeter deflection. A steady deflection on the meter indicates a breakdown. The operation of the REV key in addition to the BT and 1000 keys as indicated above supplies the test to the tip instead of the ring of the line. See Fig. 6.



**Fig. 6—Test for Breakdown of Line Insulation**

**Note 1:** The maximum reading on the breakdown test occurs when the insulation breaks down sufficiently to ground the line and is in the order of 30 volts.

**Note 2:** Do not apply this test to lines with tube-type subscriber sets since the tubes make the test ineffective.

#### Third Wire Test

**5.15** The third wire test applies only to manual offices in the same building, or step-by-step

offices when the test cabinet is connected directly to a test connector.

**5.16** To test the sleeve of a subscriber line for a cross with another line or for a cross with battery or ground operate the 3WT key (see Fig. 7). This disconnects the central office battery or ground from the test circuit sleeve and connects the voltmeter circuit to the sleeve for making the desired test. The 20,000, 1000 and VM REV keys can be used in this test. Central office battery through the milliammeter cannot be connected to the sleeve.

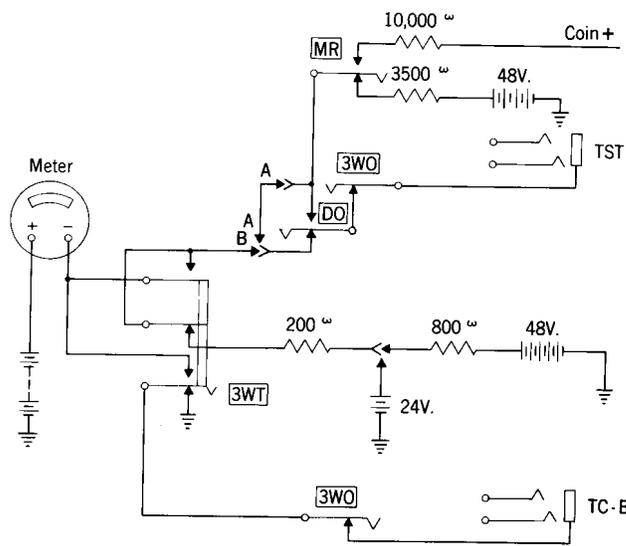


Fig. 7—Third Wire Test

#### Check of Central Office Subscriber Line Circuit Other Than Crossbar Office (See Fig. 8)

**5.17** *Line with Battery on Ring, Ground on Tip:* After connection to the subscriber line is established, operate the third wire open key 3WO to cause the release of the cutoff relay and the connection of the line relay to the line. On a connection to a test distributor trunk the TD key must be operated to the "hold" position and the

HOLD key in the trunk must be normal. Make a voltmeter test to determine the proper electrical condition on the tip and ring of a line with the line relay connected to the line.

**5.18** Operate the T key which bridges the telephone circuit across the test circuit. When the line is thus bridged the line relay should operate and be indicated by the answering of the switchboard operator or by the reception of dial tone.

**5.19** Restore the T key to release the line relay and the 3WO key to operate the cutoff relay.

**5.20** *Line With Battery on Tip, No Ground on Ring:* The check of this type of line is the same as described in 5.17 through 5.19 except that the LRP -RG key is also operated. The operation of the LRP RG key connects ground through a resistor to the tip of the circuit causing the operation of the line relay.

**5.21** *Line With Battery on Ring, No Ground on Tip:* The check of this type of line is the same as described in 5.20 except that the REV key is also operated to connect the ground through the LRP RG key to the ring side of the line.

**5.22** After completing the operations outlined in 5.18, 5.20 and 5.21 and receiving dial tone, a call can be dialed through the subscriber line circuit under test by operating the dial.

**Note:** When using this test always dial numbers which will not cause a message registration.

#### Check of Crossbar Central Office Subscriber Line Circuit

**5.23** *The central office portion of a crossbar office subscriber line cannot be tested* via the test trunks since the hold magnet that establishes the connection to the line on the line link frame also disconnects the line relay. In order to make this test it is necessary to order the line up on an MDF test trunk.

