OUTGOING TRUNK OPERATIONAL TESTS USING OUTGOING TRUNK TEST FRAME OR TESTBOARD PANEL AND PANEL TANDEM OFFICES

1. GENERAL

1.01 This section describes the methods of making operational and voltmeter tests on outgoing trunks from panel and panel tandem offices using the outgoing trunk test frame or testboard.

1.02 This section is reissued for the following reasons:

(1) To revise preparation for Test M to provide for tests of trunks arranged for centralized test access to E and M leads.

(2) To include references to operational tests of AIC trunks and revise preparation to provide for voltmeter test of AIC trunks.

(3) To revise Test A and Table B to provide for tests of No. 1 ESS trunks.

(4) To revise Test I to provide for tests of vacant code or overflow trunks.

(5) To revise Tests A and K to provide for tests of No. 5 Crossbar Centrex Phase 2 and 3 trunks.

This reissue does not affect the Equipment Test List.

1.03 The tests covered are:

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A. Trunks to No. 1 Crossbar, No. 5 Crossbar, ▶No. 1 ESS,◀ or Panel Offices: Tests of these trunks are made by directing calls to the final multiple test line ▶in panel offices◀ or incoming trunk test line in crossbar ▶or ESS◀ offices. These test lines, in conjunction with the test circuit, check the ringing and supervisory features of the trunks. 7

B. Trunks to Crossbar Tandem or Panel Office Selector Tandem: Tests of these trunks are made by directing calls to the test line in the respective type of office. 8

C. Trunks to Crossbar Tandem, Test of Remote Control Registration Pulses: This test is made by directing the test calls through tandem to some line in a terminating office on which an answer condition can be established. . 9

D. Trunks to Panel Call Indicator (Including Official PBX Trunks Requiring Call Indicator Pulses): These trunks are tested by directing calls to a call indicator test line, to a busy number, or to a PBX operator. 10

E. Call Indicator Trunks to Panel Call Indicator Tandem, Panel Sender Tandem, or Crossbar Tandem (Non-CAMA): These trunks are tested by directing a call to the tandem office test line circuit, to a busy line, or to a test line circuit in a local office reached through the tandem office. 11

F. Call Announcer Trunks: These trunks are tested by directing calls to a test line or to a busy line in the terminating local office. 12

G. Outgoing Trunks from Panel Sender Tandem Selectors to Operator: These trunks are tested by directing calls to a test line or to a busy line in the local office. 12

H. Trunks to Step-by-Step Office: These trunks are tested by directing

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calls to a connector multiple test line circuit or to a busy number. 12

I. Operator Trunks: This test checks, on a regular call basis, trunks to the official PBX, information, repair service, special service operator, intercepting, vacant code, ▶vacant code or overflow,◀ and local test desk. Verification is made for audible ringing and proper supervision. 13

J. Call Indicator Trunks to Crossbar Tandem Operator Identified CAMA: These trunks are tested either to the tandem test line or through the tandem office to a terminating office test line. 15

K. Multifrequency Trunks: Trunks direct to crossbar offices are tested by directing calls to the incoming trunk test line or busy line in the respective office. Trunks to 4A or 4M crossbar (ANI) and crossbar tandem (non-CAMA) are tested to the 4A or 4M or tandem test line or through the respective office to a terminating office test or to a busy line. CAMA trunks are tested to the 4A, 4M No. 5, or crossbar tandem test line. 16

L. Dial Coin Zone Service Trunks to Panel Selector Tandem or Crossbar Tandem: This test is made by directing a call to the tandem office test line. . 18

M. Voltmeter Test of Trunks: This test covers tests of continuity and polarity, shorts, crosses, and grounds and provides for measuring the loop resistance of the trunk facilities or resistance to trouble location. . . . 19

1.04 Tests A, B, C, D, E, and I are made from panel and panel tandem offices.

1.05 Test C can be made only with panel office testboard circuits ES-20015-01, SD-21610-01, and SD-21941-01.

1.06 Tests F, G, and H can be made only with the panel tandem office outgoing trunk testboard circuit SD-21154-01.

1.07 Test J is made from panel offices.

1.08 In the tests covered in this section, key and lamp designations used correspond to test jack T1 or to test cord TST1.

1.09 Some test circuits are arranged to test the trunk for busy as soon as the test cord is connected to the trunk jack, while other test circuits test for busy after the SDR or start (ST) key is operated. It is important in the latter case that the SDR or ST key be normal when connection is made to the trunk. If the trunk is busy, the BY or BUSY lamp lights. If the trunk later becomes idle, the BY or BUSY lamp is extinguished. If the trunk is idle, the BY or BUSY lamp remains dark but, when an ON lamp is provided, it will light after the SDR key is operated.

1.10 Certain keys and lamps having the same functions in the various types of test circuits have different designations. These functions and the associated designations are indicated in Table A.

