

**SUBSCRIBER LINES HAVING GROUND ON CUTOFF RELAYS  
VOLTMETER AND INSULATION BREAKDOWN TESTS  
USING TEST SET PER SD-21623-011 OR ES-239832  
LINE FINDER EQUIPMENT  
PANEL OFFICES**

1. GENERAL

1.01 This section describes a method of making voltmeter and breakdown tests of subscriber lines in line finder offices having ground on the cutoff relays, by means of the manually operated subscriber line test set (wagon type) per SD-21623-011 or ES-239832. The tests described are as follows:

- (A) Voltmeter Test.
- (B) Breakdown Test of Line Insulation.
- (C) Combined Voltmeter and Insulation Breakdown Test.

1.02 This section has been revised to add tests (B) and (C).

1.03 The tests are made at the final frames by directing final selectors, which are arranged for testing subscriber lines, to the final terminals. These test selectors are available for subscriber calls when not in use for testing purposes.

1.04 When a test connection has been established to an idle line, the test should be completed without delay, so as to hold the line busy for a minimum interval of time.

1.05 If a number of lines in consecutive order are to be tested, the test selector may be stepped from line to line by the operation of a non-locking key.

1.06 Any subscriber line which is passed or released, due to a busy condition, should be noted so that it may be tested later.

1.07 The terminal on which the test selector is resting at any time may be determined by referring to the associated bank terminal indicator.

2. APPARATUS

- 2.01 Subscriber Line Test Set per SD-21623-011 or ES-239832.
- 2.02 No. P2J Cord equipped with No. 110 Plugs (Battery and Ground).

2.03 Six No. P3E Cords equipped with No. 110 Plugs.

2.04 No. 110 Plug.

3. PREPARATION

3.01 Observe that the final selector to be used for the test is idle and then make the selector busy by inserting a No. 110 plug (open circuit) into the TMB jack.

3.02 Using the patching cords make the following connections:

<u>Test Set Jacks</u>	<u>Final Frame Jack Panel</u>
BAT-G	A
C (or TST-1)	C
D (or TST-2)	D
INT	E
RING (or ± GRD)	F
100V	100V
200V	200V

Note: To avoid possible grounding of the battery supply leads, connect the cords to the test set first and when disconnecting, remove the cords from the test set last.

4. METHOD

(A) Voltmeter Test

4.01 Depress the numerical key corresponding to the number of the final selector brush which has access to the subscriber line to be tested. The operation of the numerical key also functions as a start key and the final selector makes brush selection. The numerical key restores automatically when the final brush has been selected.

4.02 Depress the numerical key corresponding to the tens digit of the line. The final selector makes tens selection and the numerical key is automatically restored.

4.03 Depress the numerical key corresponding to the units digit of the line. The final selector makes units selection. The numerical key does not restore until the DISC (disconnect) key is operated. This serves as an indication of the line on which testing was started.

4.04 The TST (test) lamp is lighted if the subscriber line selected is idle, or when it becomes idle.

Note: If the subscriber line selected is busy, the BY (busy) lamp is lighted and the test circuit is not closed through to the line. In this case the final selector should be advanced to the next terminal by operating the STP (stepping) key momentarily.

4.05 Operate the VM (voltmeter) key. The VM (voltmeter) lamp is lighted to indicate that a voltmeter test is being made.

#### Test of Ring Side of Line

4.06 The test set advances and applies a high resistance ground to the tip and ring conductors of the line under test, for the purpose of discharging the condensers of the subscriber stations to avoid possible bell tapping.

4.07 A test is then made which applies 100-volt testing battery to the ring side and ground to the tip side of the line. The red R (ring) lamp is lighted. A slight deflection on the volt-milammeter may be due to the capacity on the line when the testing current is connected.

4.08 If the ring side of the line is clear of grounds or crosses, the volt-milammeter pointer should immediately return to normal. Upon the completion of the test of the ring side of the line, the R lamp is extinguished and the test set advances to test the tip side of the line as described in paragraphs 4.12 and 4.13.

