INCOMING SELECTOR CIRCUITS
FROM PANEL LOCAL, OFFICE TANDEM AND PANEL SENDER TANDEM OFFICES
MANUAL TEST USING TEST SET ES-20150-01 OR ES-239844
GROUND CUTOFF RELAY PANEL OFFICES

1. GENERAL

1.01 This section describes a method of testing incoming selector and repeating incoming selector circuits from local panel offices, office tandem and panel sender tandem offices, at the incoming frames in ground cutoff relay panel offices. The tests are made by means of the manually operated office, incoming and final selector test set (wagon type) per ES-20150-01 or ES-239844. The tests described are as follows:

A. Test with Compensating Resistance Only.

B. Test of Two-Wire Circuits with Compensating Resistance and Capacity (Except Repeating Incomings).

C. Test of Repeating Incoming Circuits Using Test Networks.

D. Busy Line Test.

E. Bell Ringing Test.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 The tests are intended for use in testing on a routine basis those incoming circuits which are not tested by an incoming selector test frame. They may also be used to supplement the test frame tests and to check trouble conditions.

1.04 The tests are made at the incoming selector frames and the test set is connected to the proper jacks by means of patching cords. On tests to final multiple test lines, the test set applies tests to the incoming L and A relays and the test line tests the tripping and supervisory features of the incoming.

1.05 Tests A, B, and C are test line tests. Test A is intended for use in testing incoming circuits over trunk loop conditions as regards resistance only. This test may also be used for making an operation test of the selection features of repeating incoming circuits (not marginal tests of L relay). Test B is intended for use in testing two-wire incoming circuits over maximum trunk loop conditions as regards both resistance and capacity. Tests A and B should be alternated on regularly scheduled test line tests of two-wire incoming circuits equipped with cutoff type jacks. If it is desired to make test B on two-wire incoming circuits equipped with bridging type jacks and serving other buildings it will be necessary to open the circuit by removing the heat coils at the main distributing frame in the terminating office. Test A can be made on circuits equipped with either type of jack.

1.06 Test C is intended for use in making tests of repeating incoming circuits where the test set is arranged to make marginal tests of the L relays of these circuits. If the circuits to be tested are equipped with bridging type jacks instead of cutoff jacks the heat coils must be removed during the test. If this is not practicable or if the test set is not arranged to make this test (no L-NO, L-HLD, and L-REL keys provided), test A should be used for making an operation test of such circuits.

1.07 Failures of L relays of repeating incoming circuits which have been detected by the incoming selector test frame, should be checked by making test C. If the test set is not arranged to make this test, the failures should be checked with a No. 35C test set, or equivalent.

1.08 Test D may be used when a rapid check test of the operation of the incoming circuit, without making a marginal test of the tripping and supervisory features, is desired.

1.09 The trunk hunting feature of incoming circuits may be checked during any of these tests, if desired, by making the first choice final circuits busy.

1.10 Any incoming circuit on which a failure is encountered when making a test, should be left busy until the trouble has been cleared.

2. APPARATUS

2.01 Office, Incoming and Final Selector Test Set per ES-20150-01 or ES-239844.

2.02 Four P3E Cords 6 feet long equipped with two No. 310 Plugs (or 110 Plugs) (3P6D Cord).

2.03 Operator's Telephone Set.

2.04 No. 32A Test Set.

2.05 No. 184 Plugs, as required.

2.06 No. 893 Cord equipped with a No. 360 Tool (socket type cord tip) and a No. 365 Tool (suspender clip) on each end (Test C).

2.07 1011G Dial Hand Test Set and one W2CK Cord equipped with one 471A Jack and one 310 Plug (or one No. 110 Plug) (2W38A Cord).

3. PREPARATION

ALL TESTS

3.01 Before starting the test on two-wire incoming selector circuits, arrange to have the trunks which are associated with the circuits to be tested, made busy at the originating office. The number of trunks to be made busy at one time should depend upon the size of the trunk group and the volume of traffic at the time of testing. However, at no time should an entire trunk group be made busy.

3.02 When testing three-wire incoming circuits equipped with separate test and make-busy jacks, make the circuits to be tested busy by inserting No. 184 plugs into the MB jacks.