TABLE A

FUNCTION	DESIGNATION
Lamps	
Busy (Red)	BUSY or BY
Sender (Green)	SENDER or SDR
Supervisory (White)	SUP or S
Keys	
Direct Mechanical	DM or PAN
Direct Call Indicator	RCI or PCI
Call Indicator Tandem or Sender Tandem	MECH T or TAN
Distant Office	DO, 2W OFF, or 1 OFF
Talk	TALK or T

1.11 For the convenience of the maintenance personnel, a list should be prepared, showing the number to be set up and the compensating

resistance key settings to be used when testing the various groups of outgoing trunks. Records of cross connections for the incoming trunk test frame and records of the office code cross connections for the decoders (or translators) will often be of assistance in making up this information.

1.12 When it is desired to check the circuit under test to see that it operates satisfactorily under existing conditions, the compensating resistance key settings shown in the list mentioned in 1.11 should be a value such that, when added to the actual trunk loop resistance plus any compensating resistance at the distant end, the sum is as near as possible to, but not less than, the minimum value shown in Table B. When the actual trunk loop resistance, plus any compensating resistance at the distant end, is greater than the minimum value given in the table, the trunk compensating resistance keys should be normal (0 resistance).

1.13 When it is desired to check the circuit under test to see that it operates under maximum external selection loop conditions, the compensating resistance key settings shown in the list mentioned in 1.11 should be a value such that, when added to the actual trunk loop resistance plus any compensating resistance at the distant end, the sum is as near as possible to, but not greater than, the maximum value shown in Table B.

1.14 A RY OPR COMP RES keys are provided for testing the A relay in the multifrequency (MF) incoming trunks. The A relay compensating resistance should be a value such that, when added to the trunk loop resistance, the sum is as near as possible to, but not more than, the maximum external circuit loop resistance value for supervision, as covered on the circuit drawing.

1.15 If any of the office brush (OB), office group (OG), tandem hundreds (TAN-H), tandem tens (TAN-T), tandem units (TAN-U), or station (STA) keys are not required, but remain operated from a previous test, momentarily depress the key release (KR) key.

1.16 The REP key (if furnished), when operated and used with the TST1 cord, will automatically make repeat tests on calls only to a "busy" test line or to a test line which conditions the distant incoming trunk circuit to send back pulses of reversed battery. In order to satisfy the test circuit, when the REP key is operated, four pulses

TABLE B

	EXTERNAL LOOP OHMS MIN.	MAX.
Ground Cutoff Incoming — Repeating (see Note)	1200	2200
Ground Cutoff Incoming — Nonrepeating	900	1488
Battery Cutoff Incoming — Short-range (R132 Relay)	1200	1830
Battery Cutoff Incoming — Long-range (N3 Relay)	1200	2885
Distant Office (Office Tandem) Short-range (E638 Relay)	1200	1860
Distant Office (Office Tandem) Long-range (N3) Relay	1200	2885
Distant (Sender Tandem)	900	2600
Panel Call Indicator	900	2600
No. 1 Crossbar (B608) (A Relay)	900	2800
No. 1 Crossbar (S523 or UA84A Relay)	900	3115
No. 5 Crossbar	900	3115
Tandem Crossbar (RP)	900	3115
Call Announcer	—	6558
Outgoing from Panel Sender Tandem Selectors	—	3095
Step-by-Step	2000	5000
Official PBX (Requiring C.I. Pulses)	900	2895
Battery Cutoff Incoming Long-range (N5 Relay)	1200	3385
Crossbar Tandem (PCI)	900	2640
No. 1 ESS	900	5300

Note: Where ground cutoff repeating incomings have been modified to overcome interference due to induced a-c voltages, see table on incoming selector schematic circuit drawing for cable loop limits.

(four flashes) of reversed battery are required from the incoming trunk circuit.

1.17 Tests on dial coin zone trunks to a panel sender tandem or to a crossbar tandem may be made from the test "in" jacks (district or office multiple side) or from the test "out" jacks (facility side). When using the test "in" jacks (includes dial coin zone trunk equipment), the tone (TN) key may be employed to indicate to the operator that the call is a test call. When using the test "out" jacks (excludes dial coin zone trunk equipment), the test call will be made directly on the facility to the panel sender tandem or to the crossbar tandem. Miscellaneous tests of the dial coin zone trunk equipment are covered in Section 215-160-501.

1.18 Overall operational tests of CAMA trunks are not intended to be made with the OGT test circuit into synchronous or non-synchronous test lines. Automatic test equipment in local and CAMA offices performs operational tests of the trunk equipment at the near and far ends. The test procedures used in making transmission tests with the OGT test circuit into 104-type test lines (Section 215-722-501) checks the ability of the CAMA trunks to complete a call. Removal of test progress tone indicates trunk cut-through, and no further operational functions can be checked.

1.19 When testing an ANI outgoing trunk, the T jack associated with the district or office multiple and the MB jack associated with the line side of the trunk circuit should be used. If provided, the ANI key on the OGT test circuit should be operated after connecting to the trunk T jack. With an ANI key provided, test calls may be directed to a special NNX code (a free code) without AMA tape registration. Any other test line termination will be routed to an operator for verification of calling number. When an ANI key is not provided, the only tests which can be performed on the ANI trunks to a 4-type toll office are transmission tests requiring operator assistance. Tests can be directed to those test lines which have been assigned a special NNX code (a free code) on ANI trunks to a crossbar tandem or No. 5 crossbar office. The ANI key does not serve PCI test facilities, therefore only tests to those lines which have been assigned a special NNX code (a free code) can be performed without operator assistance on ANI trunks requiring PCI pulsing.

