

FINAL SELECTOR CIRCUITS

TESTS USING TEST SET SD-20050-01

BATTERY CUTOFF RELAY PANEL OFFICES

1. GENERAL

1.01 This section describes a method of testing final selector circuits at the final frames in battery cutoff relay panel offices, by means of the manually operated incoming and final selector test set (wagon type) per SD-20050-01. The tests described are as follows:

- (A) Idle Line Test With Capacity Test
- (B) Idle Line Test With Commutator Resistance Test
- (C) Hunt Idle Line Test
- (D) Busy Line Test
- (E) Hunt Busy Line Test
- (F) Check of No-Test Feature
- (G) Time Measure Release Test
- (H) Telltale Test
- (I) Early Release Test
- (J) Brush Continuity Test
- (K) Particular Line Test - Idle Line Condition
- (L) Particular Line Test - Busy Line Condition

1.02 This section has been revised to include the testing of final circuits arranged to return a line busy signal when the final selector advances to telltale during units selection. Tests (J) and (K) of the previous issue and relating to tests of the T relay have been cancelled. The present tests (K) and (L) have been added.

1.03 The tests are intended for use to test those individual final selector circuits which are not tested by a final selector test frame. They may also be used to supplement the test frame tests and to check the operation of final circuits on a manual basis.

1.04 The tests are made at the final selector frames and the test set is connected to the proper jacks by means of patching cords.

1.05 For tests (A) to (G) inclusive, the final selector is directed to test lines which are connected to two final terminals (terminals Nos. 98 and 99 in the bottom bank) of each final frame. Terminal 98 is arranged as a permanently busy terminal hunting test line. Terminal No. 99 is connected to the test set during tests by means of a patching cord. When the plug is removed from the jack this test line is connected to an intercepting trunk through the final selector test frame, if provided.

1.06 The test set is arranged to check the multiple brushes for continuity and crosses and to make tests of final circuits under conditions corresponding to those encountered in service on idle and busy terminal hunting and non-terminal hunting lines. The time measure release and the no-test features can also be tested.

1.07 Brush continuity is checked on one brush by tests (A), (B), (C), (F) or (G). Test (J) is used to test brushes not checked by these tests. For this test the final selector is directed to a working final terminal.

1.08 During test (H) a visual observation may be made to detect brush chatter conditions.

1.09 Any final circuit on which a failure is encountered when making a test, should be made busy until the trouble is cleared.

2. APPARATUS

- 2.01 Incoming and Final Selector Test Set per SD-20050-01 (J24710A).
- 2.02 Five P3E Cords equipped with No. 110 Plugs.
- 2.03 Operator's Telephone Set.
- 2.04 No. 32-A Test Set.
- 2.05 No. 184 Plug.

3. PREPARATION

3.01 All covers of relays in the final circuit should be in place during the period the test of the final is in progress.

3.02 With all keys of the test set normal, connect jacks BAT-G1 and BAT-G2 of the test set to jacks A and B, on the final frame jack panel.

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.

3.03 Operate the FIN (final selector) key.

4. METHOD

All Tests - General Procedure

4.01 Connect jack TST of the test set to jack T-MB of the selector to be tested.

Note: To avoid releasing a service connection, do not connect to the jack of a selector which is off normal.

4.02 Connect jack TL (test line) of the test set to jack J on the final frame jack panel for test line tests (A) to (G). This connects the test set to final terminal No. 99 (test line) of bank O.

4.03 Depress the O key in the H row of numerical keys for tests (A) to (I). This arranges the test set to trip the brush associated with the bank in which the test line is located.

(A) Idle Line Test With Capacity Test

4.04 Operate the DIR-ID (direct line idle) key. This applies an idle line condition to the test line sleeve and arranges the test set to simulate maximum trunk loop conditions in order to check the final selector against overstepping. Brush continuity is also checked on this test.

4.05 Momentarily operate the ST (start) key to start the test. The FIN lamp lights as an indication that the test is in progress.

