

FINAL SELECTOR CIRCUITS  
AUTOMATIC TESTS  
USING FINAL SELECTOR TEST CIRCUITS  
GROUND CUTOFF RELAY PANEL OFFICES

1. GENERAL

1.01 This section describes a method of testing final selector circuits in ground cutoff relay offices by means of final selector test circuits ES-239382, ES-239967, and ES-20149-01.

1.02 This section is reissued to add Test N which checks the diode circuit when the finals are arranged to trip negative and/or positive superimposed ringing.

1.03 Three final multiple terminals (terminals 97, 98, and 99 in the bottom bank) of each final choice (500 terminals) are reserved for use with the testing circuits. These terminals are arranged as a PBX group. The sleeve of terminal 97 is wired to cause the final selector to terminal hunt. Terminal 98 is also conditioned to cause the final selector to terminal hunt with this exception: With a modified test frame and when making Test B, terminal 98 is made to appear as a direct line busy. Terminal 99 is connected to the test frame and the sleeve condition varies with the different tests being performed. In addition, when making Test B with a modified test frame the sleeve of terminal 99 is open. Terminal 99 can be transferred to an intercepting line when not used for testing.

1.04 The tests covered are:

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A. *Direct Line Idle:* In this test the test circuit is arranged for directing the final selector to terminal 99 where a direct line idle condition is simulated. When the final selector seizes terminal 99, a number of features are tested, depending upon the type of test circuit used. . . . . 5

B. *Direct Line Busy Test:* This applies a direct line busy condition to terminal 99 of each 0 blank on the final frames and arranges the test circuit for directing the final selectors to this terminal. Where the feature to eliminate false indication of a satisfactory test has been provided, the direct line busy test is applied to terminal 98 instead of 99. With this arrangement, a final selector that terminal hunts from terminal 98 due to a failure of the PBX relay to operate will stop on terminal 99 and block the test circuit rather than go to telltale and return a busyback signal. With this feature provided, final selector tea wagon tests should not be made while this circuit is performing Direct Line Busy tests. . . . . 5

C. *First PBX Line Idle:* This applies a first PBX line idle condition to the sleeve of terminal 99 and arranges the test circuit for directing the final selector to this terminal. In addition to the sleeve condition imposed on terminal 99, the tests covered in Test A are repeated as controlled by the type of test circuit used. . . . . 5

D. *Last PBX Line Idle:* This applies a last PBX line idle condition to terminal 99 and arranges the test circuit to direct the final selector to terminal 97. With this arrangement the final selector terminal hunts to terminal 99. An operate test of the TB relay is made on terminal 97 and with some test circuits a nonoperate speed test of the PBX relay is made as the selector passes terminal 98. In addition, tests covered in Test A are repeated as controlled by the type of test circuit used. . . . . 5

**E. Last PBX Line Busy Test:** This test applies a last PBX line busy test to terminal 99 and arranges the test circuit to direct the final selector to terminal 97. With this arrangement the final selector terminal hunts to terminal 99, where it returns and advances the sequence switch to busyback position and returns a busyback signal. . . . . 5

**F. Intermediate PBX Line Idle:** This test applies an intermediate PBX line idle condition to the sleeve of terminal 99 and arranges the test circuit to direct the final selector to terminal 97. With this arrangement the final selector hunts to terminal 99. When the final selector seizes terminal 99, a number of features are tested depending upon the type of test circuit used. . . . . 5

**G. No-Test:** This test applies a direct line busy condition to terminal 99. The final selector is directed to terminal 99 where the no-test feature is checked; in addition other features are tested, depending upon the type of test circuit. . . . 5

*Note:* On some test frames, the test circuit is arranged to check that the "await subscriber's release" feature is not effective on no-test calls. This applies only to later type finals; earlier type finals await called party disconnect before releasing.