Note: Do not insert a make-busy plug into the MB jack of a circuit which is off-normal.

3.03 With all test set keys except the numerical keys normal, connect jack B-GRD of the test set to jack A on the incoming frame jack panel.

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

3.04 Operate the 2WI (two-wire incoming) key to test two-wire incoming circuits from panel local or panel tandem offices and repeating incoming circuits.

3.05 When using the test set per ES-20150-01 to test two-wire incomings having A relays arranged to operate on 48 volt battery, operate the SL-48V (or A) key for a maximum external circuit loop of 6350 ohms or the LL-48V (or B) key for a loop of 7540 ohms. With these keys normal the test set is arranged for testing 24 volt A relays.

3.06 Operate the 3WI (three-wire incoming) key to test three-wire incomings from panel offices.

3.07 If it is desired to check the trunk hunting feature of the incoming circuits during these tests, make the first choice final circuits busy by inserting No. 184 plugs into the TMB (or MB) jacks at the final frame.

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

Tests A, B, C and E

3.09 Operate the TEL (telephone set) key and connect an operator's telephone set to the TEL jacks of the test set in order to check for tone or the audible ringing signal.

Note: When using test set per ES-239844, the TEL key should not be operated until after selections have been completed.

4. METHOD

ALL TESTS

4.01 Connect jack TST of the test set to the T (or TMB) jack of the incoming circuit to be tested.

Note: To avoid releasing a service connection, do not connect to a T jack of the cutoff type or to a TMB jack if the associated selector is off-normal.

A. Test with Compensating Resistance Only

4.02 With the L-NO, L-HLD, L-REL, and LGT keys normal, if provided, operate the compensating resistance keys so that the resistance furnished by the test set added to that wired in the incoming circuit, if provided, will give the total compensating resistance values listed below. No capacity should be introduced in the circuit by the test set.

RESISTANCE OF L RELAY	TOTAL COMPENSATING RESISTANCE REQUIRED FOR TEST
1000 ohms	1500 ohms
1200 ohms	1000 ohms
500 ohms (206- and 280-type relays in repeating incomings)	900 ohms

Note: In those cases where the test set is not arranged to provide the exact amount of resistance required, the next lowest value which it is possible to obtain should be used.

4.03 Depress keys in the TH, H, T, and U rows of numerical keys corresponding to the number of the final multiple test line used for testing incoming selectors.

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

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

4.06 Incoming and final selections are made in accordance with the operated test set keys to select an idle final multiple test line or one of the other test lines.

Note 1: If the trunk hunting feature is being checked, the steady lighting of the OF (overflow) lamp indicates that the incoming failed to trunk hunt and has selected one of the final circuits made busy. The OF lamp also lights if the incoming selector goes to overflow due to all trunks being busy or to understepping on group selection, or if the final selector goes to telltale.

Note 2: When testing repeating incoming circuits under test A, if a failure occurs on a circuit during selections, make test C, if possible, to determine whether apparatus readjustments are required.

4.07 After selections have been completed, the incoming circuit advances to the awaiting sender and reverse battery position. The test set checks that the incoming applies reverse battery to tip and ring conductors (ground on tip and battery on ring). The OF lamp lights momentarily as an indication that this test was satisfactory.

4.08 When the incoming advances out of the awaiting sender position the IO-OK (incoming OK) lamp is lighted.

Note: When testing three-wire incomings the test set checks for ground on the sleeve of the incoming. In this case the IO-OK lamp lights as an indication of a satisfactory test.

4.09 As the incoming advances to the awaiting trunk closure position, an operate test is applied to the A relay of two-wire circuits. If this test is satisfactory, the incoming advances to the ringing position and connects ringing current to the test line.

Note 1: In the case of three-wire circuits the incoming completes trunk closure and advances to the ringing position.

Note 2: The test set ES-239844 does not apply a marginal test to the A relay.

4.10 The final multiple test line checks for ringing ground and for immediate ringing. A check is also made for the open period between immediate ringing and machine ringing.

Note 1: The check for immediate ringing or for the open period is omitted if the incoming is not arranged for immediate ringing.