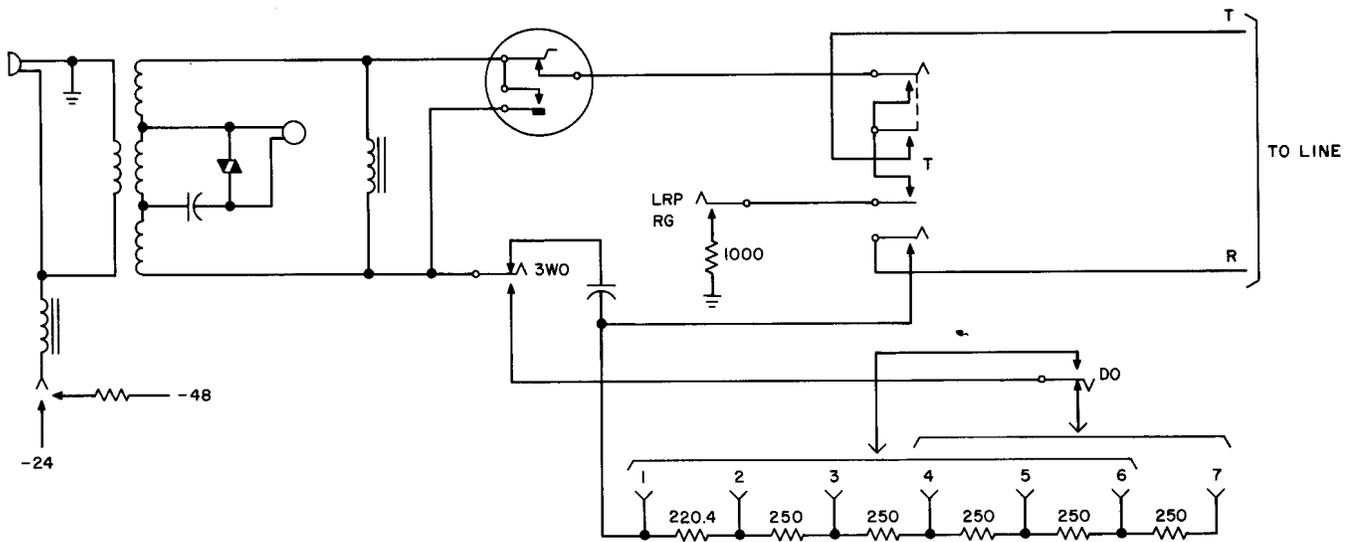


Fig. 8—Check of Central Office Subscriber Line Circuit

**5.24** *To check the F cross connection* at the block relay frame in a No. 1 crossbar office and the number group frame in a No. 5 crossbar

office, order up or dial the line to be checked and operate the 3WO key. The following voltmeter indications apply:

VOLTMETER INDICATION	NUMBER ARRANGED FOR	
	NO. 1 CROSSBAR	NO. 5 CROSSBAR
-48V Battery on ring	Ring party, individual line or last line of hunting group	Ring party or individual dual line (nonunigauge)
-24V Battery on ring	—	Ring party or individual line (unigauge)
-48V Battery on tip	Tip party	Tip party (nonunigauge)
-24V Battery on tip	—	Tip party (unigauge)
Direct ground on ring	PBX hunting line	PBX hunting line, including the last line of hunting group (nonunigauge)
1000-ohm ground on ring	—	PBX hunting line, including the last line of hunting group (unigauge)

**5.25** *To Dial on a Subscriber Line:* After a test connection has been established from the test cabinet, over an IN-OUT cord on an MDF test trunk, operate the 3WO and T keys and check that dial tone is heard. Make a voltmeter test to verify the proper electrical condition on the tip and ring of the line. If it is desired to verify that a subscriber in a No. 1 crossbar office can complete a call it will be necessary to dial a complete number.

**Note:** When using this test always dial numbers which will not cause a message registration.

**Test of Subscriber Lines Equipped with End Point Contactors**

**5.26** Establish connection to the idle subscriber line. On lines not equipped with tube-type subsets, operate the MET VM key. On lines

equipped with tube-type subsets, operate the 60V key in addition to the MET VM key. An operated contactor is indicated by a 270,000- or 330,000-ohm bridge placed across the subscriber line. Presence of this bridge on the line results in the following voltmeter readings.

TYPE OF LINE UNDER TEST	READING (VOLTS)
Lines not equipped with tube-type subsets	Approx 27 for 270,000 $\omega$
	Approx 23 for 330,000 $\omega$
Lines equipped with tube-type subsets	Approx 8.0 for 270,000 $\omega$
	Approx 6.5 for 330,000 $\omega$

#### 4-Party Full Selective Tube-Type Subscriber Set Test

**5.27 Test on Ring Side of Line:** Before checking for the presence of a station on the line observe the reading on the 120-volt scale of the meter with all keys normal. If the reading is 67 or more (indicating insulation resistance of 50,000 ohms or less) the test for the presence of the subscriber station cannot be made. If the reading is less than 67 volts (indicating insulation resistance of more than 50,000 ohms) make note of the exact reading. See Table B. The presence of the station on the line can then be tested for as covered in the following paragraphs.

**5.28** To test for a positive station, operate the +STA key and note the meter reading. To test for a negative station, operate the -STA key and note the reading. A schematic of the connection with the +STA key operated is shown in Fig. 9.

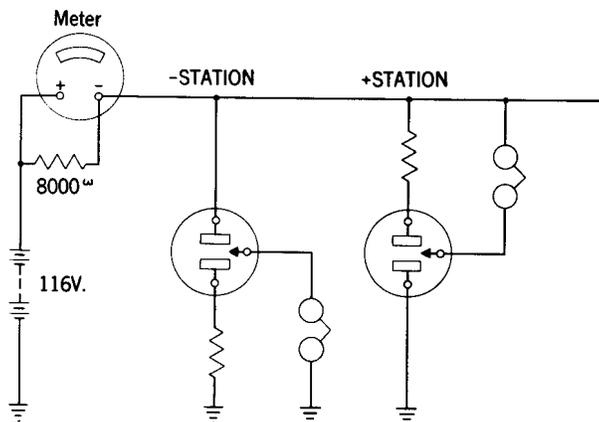


Fig. 9—Test for Tube-type Station

**5.29** The readings obtained on the 120-volt scale of the meter will then have the significance shown in Table B depending upon the voltmeter reading obtained on that scale prior to the operation of the +STA or -STA keys.

**5.30** The tests outlined in 5.27 through 5.29 are based on a test of 4-party full selective stations. To verify that two stations of the same polarity on the same side of the line as on 8-party lines are properly connected it will usually be desirable to ring each of them and check with the subscriber. However, it should be understood that in this case the tests for tube-type sets with a voltmeter can be relied upon to indicate that at least one station is connected to the line.

