COMMON SYSTEMS
LOCAL TEST CABINET NO. 2
TEST SET CIRCUIT
TEST BATTERY SUPPLY JACK CIRCUIT
FOR TESTING SUBSCRIBER LINES AND TRUNKS

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 Added arrangement for supplying battery and ground at M.D.F. for use in making breakdown tests.

B. CHANGES IN APPARATUS

B.1

Superseded	Superseded by	Added
4 - 110 Plugs Figs. 2, 3, & 4	4 - 310 Plugs	1 - W4AL Cord with 289A and 301A Plugs
1 - 109 Plug Fig. 4	1 - 309 Plug	3 - 13B Res. Lamps Fig. 8
		238 Type Jack Fig. 8

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The specification numbers have been removed from the patching cords and the assembly code numbers added. In Figs. 2, 3 and 4 the 109 and 110 plugs are shown as 109 or 309 and 110 and 310, respectively, and the change recorded in Note 108. Fig. 7 is added.

D.2 Fig. 8 and Note 109 are added.

D.3 Prior to Issue 3-D the title was as follows:

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D.4 In Note 106 "8B" is changed to "13B or equivalent".

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is to be used primarily for making voltmeter and out-of-order tests on the subscriber line and trunk plant in small offices where the expense of providing more elaborate testing means of this nature would not be warranted. Included in this class of exchange are small step-by-step offices and manual offices equipped with multiple or nonmultiple magneto switchboards or with common battery switchboards.

This test set may also be used at the main frame in larger offices, to supplement the local test desk testing facilities.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.1 To provide means for patching the test cabinet to the line under test. In manual offices, the test set ordinarily is patched through the switchboard to the line, flexible patching and jack arrangements being provided to match with the type of jack and plug used in the switchboard. In dial offices the test set is patched through the main frame to the line, using a main distributing frame patching cord. In some manual offices, likewise, the test set may be used at the main frame, and in such cases connection is made as described for dial offices.

3.2 To provide means for ringing over the line under test, and for talking between the test man and the subscriber station. In manual offices, when the test set is located at the switchboard, a switchboard cord is plugged into the test set, and access to the line is gained through the (TALK) key. Ringing current and talking battery are supplied by the switchboard cord. For talking purposes, the testman uses either the operator's telephone circuit or an extension plugged up on the other end of the switchboard cord.

In step-by-step offices, the test man will use a wall set or a hand set connected to another line, or a hand set plugged into a connector, and will dial through the connector to the multiple of the line under test. From this point, connection to the line conductors will be made through the M.D.F. cord and the (TALK) key of the test set. The connector supplies ringing current and talking battery.

3.3 To provide means for making voltmeter tests for:

3.31 Grounds

3.32 Short-Circuits

3.33 Insulation Breakdown

3.34 Resistance (i.e., Resistance Measurements)

3.35 Continuity

3.36 Capacity (by Ballistic Method)

The keys involved in these tests are the (REV), the (G) and the (BT-RG).

3.4 To provide means for opening the return ground path when ringing current is applied to party lines having grounded ringers. This feature makes it possible to ring to the ground at a station whose receiver is off the hook, in an attempt to have the receiver restored. For this test, the "Remove Ground" feature of the (BT-RG) key is used.

3.5 To provide means for making breakdown tests at the M.D.F.

4. CONNECTING CIRCUITS

4.1 Cord circuit for magneto switchboards 105A and 105B.

4.2 Cord circuit for switchboard No. 11.

4.3 Line circuit for magneto switchboard No. 105A and 105B.

4.4 Line circuit for switchboard No. 11.

4.5 Line circuit for step-by-step office.

4.6 Any standard local or combination connector circuit, for step-by-step office.

4.7 Local test desk battery or test battery circuit.

DESCRIPTION OF OPERATION

5. EQUIPMENT ARRANGEMENT AND LOCATION

Certain minor wiring changes can be made in the set to adapt it to the particular type of office in which it is to be used, as will be explained in sections 7 and 8 below.

In manual offices, the test set will be located at the switchboard, where connection can readily be made with the lines and the cord circuits. In small step-by-step offices the test set will in most cases be located permanently at the main frame. In large offices, where the test set may be used as a supplementary testing facility primarily for testing cable conductors to be used on new assignments, the test set would ordinarily be used at the main frame.

The meter used in this test cabinet is designed to meet its rated accuracy when mounted vertically, and therefore the meter will be somewhat less accurate when the test set is used in a horizontal position.