Note 2: Some test lines are not arranged to check for ringing ground.

4.11 Check that the audible ringing signal is heard in the telephone set receiver for at least one ringing interval.

Note: When using test set per ES-239844, operate the TEL key if it is desired to listen to the audible ringing signal or any tone indications. This key should be normal during the supervisory relay test.

4.12 As soon as the test line receives machine ringing current from the incoming circuit it functions to apply a non-operate (pre-trip) test to the R (trip) relay in the incoming. The failure of this test is indicated by rapidly interrupted ringing tone instead of the audible ringing signal in the telephone set receiver.

Note 1: On final multiple test lines arranged for 4-party selective ringing and equipped with a resistance instead of a condenser in series with the primary winding of the PW relay, a check is made for the polarity of the superimposed ringing current corresponding to the final choice in which the test lines are located.

Note 2: The earlier type of final multiple test lines are not arranged to transmit interrupted ringing tone.

4.13 The test line then advances and applies an operate (trip) test to the R relay. If the R relay fails to operate on this test, the audible ringing signal will continue to be heard in the telephone set receiver.

4.14 If the tripping tests are satisfactory the incoming advances to the talking position and the test line makes a check to determine if the talking battery received from the incoming is of the proper polarity. The failure of this test is indicated by the stopping of the test set.

Note: The earlier test lines are not arranged to make this check.

4.15 The test line then advances and applies a long pulse of soak current to the incoming S (supervisory) relay. This pulse is followed by a release test and two soak-release tests. A second long pulse is applied by the test line, followed by an open circuit release test and two operate-open circuit release tests.

Note: The earlier test lines are arranged to apply soak current to the supervisory relay followed by a release test. The test line then advances and applies an operate and a release test alternately to the supervisory relay until disconnection.

4.16 During the supervisory relay tests, the lighting of the IO-OK lamp in the test set should be observed. If these tests are satisfactory, the lamp should be extinguished six times. The dark periods consist of one long interval followed by two short intervals, then another long interval followed by two short intervals. After the last dark interval the lamp remains lighted.

Note 1: The IO-OK lamp may be extinguished momentarily when ringing is tripped and would occur previous to the first long dark interval. This does not indicate a trouble condition and such an interval should be disregarded.

Note 2: With the earlier test lines, the IO-OK lamp is extinguished and then flashed at regular intervals until disconnection.

4.17 After the supervisory relay test has been completed, the test line advances and connects a tone to the incoming circuit as an indication that all tests have been completed by the test line. This tone is heard in the telephone set receiver as a tick tock tone.

Note: The earlier test lines are not arranged for the tick tock tone.

4.18 Momentarily operate the DISC (disconnect) key. The incoming and final selector circuits and the test set restore to normal. Observe that the trip magnet operates during the down-drive of the incoming selector. As the final selector returns to normal the test line advances and restores to normal. The IO-OK and TST lamps are extinguished.

Note 1: In the earlier incoming circuits the trip magnet is not arranged to operate during the down-drive period.

Note 2: The BY lamp should light during the return to normal of a three-wire incoming as an indication that the circuit has applied a busy condition to the sleeve during this interval.

Repeat Test

4.19 To repeat this test, momentarily operate the ST key after the test set has restored to normal. After the tests on the circuit have been completed, momentarily operate the DISC key to restore the test set and associated circuits to normal.

Disconnection

4.20 If any of the other tests are to be made on the incoming under test, restore any keys not required to be operated for the next test.

4.21 If no further tests are to be made on the circuit under test and the same test is to be made on other circuits on the same side of the frame, disconnect the plug from the T (or TMB) jack and reconnect it to the corresponding jack of the next circuit to be tested. The proper compensating resistance keys should be operated for the incoming circuit to be tested.

Note: Before disconnecting the test set from an incoming circuit, observe that the incoming is normal.

4.22 When testing is completed on the last circuit, restore all operated keys to normal and disconnect all cords. Then remove the No. 184 plugs from the MB jacks, if provided, or arrange to have the busy trunks made available for service at the originating office. Any heat coils that have been removed should be replaced.