**5.31 Test on Tip Side of Line:** To test for stations on the tip side of the line operate the REV key and proceed as outlined in 5.27 through 5.30.

#### Tests of Lines Equipped with Cold Cathode Tube Visual Indicator or Key Equipment Having Cold Cathode Tubes (Such as No. 21 Type Visual Indicator or No. 103A Key Equipment)

**5.32 Line Not Known to be Equipped With Tubes:** Make a voltmeter test with the 100,000-ohm winding of the voltmeter as outlined in 5.04. If a steady deflection of between 12.5 and 45 volts is obtained when the G key is operated, determine whether this deflection is due to line insulation resistance or to the presence of a tube on the line by operating the 20,000 key. If a reading is obtained with the 20,000 key operated it indicates a leak on the line. If no leak is indicated then the reading obtained on the 100,000-ohm scale can be considered an indication that a tube is on the line.

**5.33** If the test cabinet is equipped with 4-party full selective station testing feature for tube-type sets, proceed to check that the station is on the line as follows: Observe the reading on the 120-volt scale of the meter with all keys normal. If the reading is 67 volts or more (indicating insulation resistance of 50,000 ohms or less) the test cannot be made due to low insulation resistance. If the reading is less than 67 volts, operate the -STA key where No. 103A or similar equipment is used or operate the +STA key and G keys where the No. 21 type visual indicator or similar equipment is used. Note the reading obtained on the 120-volt scale of the meter. A deflection of more than 17

volts is always an indication that a tube is on the line.

**5.34 Line Known to be Equipped with Tube:**

Make the voltmeter tests as described in 5.04. The presence of the tube can also be checked for as outlined in 5.32 and 5.33.

**Dial Test**

**5.35** In order to communicate with the subscriber or employee operate the RCCI and T keys as covered in 5.44. In addition to establishing a talking connection the operation of the RCCI key disconnects 100-volt test battery from the 120-volt winding of the voltmeter.

**5.36** Operate the DT key to the intermediate or "set" position. With the RH key operated adjust the rheostat so that the voltmeter needle is at 10 on the 24-volt scale.

**5.37** Operate the DT key to the "dial" position. This connects dial tone over the test trunk to the subscriber line to notify the subscriber or employee to dial the digit "0" and restore the voltmeter reading to 0. When pulsing starts, the voltmeter needle moves to a position which is a measure of the dial speed. Read the dial speed directly on the 24-volt scale just prior to the falling off which occurs at the end of the series of pulses.

**5.38** In order to repeat the dial test restore the DT key to normal and request a repeat test. Proceed as in 5.36 and 5.37. Restore the DT key to normal at the end of the test thereby restoring the circuit to normal.

**Use of Receiver Off-Hook Tone or Howler Tone**

**5.39** After connection to the receiver off-hook tone connector has been established as outlined in 3.37 through 3.40, operate the HT key or the HT1 or HT2 key on the tone connector. This connects the "T" and "R" from the telephone and test circuit to the transformer in the receiver off-hook tone connector circuit for listening and challenging. Challenge on the line and if no reply is received in response to the challenge and if the supervisory (green) lamp is extinguished, apply the tone to the test trunk by operating the ROHT or HLR key on the tone connector. The red lamp flashes while the tone is being applied to

the line and lights steadily when the tone cycle is completed.

**Caution:** To avoid noise in the cables in which the test trunks appear the howler tone will be applied only to lines terminating in the office in which the test cabinet is located.

**Caution:** Howler tone, where still used, shall not be applied on trunks to a PBX due to the possibility of the attendant listening in during the tone cycle.

**5.40** If the subscriber restores his receiver while the tone is being applied, the tone is automatically disconnected. Under this condition, or if the subscriber restores his receiver after the tone cycle is completed and before the ROHT or HLR key is restored to normal, the green lamp lights steadily and the buzzer sounds as an audible signal (if the BUZ key is operated).

**Monitoring**

**5.41 To monitor on a circuit** operate the MON key. This establishes a connection without a dc bridge across the tip and ring of the test jack and MDF jack for monitoring without affecting supervision on the connected circuit.

**5.42** To monitor on a crossbar subscriber line operate the MON key only. Monitoring a line over a test connection established through switches will cause it to reflect a busy condition and render the line unable to originate or receive calls. To monitor a line without making it busy it must be ordered up on an MDF test trunk and connected with an IN-OUT cord at the main frame. When monitoring on a test connection set up through a test distributor, the T key must be operated after the MON key to complete the monitoring connection.

**5.43** To monitor on a subscriber line without making it busy also operate the 3WO key except as modified in 5.42. Do not operate the 3WO key before connection with the line has been established.

**Supplying Talking Battery and Talking on Test Circuit**

**5.44** When it is necessary to supply talking battery through the test circuit, operate the T and

RCCI keys. This supplies central office battery through the repeating coil and milliammeter to the ring side of the line. Observe the meter for supervision on the line (see Fig. 10).

**5.45 To Listen Only, or to Talk without Supplying Talking Battery:** Operate the T key. This connects the tip and ring of the test circuit to the telephone circuit through a capacitor.