4.09 If the volt-milammeter pointer does not immediately restore to normal, operate the SOR (stop on ring) key to stop the progress of the test with the testing equipment associated with the ring of the line. The VM and R lamps remain lighted.

Note: With volt-milammeter deflection readings in excess of 65 in wet weather and 25 in dry weather (100-volt test battery), a record of the line number and the deflection readings should be entered on the proper form, unless otherwise directed by local instructions. These readings indicate a line insulation resistance of less than 50,000 and 300,000 ohms, respectively.

4.10 Operate the RG (remove ground) key to determine whether the deflection is caused by a ring and tip cross, or if the ring is crossed with battery or ground. If the volt-milammeter pointer returns to normal, a ring and tip cross on the line is indicated. The pointer does not return to normal if the ring of the line is crossed with battery or ground.

4.11 Restore the SOR and RG keys, if operated. The R lamp is extinguished. If a test of the tip is to be made, momentarily operate the RVM (repeat voltmeter test) key and permit the ring test to be repeated without operating the SOR key.

#### Test of Tip Side of Line

4.12 The test set advances and applies the voltmeter test to the tip side of the line in the same manner as for the ring side of the line, as described in paragraphs 4.06 to 4.11, inclusive. During this test the green T (tip) lamp is lighted and the ring side of the line is grounded. The SOT (stop on tip) key should be operated to stop the progress of the test if the volt-milammeter pointer does not immediately restore to normal.

4.13 The T lamp is extinguished at the completion of the test of the tip side of the line.

#### Advancing to the Next Line

4.14 If the next line above the line under test is to be tested, momentarily operate the STP key to advance the final selector to the next terminal. The tests described in paragraphs 4.04 to 4.13, inclusive, are then made on the line selected.

Note: If the next line to be tested is several terminals removed from the line under test, it may be more convenient to operate and hold the DISC key until the final selector starts downward and then proceed as described in paragraphs 4.01 to 4.13, inclusive.

#### Repeat Tests

4.15 A repeat test is made by momentarily operating the RVM key. The tests described in paragraphs 4.06 to 4.13, inclusive, are repeated on the line under test.

#### Disconnection

4.16 Restore the VM key and operate the DISC key to restore the test set and final selector used for the test, to normal. The DISC key should be held operated until the final selector starts downward.

4.17 After disconnecting the cords at the conclusion of the tests, observe that the test final selector is normal and then remove the No. 110 plug from the TMB jack.

#### (B) Breakdown Test of Line Insulation

4.18 Proceed as in paragraphs 4.01 to 4.04 inclusive. With the TST lamp lighted operate the IBD (insulation breakdown) key. The IBD lamp is lighted to indicate that a breakdown test is being made. Although the breakdown test is applied to the subscriber

line automatically, it is necessary for the testman to observe the lamp signals and the volt-milammeter while the R or T lamps are lighted, to detect failures.

4.19 The test set advances and applies a high resistance ground to the tip and ring conductors of the line for discharging the condensers at the subscriber stations, to avoid possible bell tapping.

#### Test of Ring Side of Line

4.20 A test is then made of the ring side of the line. As the test set advances, ground through a resistance and 200-volt testing battery through a high resistance is connected to the ring of the line. The value of resistance between the 200-volt testing battery and the ring of the line is gradually reduced by the test set and introduced between the ring and ground. As the last resistance unit in the 200-volt supply lead is removed the ground lead is opened and the 200-volt testing battery is directly connected to the line. At this time the R lamp is lighted. This arrangement for applying the 200-volt testing battery to the line gradually, charges the line at an approximately constant rate, to avoid possible bell tapping at the subscriber stations. The tip side of the line is grounded during this test.

4.21 Observe the volt-milammeter while the R lamp is lighted. If a momentary or steady deflection is observed make a repeat test at the completion of the test as described in paragraph 4.27 to verify the results of the first test. A deflection of more than .004 ampere should be considered as an indication of a trouble condition which should be investigated. If such a deflection is obtained on the repeat test, record the line number and the deflection reading on the report form. Momentary deflections which do not repeat on subsequent tests should not be recorded on the report form as a trouble condition.