4.06 Observe the final selector during the test and note any irregular operations, such as sluggish up-drive, slipping sequence switch drive disc, etc.

4.07 The test set directs the final selector to the second test line (terminal No. 99) of the bank. After units selection has been completed the test set applies an idle line condition, simulating an idle terminal of a terminal hunting group, to the sleeve of the test line.

4.08 As the final circuit advances through the incoming advance position, the test set checks for ground on both tip and ring conductors.

4.09 Due to the idle line condition on the sleeve of the test line, the final

selector does not terminal hunt but remains on the test line terminal. The test set checks that the final circuit places a busy condition on the test line..

4.10 As the final circuit advances to the talking position the test set checks the tip and ring conductors for continuity and that they are not reversed. The OK lamp then lights as an indication of a satisfactory test.

4.11 Momentarily operate the DISC (disconnect) key. The test set removes ground from the sleeve and checks that the final circuit immediately connects ground to the incoming sleeve. The final circuit advances out of the talking position.

4.12 With the final circuit in the awaiting called subscriber disconnect position, a hold test followed by a release test is applied to the C relay. After the C relay releases, the final circuit restores to normal. Observe that the trip magnet operates during the down-drive of the final selector. As the final circuit restores to normal the test set checks that ground is disconnected from the incoming and test line sleeves. The test set then restores to normal and the FIN and OK lamps are extinguished.

Note 1: If the test set blocks as the final circuit restores to normal, the operation of the S relay over the incoming sleeve or the failure of the hold test of the C relay is indicated. The operation of the S relay may be due to its being out of adjustment or to an open in the 25-ohm shunt path. The test set stops in position 14 under these conditions.

Note 2: A failure of the C relay to release on its release test is indicated by the final circuit remaining in the awaiting called subscriber disconnect position until timed out by the TO interrupter. The test set blocks in position 18 under this condition.

Repeat Tests

4.13 To make repeat tests, operate the REP (repeat) key after the test set has restored to normal and then momentarily operate the ST key. Restore the REP key to normal when the desired number of repeat tests have been completed. After the OK lamp lights, momentarily operate the DISC key to restore the final circuit and the test set to normal.

Disconnection

4.14 If any of the other tests are to be applied to the final circuit under test, restore any keys not required to be operated for the next test.

4.15 If no further tests are to be made on the circuit under test and the same test is to be applied to other selectors on the same side of the final frame, disconnect the plug from the T-MB jack and reconnect it to the corresponding jack of the next circuit to be tested.

4.16 When testing is completed on the last circuit, restore all operated keys to normal and disconnect all cords.

(B) Idle Line Test With Commutator Resistance Test

4.17 To make the commutator resistance test, operate the FIN-COM (final commutator) key in addition to the other keys before starting test (A). The purpose of this test is to detect excessive resistance between the A, B, U and G commutators and commutator brushes of the final selector while making an operation test of the final circuit. In this test a change is made in the fundamental circuit arrangement for final selections. This change consists of opening the capacity circuit to ground and decreasing the resistance in series with the stepping relay to a lower value. A failure of this test is indicated by the tripping of the wrong brush or by overstepping.

(C) Hunt Idle Line Test

4.18 This test checks the terminal hunting arrangement of the final circuit and its operation on encountering an idle line condition.

4.19 Operate the HTG-ID (hunt idle line) key. Then proceed as described in 4.05 to 4.16. The test is the same as test (A) except that during units selection the final selector is directed by the test set to the first test line (terminal No. 98) which is wired equivalent to that of a busy terminal of a terminal hunting group. The final selector then terminal hunts to the idle test line (terminal No. 99) for the remaining tests.

(D) Busy Line Test

4.20 In this test the test set applies a busy line condition to the test line and then checks the ability of the final circuit to advance to the busy-back position.

4.21 Operate the DIR-BY (direct line busy) key. Then momentarily operate the ST key to start the test. The FIN lamp lights as an indication that the test is in progress.