B. Test of Two-Wire Incoming Circuits With Compensating Resistance and Capacity (Except Repeating Incomings)

4.23 The purpose of this test is to add capacity to the fundamental circuit during incoming and final selections to simulate maximum trunk loop conditions in order to

test the circuit for overstepping. This test should not be made on repeating incoming circuits.

Note: When testing incoming circuits serving other buildings and the circuits are equipped with bridging jacks instead of cutoff jacks, it will be necessary to open the trunk circuit during the test by removing the heat coils at the main distributing frame in the terminating office.

4.24 With the L-NO and L-HLD or L-REL keys normal, if provided, operate the compensating resistance and capacity keys to provide the proper values as follows:

TEST SET	COMPENSATING RESISTANCE IN CIRCUIT	
	200 OHMS OR LESS	MORE THAN 200 OHMS
ES-20150-01 or ES-239844 with 1.38 MF key	(1300-r) ohms 1.38 MF key	(1300-r) ohms 1.38 MF key
ES-20150-01 with FCR key	FCR key	(1300-r) ohms 1.25 MF
ES-239844 with FCR key	FCR key	*(1500-r) ohms
ES-239844 without FCR or 1.38 MF keys	*(1500-r) ohms	*(1500-r) ohms

Note 1: In the table, the letter r refers to the compensating resistance wired in the incoming circuit under test. This value should be subtracted from the 1300 or 1500 ohm values to determine the compensating resistance required and the keys to be operated.

Note 2: The asterisk * indicates that the compensating resistance keys should be operated in the MF (capacity) direction. This connects both resistance and capacity in the circuit.

Note 3: In those cases where the test set is not arranged to provide the exact amount of resistance required, the next lowest value which it is possible to obtain should be used.

4.25 Proceed in accordance with 4.03 to 4.22. The compensating resistance and capacity values required should be checked for each circuit tested.

C. Test of Repeating Incoming Circuits Using Test Networks

4.26 This test is for the purpose of making a check test of the selection features of repeating incoming circuits.

Note 1: If the compensating resistance wired in the circuit under test exceeds 500 ohms, it will be necessary to short-circuit this resistance with the No. 893 cord during the test. This cord should be used only at the front of the frame to avoid leaving it connected when the circuit is restored to service.

Note 2: When testing repeating incoming circuits serving other buildings and the circuits are equipped with bridging jacks instead of cutoff jacks, it will be necessary to open the trunk circuit during the test by removing the heat coils at the main distributing frame in the terminating office.

Note 3: The LGT key shall be operated in addition to the L-NO, L-HLD, and L-REL keys when testing incoming selector circuits modified for the 280-type L relay. Also, all compensating resistance in the incoming selector circuit shall be short-circuited.

4.27 With all compensating resistance keys and the 1.38 MF key normal, operate the L-NO (L relay nonoperate) and L-HLD (L relay hold) keys. This arranges the test set to make a nonoperate and a hold test of the L relay. Then proceed as described in 4.03 and 4.04.

4.28 If the L relay of the incoming circuit is within its nonoperate adjustment and if its primary winding is properly shunted, the incoming will remain in position 1.

4.29 If the nonoperate test of the L relay is satisfactory, restore the L-NO key to normal. Then proceed as described in 4.05 to 4.18. The hold test of the L relay is made during final selections (selection beyond).

4.30 After the test set and associated circuits have returned to normal, restore the L-HLD key to normal and operate the L-REL (L relay release) key. Then proceed as described in 4.04 to 4.22. The release test of the L relay in the incoming is made during incoming brush and group selections and final selections. This test checks the L relay for its ability to release quickly enough to avoid overstepping.

D. Busy Line Test

4.31 This test is for the purpose of checking the operation of the incoming on a busy line condition. Since the final selector is directed to a busy line instead of a final multiple test line, marginal tests are not made on the trip and supervisory relays.

4.32 Operate the compensating resistance keys as described in 4.02. Depress keys in the TH, H, T, and U rows of numerical keys to correspond to the number of the permanently made busy final terminal. Then proceed with the test as described in 4.04 to 4.09. All tests covered in these paragraphs are made. As the incoming advances to the ringing position, the busy-back condition in the final circuit causes ringing to be tripped and the incoming S relay operates and releases in accordance with the busy-back interruptions to flash the IO-OK lamp. Observe that the lamp flashes at the busy-back rate.