**Transmission Tests**

**5.46** To make a transmission test with an employee or a subscriber at a station, operate the RCCI key. Also operate the TMT key, except where 1500-ohm range test trunks are used and the actual resistance of the test trunk is at or near this value. In these cases, the test trunk will provide sufficient transmission loss for the test. Operation of the RCCI key supplies battery and ground to the line. The TMT key, when operated, cuts an attenuator into the transmission path to increase the loss so that the transmission level is about equal to that received by the subscriber on a toll connection (see Fig. 11).

**5.47** Proceed with the test by talking to the person at the station and observe the following:

- (a) Talk directly into the transmitter and not across or around it.
- (b) The lips should almost touch the mouthpiece.
- (c) The tone of voice should be a natural conversational tone, neither too low nor too soft, and therefore one that can be maintained during the course of the day. Supervision should be given to the person at the station to insure his talking directly into the transmitter at all times.

**5.48** In judging the conversation, consider the following:

- (a) Necessity for repetition.
- (b) Volume.
- (c) Quality, that is, the distinctness or clarity of the conversation. Quality may be poor on transmitters even though the volume is good, or vice versa.

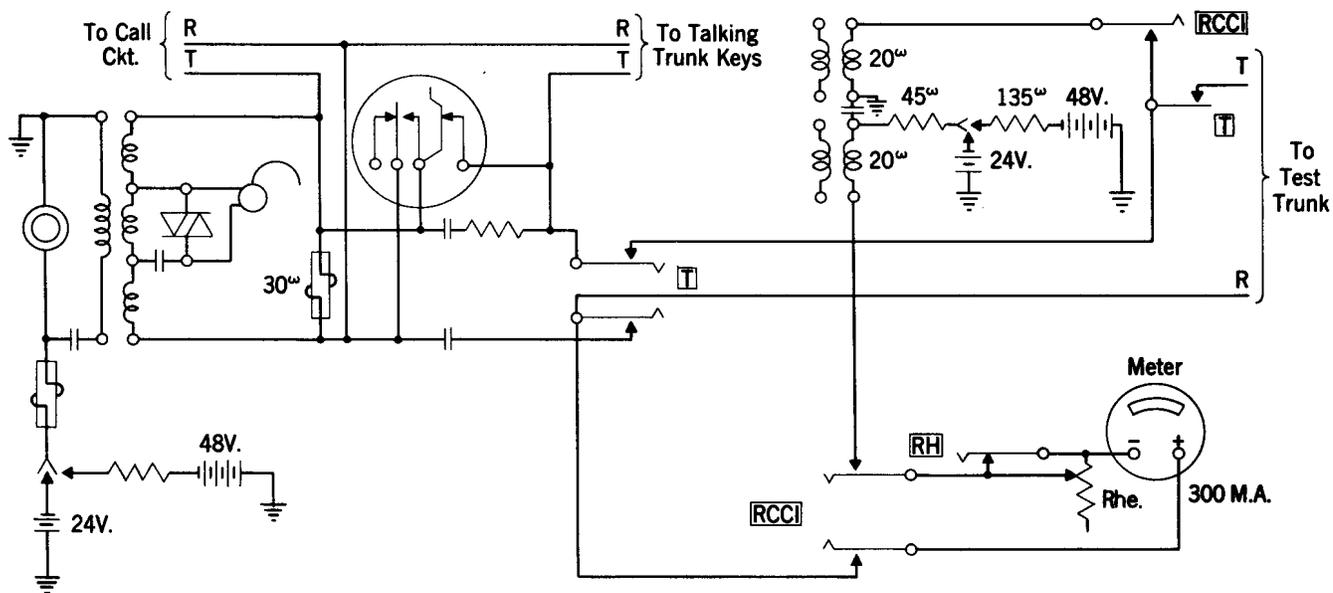


Fig. 10—Supplying Talking Battery to Test Trunk

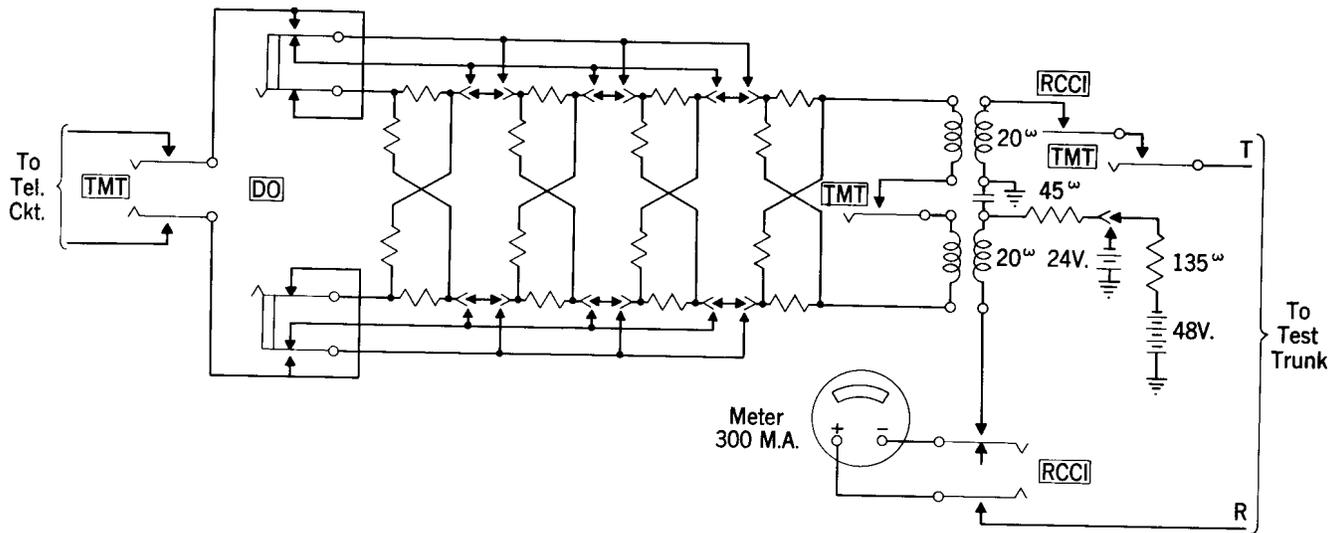


Fig. 11—Transmission Test

**5.49 To Test the Station Transmitter and Cords for Burning:** Restore the TMT key and operate the T key. Request the employee at the station to listen for burning noises while he shakes the cords and checks the transmitter by blowing gently into it. The testing employee should also listen.

#### Coin Collector Relay Test

**5.50** Use the primary test cord for coin collector relay tests. Request the employee at the station to remove the coin collector housing, trip the coin trigger, and report the type of coin relay. The older type 60-volt relays are two-coil relays while the newer type 50-volt relays have only one coil. The nonoperate and operate values are given below and should be applied as described for the type of relay under test.

	NONOPERATE	OPERATE
60-Volt Relay	40 ma	60 ma
*50-Volt Relay	40 ma	48 ma

\*Manufacturing requirements for the 50-volt relay call for a nonoperate value of 42 ma and an operate value of 46 ma. For the purposes of this test, these values have been broadened to 40 ma and

48 ma, respectively, to aid in reading these values on the test meter.

#### Nonoperate tests—All type relays

- Operate the rheostat key, RH, and adjust the rheostat to include maximum resistance.
- Operate and hold the COIN- key while adjusting the current flow to the nonoperate value. Release and reoperate the COIN-KEY several times. The milliammeter should show a deflection each time the key is operated. No deflection indicates that the coin relay has operated on the previous application of nonoperate current.
- Operate and hold the COIN+ key. A milliammeter deflection of the nonoperate value should be obtained. Release and reoperate the COIN+ key several times. The milliammeter should show a deflection each time the key is operated. No deflection indicates that the coin relay has operated on the previous application of nonoperate current.

#### Operate tests—60-volt relays

- Operate and hold the COIN+ key while adjusting the current flow to the proper operate value taking care that the operate value