4.22 Observe the final selector during the test and note any irregular operations, such as sluggish up-drive, slipping sequence switch drive disc, etc.

4.23 The test set directs the final selector to the second test line of the

bank. After units selection has been completed the test set applies a busy line condition, simulating a busy terminal not arranged for terminal hunting, to the sleeve of the test line.

4.24 As the final circuit advances out of the units selection position the test set checks that the final circuit connects ground to the ring conductor. A non-operate test is then applied to the final S relay.

4.25 The final selector does not terminal hunt upon reaching the busy line. The final circuit advances under this condition and the selector returns to normal. During the down-drive observe that the trip magnet is operated.

4.26 As the final circuit advances to the busy-back position, the test set checks that busy-back current is connected to the ring conductor and whether the relay winding in the busy-back tone supply circuit is short-circuited. The BB (busy-back) lamp flashes as an indication of a satisfactory test.

Note: The busy-back tone may be checked by means of an operator's telephone set plugged into the TEL jacks of the test set. If busy-back tone is heard and the BB lamp does not light the indication is that the relay winding in series with the busy-back tone supply is short-circuited.

4.27 Momentarily operate the DISC key. The final circuit and the test set restore to normal and the BB and FIN lamps are extinguished.

Repeat Tests

4.28 To make repeat tests, operate the REP key after the test set has restored to normal and then momentarily operate the ST key. Restore the REP key to normal when the desired number of repeat tests have been completed. After the BB lamp flashes, momentarily operate the DISC key to restore the final circuit and the test set to normal.

Disconnection

4.29 After this test is completed on the circuit under test proceed as described in 4.14 to 4.16.

(E) Hunt Busy Line Test

4.30 This test checks the terminal hunting arrangement of the final circuit and its operation on encountering a busy line condition after terminal hunting to the last line of the group.

4.31 Operate the HTG-BY (hunt busy line) key. Then proceed as described in 4.22 to 4.29. The test is the same as

test (D) except that during units selection the final selector is directed by the test set to the first test line (terminal No. 98) which is wired equivalent to that of a busy terminal of a terminal hunting group. The final selector then terminal hunts to the second test line (terminal No. 99), which is busy, for the remaining tests.

(F) Check of No-Test Feature

4.32 This test is for the purpose of checking the ability of the final selector to stop on a busy line on calls placed over no-test incoming circuits.

4.33 Operate the NT (no test) key. Then momentarily operate the ST key to start the test. The FIN lamp lights as an indication that the test is in progress.

4.34 The test set directs the final selector to the second test line of the bank.

4.35 Immediately after units selection has been completed the test set connects a busy condition to the test line and checks that the final circuit applies ground to the ring conductor. An operate test is then applied to the S relay in the final circuit.

4.36 The test of the test line sleeve is omitted by the final circuit and the final selector remains on the busy terminal. A check is then made that the make-busy resistance connected to the sleeve by the final circuit is not short-circuited.

4.37 As the final circuit advances to the talking position the test set checks the tip and ring conductors for continuity and that they are not reversed. The OK lamp then lights as an indication of a satisfactory test.

Note: The OK lamp fails to light and the test set blocks in position 14 if the make-busy resistance is short-circuited or the S relay fails on its operate test.

4.38 Momentarily operate the DISC key. The test set maintains a receiver off the switchhook condition on the tip and ring of the test line and checks that the final circuit restores to normal without timing out of the awaiting called subscriber disconnect position. The final circuit is also checked for holding itself busy during disconnection and for the removal of the busy condition as it restores to normal. The test set then restores to normal and the FIN and OK lamps are extinguished.

4.39 To make repeat tests proceed as described in 4.13. To disconnect after this test is completed proceed in accordance with 4.14 to 4.16.

(G) Time Measure Release Test

4.40 This test is for the purpose of checking the time measure disconnect feature of the final circuit. This feature functions in service to cause the final circuit to time out and restore to normal in case the called subscriber does not hang up within a certain interval after the calling subscriber has disconnected.