4.22 After a short interval the R lamp is extinguished.

4.23 The test set advances and discharges the line by gradually increasing the resistance between the 200-volt test battery supply and the ring side of the line. At the same time the high resistance between the ground lead and the ring side of the line is gradually reduced until ground is directly connected to the ring. This arrangement for reducing the 200 volts and connecting ground to the line discharges the line at an approximately constant rate to avoid possible bell tapping at the subscriber stations.

#### Test of Tip Side of Line

4.24 The test set advances and applies the breakdown test to the tip side of the line in the same manner as for the ring

side of the line as described in paragraphs 4.20 to 4.23, inclusive. During this test, lamp T is lighted and the ring side of the line is grounded. The volt-milammeter should be observed while the T lamp is lighted.

4.25 The IBD and TST lamps remain lighted at the completion of the test of the tip side of the line.

#### Advancing to the Next Line

4.26 If the next line above the line under test is to be tested, momentarily operate the STP key to advance the final selector to the next terminal. The tests described in paragraphs 4.19 to 4.25, inclusive, are made on the line selected.

Note: If the next line to be tested is several terminals removed from the line under test, it may be more convenient to operate and hold the DISC key until the final selector starts downward and then proceed as described in paragraphs 4.18 to 4.25, inclusive.

#### Repeat Tests

4.27 A repeat test is made by momentarily operating the RVM key. The tests described in paragraphs 4.19 to 4.25, inclusive, are repeated on the line under test.

#### Disconnection

4.28 Restore the IBD key and operate the DISC key to restore the test set and final selector used for the test, to normal. The DISC key should be held operated until the final selector starts downward.

4.29 After disconnecting the cords at the conclusion of the tests, observe that the test final selector is normal and then remove the No. 110 plug from the TMB jack.

#### (C) Combined Voltmeter and Insulation Breakdown Test

4.30 Proceed as in paragraphs 4.01 to 4.04, inclusive. With the TST lamp lighted operate the VM (voltmeter) and IBD (insulation breakdown) keys. The VM (voltmeter) lamp is lighted to indicate that a voltmeter test is being made.

4.31 The test set advances and applies the voltmeter test outlined in paragraphs 4.06 to 4.13, inclusive.

4.32 After the completion of the voltmeter test a breakdown test is made on the tip and ring sides of the line. The VM lamp is extinguished and the IBD lamp is lighted to indicate that a breakdown test is in progress. Although this test is applied to the line automatically, it is necessary for the testman to observe the

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lamp signals and the volt-milammeter while the R or T lamp is lighted, to detect failures.

4.33 The test set advances and applies the breakdown test described in paragraphs 4.19 to 4.25, inclusive.

### Advancing to the Next Line

4.34 If a combined voltmeter and insulation breakdown test is to be made on the next line above the line under test, momentarily operate the STP key to advance the final selector to the next terminal. The voltmeter test followed by the insulation breakdown test as described in paragraphs 4.31 to 4.33, inclusive, are made on the line selected.

Note: If the next line to be tested is several terminals removed from the line under test, it may be more convenient to operate and hold the DISC key until the final selector starts downward and then proceed as described in paragraphs 4.30 to 4.33, inclusive.

### Repeat Tests

4.35 A repeat test is made by momentarily operating the RVM key. The tests described in paragraphs 4.31 to 4.33, inclusive, are repeated on the line under test.

### Disconnection

4.36 Restore the VM and IBD keys and operate the DISC key to restore the test set and test final selector to normal. The DISC key should be held operated until the final selector starts downward.

4.37 After disconnecting the cords at the conclusion of the tests, observe that the test final selector is normal and then remove the No. 110 plug from the TMB jack.

## 5. REPORTS

5.01 The required record of these tests should be entered on the proper form.