**H. Time Measure Release Test:** This test applies a direct line idle condition to terminal 99 and arranges the test circuit for directing the final selector to this terminal. The final selector circuit advances to one position past the talking position and the test circuit checks that it is automatically released in 2 to 4 minutes. . . . . 5

**I. Telltale Test:** This test sends the final selector to telltale; the selector then advances and restores to normal. . . . . 5

*Note:* This test cannot be made on test circuits not equipped with class keys.

**J. Multitests:** This test provides a means of making a multiple of tests by selection of class test keys. When class test keys are not provided, operate the MT key and if desired the TMR key, if provided. . . . . 5

*Note:* Where the test circuit is equipped with a class key number 10 or a DCT-FB key, these keys should not be used when making a multitest.

**K. Double Connection Test — Hunt Last PBX Line Busy:** This test is designed to detect failure of the PBX relay to operate on a last PBX line busy condition. The final selector is directed to terminal 97. With this arrangement the final selector terminal hunts to terminal 99 where it restores and advances the sequence switch to busyback position. Some test circuits may not be modified to make this. . . . . 5

*Note:* This test cannot be made in conjunction with other tests.

**L. False Busy Test — Intermediate PBX Line Idle:** This test is designed to reduce double connections. The test applies a PBX line idle condition to the sleeve of terminal 99 and arranges the test circuit for directing the final selectors to terminal 97. With this arrangement the final selector terminal hunts to terminal 99. Some test circuits may not be modified to make this test. . . 5

*Note:* This test should not be made in conjunction with other tests.

**M. Brush Continuity Test:** This test checks the brush continuity of the tip and ring of the final circuits when the selectors are routed to a particular terminal, determined by the operation of the FB, FT, and FU keys. Some test circuits are equipped with jacks. In the event of a continuity failure the selector is restored to normal after a predetermined timing interval. The following conditions may be encountered when making this test. . . . . 8

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**Busy Line:** If the line selected is busy, the final selector restores to normal and the test circuit causes the final selector to reselect the line at intervals of approximately 2 minutes. If the line is still busy after usually four attempts, the LB lamp is lighted and the test circuit stops; after a predetermined interval the TBL lamp is lighted and an audible alarm is sounded.

**Note:** With some test circuits, a BB lamp flashes and the test stops when the busy line is encountered.

**Intercepting Line:** If, as the test progresses from one final frame to another, the final line selected is an intercepted line, the test frame will block. After a predetermined interval, the TBL lamp will light and an audible alarm will sound.

**Note:** On some test frames an immediate answer by an intercepting operator is indicated by a lighted IN lamp.

**Party Line, Grounded Ringing PBX Lines, or PBX Lines with Thermistors in the Ringup Relay Circuit:** When 2- or 4-party lines on which there is no working station on one side of the line, grounded ringing PBX lines, or PBX lines with thermistors in the ringup relay circuit are encountered, the test frame stops and brings in an alarm in the usual manner.

**Note:** When testing lines equipped with tube type subscriber's sets, a failure may be indicated due to insufficient current flow. Some test frames can be modified to eliminate this. When it is desired to test one of these lines with a test frame that has not been modified, a 0.5 uf capacitor may be temporarily connected across the tip and ring of the terminal under test at the IDF.

**N. Diode Circuit Test:** This test checks for a possible open in the diode circuit that would result in failure to trip positive and negative superimposed ringing. The electro-mechanical operation is the same as in Tests B and E. .... 5

**1.05 Lettered Steps:** A letter a, b, c, etc, added to a step number in Parts 3 and 4 of this section, indicates an action which may or may not be required depending upon local conditions. The condition under which a lettered step or series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within the test. Where a condition does not apply, all steps designated by that letter should be omitted.

**1.06** The timing test set SD-21984-01 may be used in conjunction with Tests A to M to detect selector circuits which are slow in completing final brush and final tens selections. If a selector circuit fails to complete these functions within the required interval, the timing test set will cause the test frame to block and bring in an alarm. The TBL lamp will be lighted on the timing test set.

**1.07** The recorder circuit SD-21978-01 is designed to start and control the test circuit on an automatic start basis or to control it on a manual start basis. Information on the operation and functions of the recorder circuit is covered in Section 215-181-501.