4.41 Proceed in accordance with 4.04 to 4.10. After the OK lamp lights, momentarily operate the TMD (time measure disconnect) key. The final circuit advances to the awaiting called subscriber disconnect position. The OK lamp is extinguished and the TMR (time measure release) lamp is lighted.

4.42 The TO interrupter functions to advance the final circuit out of the awaiting subscriber disconnect positions. During this interval a hold test followed by a release test is applied to the C relay. After the timed interval is completed the final selector returns to normal from the test line. As the final circuit restores to normal the TMR lamp is extinguished. The test set then restores to normal and the FIN lamp is extinguished.

Note: If the time measure disconnect test or the C relay hold test fails, the final circuit restores to normal without timing out, the TMR lamp does not light and the test set blocks.

Repeat Test

4.43 To repeat this test, momentarily operate the ST key after the test set has restored to normal. Then after the OK lamp lights, momentarily operate the TMD key. After the test is completed the final circuit and the test set restore to normal.

Disconnection

4.44 At the completion of this test proceed in accordance with 4.14 to 4.16.

(H) Telltale Test

4.45 This test is for the purpose of testing the ability of the final circuit to advance under control of the X commutator in those cases where the final selector goes to telltale on final selections. This test may also be used to detect any chatter of brushes.

4.46 Operate the TT (telltale) key. Then momentarily operate the ST key to start the test. The FIN lamp lights.

4.47 Final brush and tens selections are made and on units selection the final selector is driven to telltale. As the

selector rod moves upward, observe whether the trip lever of the tripped brush has a tendency to chatter. Investigate any condition which causes excessive vibration of the trip lever in order to determine whether such chatter is due to a worn brush or some other cause.

Note: To check the other brushes on the selector rod arrange the test set to make repeat tests and after one brush is checked, depress a key in the H row of numerical keys for the next brush to be selected.

4.48 As the selector reaches telltale, the X commutator segment should advance the final circuit to the awaiting TK relay position. The test set checks that the final connects ground to the tip and ring conductors. After the final reaches the talking position the X commutator advances the circuit to the busy-back position. The final selector remains at telltale. The OK lamp lights and the BB lamp flashes as an indication of a satisfactory test.

Note: If the final circuit is not arranged to return busy-back pulses on telltale conditions the final will remain in the talking position and the OK lamp only will light.

4.49 Momentarily operate the DISC key. The final selector down-drives and the final circuit and the test set restore to normal. The OK, BB and FIN lamps are extinguished.

4.50 To make repeat tests proceed as described in 4.13. To disconnect after this test is completed, proceed in accordance with 4.14 to 4.16.

(I) Early Release Test

4.51 During this test a check is made of the ability of the final circuit to advance under control of the Y commutator in those cases where a premature disconnect condition occurs during brush or tens selection.

4.52 Operate the ER (early release) key. Then momentarily operate the ST key to start the test. The FIN lamp lights.

4.53 Final brush selection is completed and then the test set removes ground from the sleeve to simulate a disconnect condition by the calling subscriber. The final circuit advances to the awaiting sender position where the final selector down-drives to normal. Observe that the trip magnet operates during the short down drive interval. As the selector rod reaches normal the Y commutator segment should advance the final circuit to the awaiting TK relay position. As the final circuit advances, the test set checks that ground is connected to the ring conductor.

4.54 During the return of the final circuit to normal the test set checks that the final applies a busy condition to the sleeve and that this ground is removed when it reaches normal. The test set then restores to normal and the FIN lamp is extinguished.

Repeat Tests

4.55 To make repeat tests, operate the REP key and then momentarily operate the ST key. Restore the REP key to normal when the desired number of repeat tests have been completed. The final circuit and the test set restore to normal and the FIN lamp is extinguished.

Disconnection

4.56 After this test is completed on the circuit under test proceed as described in 4.14 to 4.16.

(J) Brush Continuity Test

4.57 This test is for the purpose of checking for continuity and freedom from crosses of the tip, ring and sleeve springs of the brush under test. It is used to test brushes not checked by the test line tests (A), (B), (C), (F) or (G).