is not exceeded during adjustment. If the operate value should be exceeded, signal the employee and after requesting him to retrip the coin trigger, repeat the adjustment. On long loops where the operate value cannot be obtained from the test desk restore the rheostat key and repeat the test. Release and reoperate the COIN+ key. If the relay is properly adjusted, no deflection will be obtained. Signal the employee and ascertain that the relay operated properly. If it did, request employee to trip the coin trigger again.

(e) Operate and hold the COIN- key. The milliammeter should indicate the same current flow as obtained in item (d). Release and reoperate the COIN- key. If the coin relay is properly adjusted, no deflection will be obtained on this test. Signal the employee and ascertain that the relay operated properly.

#### **Operate tests—50-volt relays**

**Note:** The 50-volt coin relay is self-restoring and will result in the station ground being removed after the operate and slow-release holding period of the relay. Due to this feature, it will not be possible to obtain a steady reading of the operate current being applied.

(f) Operate and hold the COIN+ key. Gradually increase the current flow, closely observing the milliammeter reading while this is being done. The coin relay should operate, as indicated by the meter needle returning to zero, before the operate value is exceeded. Signal the employee and ascertain that the relay operated properly. If it did, request employee to trip the coin trigger again.

(g) Reset the rheostat to include maximum resistance. Operate and hold the COIN- key. Adjust the current flow to the nonoperate value. Gradually increase the current flow, closely observing the meter reading while this is being done. The coin relay should operate, as indicated by the meter needle returning to zero, before the operate value is exceeded. Signal the employee and ascertain that the relay operated properly.

#### **Tests of Coin Collector Ground Connections**

**5.51** In order to insure the correctness of the ground connection on coin collectors, the following test may be made.

- (a) Request the employee at the station to remove the coin collector housing and place a short across the tip and ring of the line.
- (b) Make a resistance measurement of the conductor loop (see 5.09).
- (c) Ask the employee to remove the short and connect the station ground to the tip side of the line by using a test jumper to bypass the coin relay.
- (d) Make a resistance measurement of the tip ground (see 5.09).

The resistance of the tip ground is the difference between the measured resistance (d) and one-half of the measured conductor loop (b).

For example:

- (1) Conductor loop 600 ohms as measured in (b) above.
- (2) One-half 600 ohms = 300 ohms.
- (3) Tip ground measurement (d) of 340 ohms minus 300 ohms = 40 ohms ground resistance.

**Note:** Ground resistance readings should be within the limits prescribed locally.

#### **Ringling**

**5.52** The ringling current is normally supplied to the ring side of the line when the ringling key is operated. By operating the REV key and then the ringling key, ringling current is supplied to the tip side of the line. If the test trunk is equipped with a test trunk ringling circuit operate the MR and DO keys before operating the ringling key. In addition, on connections to a test distributor it will be necessary to operate the TD key to the "hold" position with the trunk HOLD key normal before operating the ringling key.