**1.08** Local instructions should be followed with reference to recording and reporting any register operations caused by performing these tests.

**1.09** If the remote control feature is provided, it may be used to observe the action of a final selector.

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2. APPARATUS

2.01 Final selector test circuits ES-239382, ES-239967, and ES-20149-01.

2.02 184B plugs as required.

2.03 Timing test circuit SD-21984-01 and patching cords; two P2J cords, 6 feet long, equipped with two 310 plugs (2P9C cord); one P3K cord, 6 feet long, equipped with two 310 plugs (3P15A cord).

2.04 Recorder circuit SD-21978-01.

3. PREPARATION

STEP	ACTION	VERIFICATION
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→ Tests A Through N

1 Restore all lever-type keys to normal.

2a If any connecting switches are off normal — Operate RN key.

All connecting switches restored to normal.

3a Restore RN key.

4 Operate LP key.

5b If timing test set is used — Patch timing test set BAT-G jack to final test circuit A jack using P2J cord.

6b Momentarily operate PREL key of timing test set several times.

TBL lamp of timing test set lights for each operation of PREL key.

7b Patch timing test set TM1 jack to final test circuit TM1 jack using P3K cord.

8b Patch timing test set TM2 jack to final test circuit TM2 jack using P2J cord.

9b Operate TMG key of timing test set to TST position.

10 Operate TRA or TRB key to transfer test line from intercepting operator's position to testing circuit.

*Note:* On some test frames, the TRA key may be left normal while making a brush continuity test.

Where Test Frame is to be Controlled by Recorder Circuit, if Provided

11c If recorder circuit is used in conjunction with test circuit on manual start basis — Operate associated MST-key.

At recorder frame — Associated TF- lamp lights when ST key is operated at test circuit.

STEP	ACTION	VERIFICATION
12d	If recorder circuit is used in conjunction with test circuit on automatic start basis — Set CL timer for time to start test.	
13d	Operate associated AST-key.	Associated TF- lamp lights when CL timer contacts close.

#### 4. METHOD

STEP	ACTION	VERIFICATION
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##### → Tests A Through L and N

14e	If testing particular circuits — Operate PC key.	
15e	Operate U-, T-, TW-, and GN keys corresponding to location of incoming group that contains terminals of particular circuits to be tested.	
16f	If only one circuit is to be tested — Operate REP key.	
17g	If more than one circuit is to be tested — Operate OC key corresponding to number of adjacent groups to be tested in bank selected by test selector.	
→ 18h	If Test N is to be performed and preference by key is provided — Operate POS-NEG key to select polarity of ringing required.	
↗	Otherwise Test N will be provided as a feature of Tests B and E and polarity is pre-determined.	
↘		
19	Operate test class key or group of test class keys as required. If test class keys are not provided, set MULTITEST sequence switch for test required, or operate MT key if multi-test is required. See Table A.	

TABLE A

TEST	TEST CLASS KEY	MULTITEST SEQUENCE SWITCH POSITION	
	ES-20149	ES-239967	ES-239382
A Direct line idle	1	1	1
B Direct line busy	2	3	3
C First PBX line idle	3	5	5
D Last PBX line idle	4	7	7
E Last PBX line busy	5	9	9
F Intermediate PBX line idle	6	11	11
G No-test	7	13	13
H Time measure release	8	15	5 TMR key operated
I Telltale	9	—	—
J Multitest	1-9 as required	MT	MT
K Double connection — Hunt last PBX line busy	5 see Note 3	9	9
L False busy — Intermediate PBX line idle	6 see Note 3	11	11
N Diode Circuit Test	2 or 5	3 or 9	

**Note 1:** On test circuits ES-239967 and ES-239382, time measure release test can be incorporated in multitest by operating TMR key.