4.58 Connect jack \pm (or \pm GRD) of the test set to jack F on the final frame jack panel.

4.59 Depress keys in the H, T and U rows of numerical keys to direct the selector under test to the terminals of the working line to be used for the test. The line used must provide a bridge across tip and ring conductors which will pass ringing current. This bridge is not provided on lines arranged for semi-selective ringing where one side of the line has no station connected, or on a terminal hunting line having the ring-up relay connected from one side of the line to ground or on desk or local plant lines not arranged for ring-up operation.

Note: The use of important lines or lines in terminal hunting groups should be avoided, in so far as possible. If there are indications that the test is interfering with service to a subscriber whose line is being used, disconnect immediately and select another working terminal for the test.

4.60 Operate the FBC (final brush continuity) key. Then momentarily operate the ST key to start the test. The FIN lamp lights.

4.61 Observe the final selector during the test and note any irregular operations, such as tripping the wrong brush, sluggish up-drive, slipping sequence switch drive disc, etc.

4.62 Final selections are made in accordance with the operated numerical keys and the final selector is directed to the line selected for the test.

4.63 As the final circuit advances out of the units selection position the test set checks that the final circuit connects ground to the ring conductor and that this ground is removed as the final circuit advances.

4.64 The final selector stops on the line selected, if idle, and advances to the talking position. The tip, ring and sleeve conductors and multiple brushes are checked for continuity and for crosses. The final selector then down-drives. The OK lamp lights as an indication of a satisfactory test and the final circuit restores to normal immediately even if the subscriber has removed the receiver from the switchhook after the busy test.

Note: If the OK lamp does not light, a trouble condition is indicated. The BB lamp flashes if the final selector encounters a busy line or in case of a cross between ring and sleeve conductors. It also flashes if the final selector is arranged to transmit busy-back pulses after going to telltale. If the terminal on which the selector stops is connected to an intercepting trunk the IO(intercepting operator) lamp lights as soon as the operator answers. This lamp also lights if there is a cross between tip and sleeve conductors. An open tip or ring is indicated if the selector stops on an idle line and no lamp lights.

4.65 Momentarily operate the DISC key to restore the test set to normal. The OK and FIN lamps are extinguished.

4.66 To make a test on another brush of the same selector, proceed in accordance with 4.59 to 4.65 using a different brush selection.

Repeat Tests

4.67 To repeat this test, momentarily operate the ST key after the test set has restored to normal. After the OK lamp lights, momentarily operate the DISC key to restore the test set to normal.

Disconnection

4.68 At the completion of this test proceed in accordance with 4.14 to 4.16.

(K) Particular Line Test - Idle Line Condition

4.69 This test provides a method of testing final circuits to particular terminals in connection with "don't answer" and "wrong number" reports. This test

checks the operation of the circuit for an idle line condition.

4.70 Make busy a final selector circuit which is arranged for testing subscriber lines and which has access to the particular number to be used in the test by inserting a No. 184 plug into the T-MB jack. Then connect the associated jack D and jack F on the final frame jack panel to jacks D and \pm (or \pm GRD), respectively, of the test set.

4.71 Manually raise the test final selector to the particular final terminal and then trip the proper brush. This connects the tip, ring and sleeve of the final terminal through to the test set but the sleeve only is used for this test.

4.72 Depress keys in the H, T and U rows of numerical keys to direct the selector under test to the terminals of the line to be used for the test.

4.73 Operate the FBC and PLI (particular line idle) keys. Then momentarily operate the ST key to start the test. The FIN lamp lights.

4.74 Final selections are made in accordance with the operated numerical keys and the final selector is directed to the terminal selected for the test.

4.75 Observe the final selector during the test and note any irregular operations, such as tripping the wrong brush, sluggish up-drive, slipping sequence switch drive disc, etc.

4.76 As the final circuit advances through the incoming advance position, the test set checks for ground on both tip and ring conductors.