6. BATTERY SUPPLY

6.1 When the battery supply is not permanently connected to the test set, battery and ground will be patched to the set as follows:

6.11 Ordinarily, it is expected that the battery supply for this test set will be taken from a separate 45 volt dry cell battery, grounded on the negative side. The battery cord of Fig. 2 will be used for making the connection.

6.12 In some small offices, and particularly in some step-by-step exchanges, the regular central office battery supply may be used instead of a separate dry cell battery when the expense of providing the latter is not justified. When the central office battery thus used is grounded on the positive side, it is necessary to reverse the voltmeter leads in the test set. The battery cord of Fig. 2 will be used in such case.

6.13 In cases where this set is used for supplementary testing at the main frame, it may be expected that a separate 100 volt battery will already be available for testing purposes. The battery cord of Fig. 3 will be used for patching to a jack connected with this battery.

6.14 When the breakdown test feature of the test set is to be used, a separate 200 volt test battery of dry cells should be provided for the purpose, or connection should be made to an available 200 volt test battery. In either case the 200 V. test battery will appear on a jack, together with the lower voltage battery and ground, and the cord of Fig. 3 will be used for patching. If the breakdown test feature is to be used at the M.D.F. Fig. 8 should be provided.

6.2 In cases where the test set is to be given a fixed location, a permanent battery supply may be desirable. In these cases, the battery and ground terminals may be used in place of the battery and ground jack, the lead-in wires being brought into the box through a small hold provided for the purpose. The voltmeter leads must be reversed when the test set is supplied from positive grounded central office battery.

7. CONNECTION TO LINE - RINGING AND TALKING

7. For manual switchboards other than nonmultiple magneto boards, the patching cord of Fig. 4 is used to patch the

(TST) jack to the line jack in the switchboard. A switchboard cord is now plugged into the (TLK) jack of the test set and the other end of the switchboard cord is plugged into a line terminating in a wall set located nearby. In place of the wall set, the tester may use the operator's telephone set. The cut-off relay of the called line is operated in a circuit extending through the sleeves of the (TST) and the (TLK) jacks to the sleeve of the cord circuit.

With the connections made as above outlined, the voltmeter is normally connected to the ring side of the called line, but when the (TALK) key is operated the tip and ring of the line are switched to the tip and ring, respectively, of the switchboard cord. The cord now supplies ringing current and a talking connection between the tester and the subscriber station.

In cases where the switchboard cords have 109 or 309 plugs, it is necessary to interchange jacks (TLK) and (TST). This change having been made, the 109 or 309 plug of the switchboard cord will be connected to the 246 type jack (TLK), while the patching cord of Fig. 4 will be reversed so that the 110 or 310 plug fits into the 238 type (TST) jack and the 109 or 309 plug fits into the line jacks of the switchboard.

7.2 When this test set is used with a nonmultiple magneto switchboard, the functions of the (TST) and (TLK) jacks are performed by the (MF1) and (MF2) jacks, respectively, since the latter type of jack (221 or 223 type) is adapted to the plug used in this kind of board. In such case a slight wiring change, indicated by "Y" wiring, is made at the (MF1) and (MF2) jacks, in order to connect the called line into the test box on the lever spring side of the (REV) and (TALK) keys, and the switchboard cord on the front contact side of the (TALK) key. In such cases, also, the line is patched to jack (MF1) by means of the patching cord of Fig. 6, rather than with the patching cord of Fig. 4.

7.3 When used at the main frame, the test set is connected by means of the main frame patching cord shown in Fig. 5 or Fig. 7. This cord detaches the line conductors from the line equipment, bringing the former into the test set over the tip conductors of the plug and jack to the lever spring side to keys (REV) and (TALK), while the line equipment side of the connection is brought in on the front contact side of the (TALK) key. "X" wiring is, of course, used in connection with jacks (MF1) and (MF2) in this case.

In order to signal and talk to a subscriber on a line plugged up through an MDF cord, the tester reaches the line through the multiple which is attached to the line equipment side of the connection. In a manual exchange, such connection is made at the switchboard in the manner already de-

scribed. In a step-by-step office, the test man might use a wall set terminating in a line circuit, or he might use a hand set connected at an appropriate point and dial up a connection through the connector switch to the multiple of the line under test. The connector would furnish ringing current and talking battery, the (TALK) key of the test set being operated to complete the connection.

8. VOLTMETER TEST

8.1 Test for Grounds

Tests for grounds on the line are made with the line under test patched to the test box as outlined under section 7 above. With the (TALK) and (BT-RG) keys normal, battery of medium voltage (e.g. 45V or 100V) is connected through the voltmeter to the ring side of the line. The voltmeter should show no permanent deflection or at most a very small one if the line is clear, except in the case of a grounded rural line where the bells are rung with a grounded return and no condensers are in series with the ringers. To test the tip side of the line for grounds, the reversing key (REV) is operated.