### To Ring Bells on a Party Line Having a Receiver Off the Hook

**5.53** Use the LRP RG (remove ground) key to disconnect the ringing ground from the line in order to ring the bells on a party line on which the ringers are connected to ground. Operate the LRP RG key, then the ringing key to attract the attention of a subscriber who has left his receiver off the hook. This applies whether the ringers are connected through capacitors or through cold cathode tubes but does not apply to lines equipped with relay-type subscriber sets.

### Testing Subscriber Lines Equipped With Pole-Mounted Message and Signal Repeaters (J98619A)

**5.54** Establish a test connection to the line in the normal manner through the line number or directory number. Apply positive coin potential (see Note) to the line under test for less than 10 seconds to operate the bypass circuit in the repeater. When two units are used in tandem, the positive coin potential must be applied sequentially to both units. After the bypass mode is established, the line may be tested for tip and ring continuity, grounds, shorts, and crosses. When testing in the bypass mode has been completed, application of a ringing signal to the line will restore the line to normal. A 3-minute timer is provided to restore the line to normal in the event a ringing signal is not applied to the line.

**Note:** Usually the COIN+ key applies positive coin potential to the test circuit. In some central offices and test cabinets, the polarity of the coin potential is reversed; therefore, operation of the COIN- key will be required to apply positive coin potential.

**5.55** ▶A test cabinet may be equipped with a % BK-TMS key and associated jacks. This permits percent break and transmission measurements to be performed using an external measuring test set. Plug the test set into the proper jack and then operate the % BK-TMS key to the corresponding position to transfer the line under test to the test set (see Fig. 2). When a remote testing, signal and timer unit (J98619E) is provided in the repeater cabinet, transmission and dial signaling tests can be made with test instruments using the % BK and TMS jacks. After establishing a bypass mode for any preceding dial long line unit, the application of positive coin potential to the line for more than

25 seconds activates the J98619E unit. This unit provides a 20-second interval of 1000 Hz milliwatt tone for a period of approximately 20 seconds. The tone is followed by 20 seconds of simulated dial pulses at 11 PPS and a constant percentage break between the limits of 59.7 and 62.3 percent. The received level of the milliwatt signal and percentage break measurements should be made relative to the value measured at the time of installation or when a line is equipped and placed in service.◀

### Testing Subscriber Lines Equipped With Unigauged Range Extender Circuits, No. 5 Crossbar Office

**5.56** Establish a test connection to the subscriber line in the normal manner. Consult the line card record to determine whether the line is an extended unigauged range line. (If the line card record is not available, see Notes 1 and 2). Operate the REX, T, and RCCI keys before talking on the test connection. If the test connection is at the MDF with a main frame test cord, see Note 3.

**Note 1:** The 3WO key may be used to verify an extended unigauged range line. Individual lines and the ring party of 2-party lines have -24 volts on the ring side; tip party lines have -24 volts on the tip side. PBX trunks have 1000 ohms of ground on the ring side.

**Note 2:** Testing a busy extended unigauged range line will register approximately -65 volts on the position meter from the -72 volt talk battery. This voltage may be read on the ring by operating the FEMF and VM REV keys with the MON key normal.

**Note 3:** When testing IN toward the central office on a unigauged extended range line, the number called should be the balance test line or the milliwatt supply to prevent an unbalance (and subsequent repeater squeal) in the unigauged range extender.

### Testing Subscriber Lines Equipped With UI Carrier System

**5.57** Limited testing is possible on *carrier-derived* lines. Establish a test connection to the carrier-derived line in the normal manner. (Consult the line card record.) Continuity and leakage tests may be performed in the usual manner up to the *input* of the central office carrier equipment. (A

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2-microfarad capacitor is bridged across the tip and ring of the line at input.) Ring the station and make normal talking tests with the customer. These tests are possible depending on the condition of the line. If physical line trouble is suspected, establish a test connection in the normal manner to the associated physical line. (Consult the line card record.) Test procedures on the physical line are the same as those used on regular individual subscriber lines.

### Testing Subscriber Lines Equipped With DK1 Circuit Pack Range Extender

**5.58** This range extender is a solid-state design of a dial long line circuit. It is used on subscriber lines over 30 kf from the central office, with as much as 1800-ohm conductor loop resistance. The LTD can make voltmeter tests on subscriber lines through the DK1 circuit pack without having to use an MDF test trunk.

**5.59** Establish a connection to the subscriber line in the normal manner. With the G key operated, a meter deflection of 37.5 to 42 volts should be measured on the 120V scale. Operate the 60V key, and with the G key still operated, a meter deflection of less than 4.0 volts should be measured on the 60V scale. A drop from about 40 volts to about 4.0 volts when the 60V key is operated is an indication that a range extender is in series with the line. In addition, reasonably accurate tip to ring leakage measurements, as well as loop continuity tests, may be made while the 60V key is operated. The station may be rung in the normal manner.

**5.60** Further tests for correct operation of the range extender may be made when the station is off-hook or 1800 ohms is bridged across the tip and ring of the cable pair at the MDF. Operate the RCCI, T, and REV keys. With each operation of the REV key there should be a meter deflection of approximately 30 ma for about 1/2 second, followed by a drop back to about 22 ma. Subsequent operations of the REV key should give the same deflections.

### ◆ Testing Coin Telephone Sets Modified for DTF, Multi-slot (200-Type) and Single-slot (1A- and 1C-Type). (See Fig. 12 and 13)◆

**5.61** Establish a connection to the line to be tested. Perform continuity and leakage tests

in the usual manner. Note the absence of ground on the tip. Only normal leakage should be present.