4.33 If the IO-OK lamp flashes at regular intervals, proceed in accordance with 4.18 to 4.22.

E. Bell Ringing Test

4.34 This test is used to supplement the test line test in checking the ringing on party lines and for making rapid ringing tests. The final multiple test line used in the test line tests, checks only for the ringing current applied to the particular final choice in which the test lines are located.

> ***Note:*** In 4-party offices, two bell ringing test lines are provided, one for each of final groups 0-499 and 500-999 or equivalent, to provide for checking the two ringing choices. Ordinarily, when this test follows a test to a final multiple test line it will be necessary to check only the ringing choice not tested by the final multiple test line. However, in offices arranged for 4-party selective ringing and the final multiple test lines are equipped with a condenser instead of a resistance in series with the PW relay, a ringing polarity check is not made during test line tests. In this case a bell ringing test for both ringing choices will be required to check the polarity of the positive and negative superimposed current supplied by the incoming circuit. The test line is equipped with two subsets for this purpose, each subset having gongs of a different tone. In offices having individual, 2-party selective or 4-party semi-selective ringing, and one subset is provided.

4.35 Connect test line jack C to bell set jack D on the incoming frame jack panel. This connects the subset or subsets used for ringing tests to the final terminals used in making the test.

> ***Note:*** Where two bell ringing test lines are provided, jack C is common to both test lines.

4.36 Operate the compensating resistance keys as described in 4.02. Then depress keys in the TH, H, T, and U rows of numerical keys to correspond to the number of the bell ringing test line which is associated with the ringing choice to be tested.

4.37 Proceed with the test as described in 4.04 to 4.09. After the test line associated with the subset or subsets has been selected, the incoming advances to the ringing position.

4.38 Observe that the test line bell rings in accordance with the ringing current provided for the final choice in which the test line is located. Also observe that the audible ringing signal is heard in the telephone set receiver.

Note: When using test set per ES-239844, restore the TEL key to normal after observing the audible ringing signal for at least one ringing interval.

4.39 Momentarily operate the DISC key. The incoming and final selector circuits and the test set restore to normal. The TST lamp is extinguished.

Note: The BY lamp lights during the return to normal of a three-wire incoming circuit.

4.40 To make a test of the other ringing choice on circuits arranged for 4-party ringing, proceed in accordance with 4.36 to 4.39 using the bell ringing test line number associated with the ringing choice to be tested.

Note: In 4-party full selective ringing offices where it is desired to apply a ringing and tripping test for the polarity of ringing opposite to that supplied to the final choice in which the final multiple test line is located, the test may be made as described below. With the C and D jacks at the jack panel of the incoming selector frame at the end of the line-up patched with a P3E cord equipped with 110 plugs and a 1011G dial hand test set with the key operated to the MONITOR position connected to the C jack at the frame where the test is to be made; start the normal bell ringing test. Observe that the proper test line bell rings and then operate the key of the 1011G handset to the TALK position. Should this operation fail to trip ringing, the test line bell will continue to ring.

Repeat Test

4.41 To repeat this test, momentarily operate the ST key after the test set has restored to normal. The test proceeds as described in 4.37 to 4.39.

Disconnection

4.42 At the completion of this test proceed in accordance with 4.20 to 4.22.

5. SPECIAL FEATURES

Trouble Restore

5.01 Momentarily operate the DISC key when it is desired to restore the test set to normal after the test set 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 by steps during the progress of a test 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 each of certain selections consisting of incoming brush and group selections and final brush and tens selections, have been completed.

5.04 To advance the test set under this condition, momentarily operate the ST key. After the desired selections have been 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 incoming circuit.

5.06 With the test set keys required for a particular test in an operated position, insert the plug of a No. 32A 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, momentarily depress the WH (white) key of the No. 32A 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 on if the test set blocks on a trouble condition, momentarily depress the RED key of the No. 32A test set. The operation of this key simulates the operation and release of the DISC key of the selector test set. To repeat the test after the test set restores to normal, momentarily depress the WH key.

6. REPORTS

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