In order to determine whether the ground is low in resistance, the voltmeter shunt key (VS) may be operated. With the (BT-RG) key normal, the operation of the (VS) key places a low resistance shunt around the meter, therby insuring appreciable differences in the readings corresponding to low resistance grounds. Without the shunt, the total resistance of the circuit would be so high that variations of serveral hundred ohms in the ground resistance would be almost negligible, and therefore the meter deflections would scarcely show the difference. With the shunt, however, the total resistance of the circuit is reduced to a value where slight variations in ground resistance become relatively important, with the result that the meter shows wider variations in its readings.

The voltmeter shunt key (VS) should be kept operated no longer than is required for reading the meter, in order to save drain on the battery and to minimize the effect of the increased current upon both the testing equipment and the line.

8.2 Test for Short Circuits

Tests for short-circuits are made with the (TALK) and (BT-RG) keys normal. The ground key (G) is first operated, and then the reversing key (REV) is operated and restored. If the line is directly short-circuited, the voltmeter will deflect to a scale reading indicating the test battery voltage and will read the same when the (REV) key is operated and then restored.

Readable deflections are, if necessary, obtained during this test by using the voltmeter shunt key (VS) in the manner explained in section 8.1 above.

8.3 Resistance Measurements

This test set can be used for making various resistance measurements upon lines on which the ringers are in series with condensers. The process of measurement involves a simple computation, and this may be done with the aid of a table or a formula which takes into account the test battery voltage the voltmeter deflection, the voltmeter resistance, and any lamp resistance that may be provided in the battery supply lead. In this way, measurement may be made of a resistance between either line conductor and ground, or between the two line conductors, following the procedures outlined in sections 8.1 and 8.2.

8.4 Cross with Central Office Battery or Foreign Potential

If in any of the voltmeter tests just outlined the voltmeter shows a reading in excess of the test battery voltage, it indicates a cross to battery on the line, probably a cross with another line. In such case, the voltmeter reading will be equal to the sum of the test battery voltage and the voltage of the battery cross.

8.5 Test for Continuity

Tests for continuity of the line conductors are made in much the same manner as are tests for short circuits. With the (TALK) key normal, the (G) key is operated, and then the (REV) key is operated and restored serveral times. This should cause momentary deflections of the voltmeter needle by reason of the charge and discharge of the capacity on the line. If the needle does not return to zero, both after the operation and after the restoration of the (REV) key, it indicates trouble or line leak.

8.6 Ballistic Test for Capacity

This test is to determine the approximate capacity of the line and the total capacity of condensers connected to the line. The test operations are made as described in paragraph 8.5 above. The momentary deflection of the voltmeter gives a measure of the line capacity.

8.7 Tests for Insulation Breakdown

The breakdown test feature is for use primarily in connection with new cable assignments. It should be pointed out that the breakdown test afforded by this test cabinet will not prevent bell tapping if the test is applied to a working subscriber line.

With the (TALK) key normal, the breakdown test - remove ground key (BT-RG) is operated. This connects 200 volts through a 100,000 ohm resistance and the meter winding in series to the ring side of the line, while ground is connected to the tip. After a few seconds delay to permit the line to charge through this resistance, the voltmeter shunt key (VS) is operated to throw a shunt around the voltmeter and the 100,00 ohm resistance. If a breakdown of the dielectric occurs it will be indicated by an appreciable reading of the meter, sicne the increased current flow will now be attended by an IR drop acroww the resistance of sufficient magnitude to be detected on the meter. The tip side of the line may be tested in the same manner with the (REV) key operated.

9. REMOVAL OF RINGING GROUND DURING TESTING

In testing party lines, it may be desirable to open the ringing ground in the test circuit in cases where a subscriber's receiver is left off the switchhook and an attempt is to be made to have the receiver restored. With grounded ringing on the party line and with the ringing ground circuit left closed in the test set, it might be impossible to ring a station on the line, since it is assumed that the station receiver is off the hook and thus provides a shunt around the ringers. To remove this shunting ground and permit the station ringer to operate, the ground return path is opened in the test set by the operation of the breakdown test - remove ground key (BT-RG).

10. USE OF TEST SET FOR TESTING TRUNKS

For testing trunks with this cabinet, the connections are made and the tests performed according to the methods described above for subscriber lines.

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