**5.62** Test the central office line relay to verify it operates to provide DTF service.. Procedure for testing the line relay of DTF lines is the same as the procedure for testing loop start lines described in 5.17 through 5.20 and in 5.23 of this section.

**5.63** Test for coin ground closure by ringing the station and requesting the station attendant to deposit coins equal to the initial rate. Disconnect talking battery and ground by restoring the RCCI and T keys. Operate the REV key. The test meter will indicate a coin ground on the tip with the station on-hook and on both tip and ring with the station off-hook. Operate the RCCI key. With RCCI and REV keys operated, -48-volt or -24-volt local office talking battery is connected to the tip through the test meter with the ring lead open. The test meter will indicate the tip ground. Restore RCCI and REV keys. Operate the COIN- key to return the coins. (See Note in 5.54). If coins cannot be returned while making any coin test, arrange for recovery of coins or reimbursement to attendant as covered by local procedures.

**5.64** Single-slot sets and some multi-slot sets include a *ground removal relay*. This relay reduces noise by removing the unbalancing ground at the station during conversation. A modification of the local test cabinet consists of (a) applying COIN+ or COIN- potential to the tip lead only, and (b) grounding the ring lead through 1780 ohms when the G key is operated, (See Fig. 12). Test the ground removal relay as follows:

(a) With the connection established, operate the RCCI and T keys to supply talking battery and ground. Request attendant to deposit coins equal to the initial rate while remaining off-hook. Request attendant to delay a few seconds before depositing coins to permit time to prepare for the test. During the pause, operate the COIN- and G keys. This connects coin return battery to the tip and grounds the ring through 1780 ohms.

(b) The ground removal relay (A) was operated over loop current when the talking connection with station attendant was established. Contacts of the A relay opened the coin relay ground path. Operation of the COIN- and G keys will apply coin return potential to the tip and resistance

ground to the ring. The A relay will either hold or release and then reoperate during the change from talk battery to coin return battery. Under these conditions, the test meter should read some value greater than 20 ma. With the coin relay ground path open, there should be no change in meter reading when coins are deposited.

(c) Wait sufficient time for coins to be deposited, then verify their presence in the hopper by releasing the T and RCCI keys and then releasing the COIN- and G keys in that order and operating the REV key. Since the ground removal relay is in series with the ring lead, the relay releases and a coin ground is indicated on the tip. Return the coin in the normal manner.

**5.65 Failure of the ground removal relay to operate** as described in 5.64 will cause the test meter current to increase momentarily to some value over 45 ma. when coins are deposited. With the ground path intact, the coin relay should operate to automatically return the coins. This will cause test meter current to return to the value greater than 20 ma. described in 5.64 (b). If the loop is near maximum length, the coin relay may not operate, since it is in parallel with the station transmitter circuit. In this case, test meter current will remain near 45 ma. If this happens, return coins in normal manner by operating the COIN- key with the G key normal.

**5.66 Testing the Chute Electromagnet in Multi-slot Sets:** When a multi-slot set is in the talking mode, a single nickel deposit is held in the chute. This is caused by conduction of a diode. The diode shunts the chute magnet and prevents it from operating. To test the diode and magnet, establish a connection and request attendant to deposit a single nickel. While still supplying talking battery and ground, operate the REV key. With battery potential reversed, the diode should not conduct. Loop current should operate the chute magnet to drop the coin in the hopper. Read the coin ground on the tip to verify proper action has occurred, and return the coin.

**5.67 Testing the Totalizer Shunt Diode in Single-slot Sets:** Single-slot sets contain a diode which shunts the totalizer. This diode prevents the "readout" (coin identifying beep tone)

of a single nickel deposit unless a positive potential of sufficient value is applied to the ring lead. Test the diode by establishing a connection and requesting station attendant to deposit a single nickel while keeping the station off-hook.

(a) With the RCCI and T keys operated, listen for a readout when the coin is deposited. If the diode is functioning properly, no readout will be heard.

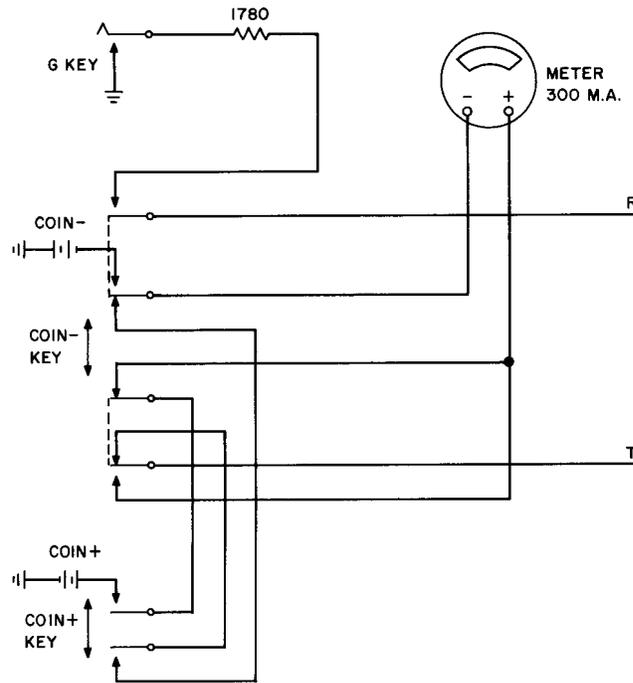
(b) Operate the COIN- key to return the coin and request the coin be redeposited. While keeping the T and RCCI keys operated, operate the REV key. With battery polarity at the diode reversed, the diode should become nonconducting and the readout should be heard. Return the coin.