4.77 The final selector remains on the final terminal and the buzzer in the test set operates as an indication of a satisfactory test. The OK lamp lights.

Note 1: If the final selector remains on the line and the buzzer does not operate, a trouble condition is indicated.

Note 2: If the final selector restores to normal from the final terminal and the final circuit advances to the busy-back position, the buzzer operates to indicate a busy line. However, if the buzzer does not operate in this case, a trouble condition is indicated.

4.78 Momentarily operate the TBL key to restore the final circuit and the test set to normal. The buzzer stops operating and all lighted lamps are extinguished.

4.79 To check another final circuit to this particular terminal, remove the plug from the T-MB jack and insert it into the T-MB jack of the next circuit to be tested. Then proceed as described under the test.

Note: To make a complete check, all final circuits having access to the particular final terminal should be tested to that terminal.

Repeat Test

4.80 To repeat this test, momentarily operate the ST key after the test set has restored to normal. After the buzzer operates on test (K) or the BB lamp lights on test (L), momentarily operate the TBL key to restore the final circuit and the test set to normal.

Disconnection

4.81 At the completion of this test proceed in accordance with 4.14 to 4.16.

(L) Particular Line Test - Busy Line Condition

4.82 This test is similar to test (K) except that the test set checks the operation of the final circuit for a busy line condition.

4.83 Proceed as described in 4.70 to 4.75 except that the PLB (particular line busy) key instead of the PLI key is operated and no connection is made to the \pm jack. This arranges the test set to connect a busy condition to the final terminal.

4.84 After final selections have been completed the test set checks that the final circuit connects ground to and then later removes ground from the ring conductor.

4.85 As the final selector finds a busy condition on the line it restores to normal and the final circuit advances to the busy-back position. The test set checks that the resistance in the busy-back lead is not short-circuited. The BB lamp flashes as an indication of a satisfactory test.

Note: The busy-back tone may be checked by means of an operator's telephone set plugged into the TEL jacks of the test set. Also, observe that the final selector is normal and is not at telltale. If busy-back tone is heard and the BB lamp does not flash, the relay winding in the busy-back tone supply circuit probably is short-circuited.

4.86 Momentarily operate the TBL key to restore the final circuit and the test set to normal. The BB and FIN lamps are extinguished.

4.87 To check another final circuit to this terminal proceed as described

in 4.79. To make a repeat test proceed in accordance with 4.80.

Disconnection

4.88 At the completion of this test proceed in accordance with 4.14 to 4.16.

5 SPECIAL FEATURES

Trouble Restore

5.01 Momentarily operate the TBL (trouble disconnect) key when it is desired to restore the test set to normal after it has blocked on a trouble condition.

Step-by-Step Advance

5.02 The step-by-step control feature permits canceling the automatic advance of the test set in those cases where it is desired to advance the test set in steps during the progress of a test cycle in order to make observations on a particular test.

5.03 Operate the STP (step-by-step) key and then momentarily operate the ST key to start the test. The test set stops after final brush and final tens selection has been completed.

5.04 To advance the test set under this condition, momentarily operate the ST key. After a desired selection or selections are checked, restore the STP key to normal and the test set proceeds with the remaining operations of the test.

Remote Control

5.05 This feature provides a convenient means of starting a test, of advancing the test set in steps and of restoring the test set to normal while observing the operation of the final circuit.

5.06 With the test set keys required for a particular test in an operated position, insert the plug of a No. 32-A test set into the EX-K (extension key) jack of the test set. If it is desired to control the test in steps, operate the STP key.

5.07 To start the test or to advance the test set in steps where the STP key is operated, depress the WH (white) key of the No. 32-A test set. This simulates the operation and release of the ST key of the selector test set.

5.08 To restore the test set to normal on a satisfactory test or if the test set blocks on a trouble condition, depress the RED key of the No. 32-A test set. The operation of this key simulates the operation and release of the TBL key of the selector test set. To repeat the test after the test set restores to normal, depress the WH key.

6. REPORTS

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