**Note 2:** COM key may be operated in conjunction with any test except H and I to test commutator resistance.

**Note 3:** To make Test K, operate the DCT-FB key to the DCT position or class key 10 as provided. To make Test L, operate the DCT-FB key to the FB position. These tests cannot be made at the same time that other classes of tests are being made.

STEP	ACTION	VERIFICATION
20	Operate ST key.	<p>Test circuit proceeds to location determined by keys operated in Step 15e as indicated by locating lamps where provided.</p> <p>BI lamp lighted indicates busy incoming test selector.</p> <p>BY lamp lights and minor alarm sounds when incoming test selector is busy for pre-determined time.</p>

STEP	ACTION	VERIFICATION
21	<p>After BI lamp is extinguished — Operate and release MPB or APB key, as required, until test selector is located on terminal associated with final selector circuit to be tested. Where test circuit is not equipped with locating lamps, it will be necessary to manually raise test selector to terminal desired.</p> <p><i>Note:</i> When the recorder circuit is used in conjunction with test circuit on a particular circuit test on an automatic start basis, testing will always begin with the first terminal of the incoming group which has been selected by the operation of the TW- key.</p>	<p>Locating lamp where provided indicates location of test selector on terminal selected.</p>
22e	<p>If testing particular circuits — Restore PC key.</p>	<p>If final selector circuit is idle — Test circuit proceeds to test final selector circuit. BF lamp lighted indicates busy final circuit. BY lamp lights and minor alarm sounds when circuit is busy for predetermined time.</p>
23d	<p>If recorder circuit is used in conjunction with test circuit on automatic start basis — Restore ST key.</p>	<p>When CL timer contacts close at recorder circuit — Test circuit proceeds to test final selector circuits to which it is directed.</p>
24i	<p>If not testing particular circuit — Operate APB key if busy circuits are to be passed by automatically. <i>Note:</i> If recorder circuit is used in conjunction with test circuit, the recorder circuit will cause the test circuit to automatically pass by busy final selector circuits on a time-out basis.</p>	
25i	<p>Operate ST key.</p>	<p>Test circuit proceeds to test final selector circuits to which it has access. BI lamp lighted indicates busy incoming test selector. BF lamp lighted indicates busy final selector circuit. BY lamp lights and minor alarm sounds when test selector or (with APB key normal) final selector circuit is busy for predetermined time. When all final selector circuits are tested — EC lamp lights. Minor alarm sounds.</p>

STEP	ACTION	VERIFICATION
26d	If recorder circuit is used in conjunction with test circuit on automatic start basis — Restore ST key.	When CL timer contacts close at recorder circuit — Test circuit proceeds to test final selector circuits to which it has access. BI lamp lighted indicates busy incoming test selector. BY lamp lights and minor alarm sounds when test selector is busy for predetermined time. When all final selector circuits are tested, test circuit is restored to normal. All lamps extinguished. At recorder circuit — Associated TF- lamp extinguished.
27	Restore ST key.	If recorder circuit is used in conjunction with test circuit on manual basis — At recorder circuit — Associated TF- lamp extinguished.
28	Operate RN key.	All lamps extinguished. If not testing particular circuit — Minor alarm silenced.
29	Restore RN key.	
30c	If recorder circuit is used in conjunction with test circuit on manual start basis — At recorder circuit — Restore associated MST- key.	
31d	If recorder circuit is used in conjunction with test circuit on automatic start basis — At recorder circuit — Restore associated AST- key.	
32b	If timing test set is used — At timing test set — Restore TMG key.	
33b	At test circuit — Remove patching cords from TM1, TM2, and A jacks.	

#### M. Brush Continuity Test

**Note 1:** Brush continuity tests cannot be made in conjunction with Tests A to L.

**Note 2:** The test frame will block when testing a 2- or 4-party line on which there is no working station on one side, or a grounded PBX line or a PBX line with thermistors in the ringup relay circuit.

**Note 3:** A line with a tube-type set may give a failure indication. If it is necessary to test this particular set of terminals, temporarily connect a 0.5 mf capacitor across the line at the IDF.