**5.68 Testing the Silicon Controlled Rectifier in Single-slot Sets (See Fig. 13):** A silicon controlled rectifier (Q2) is in parallel with the totalizer initial rate contacts (T1). This arrangement permits the return of a single nickel deposit. A high negative voltage triggers the SCR (silicon controlled rectifier) causing it to conduct to close the coin relay ground path. Test to verify the SCR is triggered only by a high negative voltage.

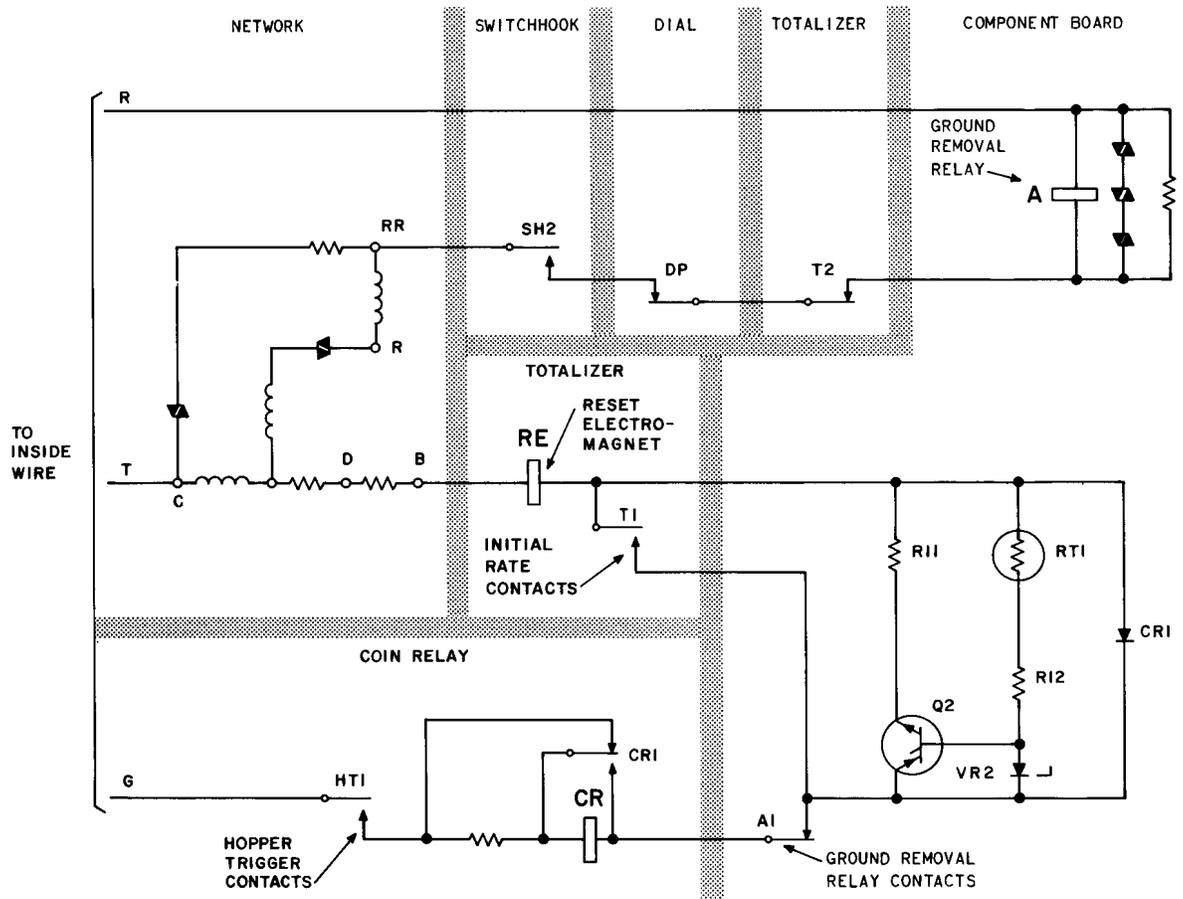
(a) Request station attendant to deposit a single nickel. After the coin is deposited, restore all operated keys and operate the REV key. A coin ground on the tip with the station on-hook and on both tip and ring with the station off-hook shows at least one of the diodes, CR1 and VR2, is conducting. Restore REV key.

(b) Operate the REV and RCCI keys to apply -48 or -24 volts of talking battery to the tip with the ring open. No current reading above normal leakage should be obtained if the SCR does not trigger and if diodes CR1 and VR2 remain nonconducting.

(c) Return the coin by restoring the REV key and operating the COIN- key to apply coin return potential to the tip to trigger the SCR. Failure to return the coin indicates a failure in the SCR or one or more of the circuit components paralleling the SCR. These items are shown on the component board, Fig. 13.♦



▶ Fig. 12—Coin—, Coin+, and G Key Circuits for Testing Coin Telephone Sets Modified for DTF ◀



◆ Fig. 13—Operating Paths of Ground Removal and Coin Relays in Single-Slot Coin Telephone Sets Modified for DTF ◆