STEP	ACTION	VERIFICATION
14e	If testing particular circuit — Operate PC key.	
15e	Operate U-, T-, TW-, GN keys corresponding to location of incoming group that contains terminals of particular circuit to be tested.	
16f	If more than one final selector circuit is to be tested — Operate OC key corresponding to number of adjacent groups to be tested in bank selected by test selector.	
17	Operate an FB-, FT-, FU- key or insert 184-type plugs into FB-, FT-, FU- jacks if provided for directing final selector to line selected for test.	
18	Operate BC key.	
19e	If testing particular circuit — Operate ST key.	Test circuit proceeds to location determined by keys operated in Step 15e as indicated by locating lamps. BI lamp lighted indicates busy incoming test selector. BY lamp lights and minor alarm sounds when circuit is busy for predetermined time.
20e	When BI lamp is extinguished — Operate and release MPB or APB key, as required, until test selector is located on terminal associated with particular circuit to be tested. On final selector test frames not equipped with locating lamps, it is necessary to manually raise test selector to terminal desired.  <i>Note:</i> When the recorder circuit is used in conjunction with test circuit on an automatic start basis, testing will always begin with the first terminal of the incoming group which has been selected by the operation of the locating keys.	
21e	Restore PC key.	If final selector circuit is idle — Test circuit proceeds to test particular circuit. BF lamp lighted indicates busy final selector circuit. BY lamp lights and minor alarm sounds when circuit is busy for predetermined time. BL lamp lighted indicates that line selected for test is busy, and several attempts to select it have been made (usually 4).

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STEP	ACTION	VERIFICATION
22d	If recorder circuit is used in conjunction with test circuit on automatic start basis — Restore ST key.	When CL timer contacts close at recorder circuit — Test circuit proceeds to test final selector circuits to which it has been directed. BI lamp lighted indicates busy incoming test selector. BY lamp lights and minor alarm sounds when incoming test selector is busy for predetermined time.
23g	If repeat test of particular circuit is required — Operate REP key.	
24g	Momentarily operate CA key for each test required on particular circuit.	
25h	If not testing particular circuit — Operate APB key if busy circuits are to be passed by automatically.	
	<i>Note:</i> If recorder circuit is used in conjunction with test circuit, the recorder circuit causes the test circuit to automatically pass by busy final selector circuits on a time-out basis.	
26	Operate ST key.	Test circuit proceeds to test final selector circuits to which it has access. BI lamp indicates busy incoming test selector. BF lamp lighted indicates busy final selector circuit. BY lamp lights and minor alarm sounds when test selector or (with APB key normal) final circuit is busy for predetermined time. TBL lamp lighted and minor alarm may indicate that test line selected is intercepted line. On some test circuits, immediate answer by trouble intercept operator will be indicated by a lighted IN lamp. In either event, change FU- key or where provided FU- plug to select different line.

STEP	ACTION	VERIFICATION
27d	If recorder circuit is used in conjunction with test circuit on automatic start basis — Restore ST key.	When CL timer contacts close at recorder circuit — Test circuit proceeds to test final selector circuits to which it has access. BI lamp lighted indicates busy incoming test selector. BY lamp lights and minor alarm sounds when incoming test selector is busy for pre-determined time. When all final selector circuits are tested, test circuit is restored to normal. All lamps extinguished. At recorder circuit — Associated TF- lamp extinguished.
28	Restore ST key.	If recorder circuit is used in conjunction with test circuit on manual basis — At recorder circuit — Associated TF- lamp extinguished.
29	Operate RN key.	Test circuit restores to normal. All lamps extinguished.
30	Restore RN key.	
31c	If recorder circuit is used in conjunction with test circuit on manual start basis — At recorder circuit — Restore associated MST- key.	
32d	If recorder circuit is used in conjunction with test circuit on automatic start basis — At recorder circuit — Restore associated AST- key.	
33b	If timing test set is used — At timing test set — Restore TMG key.	
34b	At test circuit — Remove patching cords from TM1, TM2, and A jacks.	