1.20 When testing ANI trunks involving various grouping conditions such as more than one ANI group or separate groups in the same ANI group having customers with different office codes, it is necessary to use a particular test number network for each trunk group condition. When this condition exists, patch the ANI jack to the correct NM_ jack and operate the ANI key. When only one test number network is required, operate the ANI key.

1.21 When the CAMA operator requests the calling number on through calls to a terminating office, give the name (or number) of the office which has access to the trunk being tested and a busy line, test line, or charge number, in accordance with local practice.

1.22 If the trunk being tested has previously been made busy, the make-busy plug may be removed for the test or the NT key, if provided, may be operated to cancel the busy test. This key remains operated for the duration of the test on the particular trunk.

1.23 There will be no flash of the supervisory lamp on calls to a busy line in those offices where the busyback has been modified to give interrupted tone only. However, if the test circuit is modified to include the tone detector circuit, busy lines will be detected by the tone detector circuit and indicated by flashing of the S1 lamp at a busyback rate. If the TND key is provided, this key must be operated for the tone detector to operate on busyback. A later modification of the test frame does not provide a TND key but does provide a DBY lamp to indicate the tone detector has been selected by the test termination circuit (DET key operated). With this feature the DBY lamp must not be lighted when the tone detector is to operate on busyback.

1.24 ▶Operational tests of trunks to automatic intercept center (AIC) are made at the OGT testboard by means of jacks associated with the AIC trunks. These tests are described in Section 215-351-501 (GCO offices) and Section 215-551-501 (BCO offices).◀

1.25 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 3 or 4 of this section, indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a 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 a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 The apparatus required for each test is shown in Table C. The details for each item are covered in the indicated paragraphs.

2.02 Test circuit ES-20015-01.

2.03 Test circuit SD-21154-01.

2.04 Test circuit SD-21610-01.

2.05 Test circuit SD-21941-01.

2.06 ES-207571 voltmeter test cord circuit, for use in Test M by itself or with test circuits SD-21941-01 or ES-226467.

2.07 Test circuit ES-226467, without recording keys.

2.08 Test circuit ES-226467 modified by ES-261223 for recording keys.

2.09 52-type head telephone set.

2.10 P3F cord, 4 feet long, equipped with one 309 and one 310 plug (3P12B or 3P12C cord). For use where the OGT test circuit is provided with test jacks T1 and T2.

2.11 P3D cord, 8 feet long, equipped with two 309 plugs (3P3B cord). For use where OGT jacks require 309 plugs.

2.12 P3E cord, 8 feet long, equipped with two 310 plugs (3P6E cord). For use where OGT jacks require 310 plugs.

3. PREPARATION

STEP	ACTION	VERIFICATION
All Tests		
	Caution: If, at any time during the following tests, the trunk is found busy on a service call, immediately restore the talk key, if operated. When the trunk becomes idle, make the trunk busy and	

TABLE C

APPARATUS	TESTS												
	A	B	C	D	E	F	G	H	I	J	K	L	M
Test Circuit (2.02, 2.03, 2.04, 2.05, 2.07, or 2.08)	1	1	–	1	1	–	–	–	1	–	–	1	–
Test Circuit (2.02, 2.04, or 2.05)	–	–	1	–	–	–	–	–	–	–	–	–	–
Test Circuit (2.03)	–	–	–	–	–	1	1	1	–	–	–	–	–
Test Circuit (2.02, 2.04, 2.05, 2.07, or 2.08)	–	–	–	–	–	–	–	–	–	1	–	–	–
Test Circuit (2.02, 2.04, or 2.08)	–	–	–	–	–	–	–	–	–	–	1	–	–
Test Circuit (2.02, 2.03, 2.04, or 2.06)	–	–	–	–	–	–	–	–	–	–	–	–	1
Head Telephone Set (2.09)	1	1	1	1	1	1	1	1	1	1	1	1	1
Cord (For usage see 2.10)	–	–	–	–	–	–	–	–	–	–	–	–	–
Cord (For usage see 2.11, 2.12)	–	–	–	–	–	–	–	–	–	–	–	–	–

STEP	ACTION	VERIFICATION
	continue testing. If other trunks are to be tested, the test cord may be moved to an idle trunk and testing continued. If, however, testing is to be discontinued at this time, restore the test circuit keys to normal and disconnect test cord from trunk jack.	
1	Restore test circuit keys to normal.	
2	Connect head telephone set to TEL jack of test circuit.	
3a	If coin special service trunks arranged for dial tone first operation are being tested— Operate ANI key.	
4	Connect test cord to test jack of trunk to be tested. ***Note 1:*** ◗For the purpose of making voltmeter tests of AIC trunks, jacks TO (test out) and TI (test in) are provided. ***Note 2:*** When testing ANI-B outgoing trunks to TSP or TSPS, one test jack is provided for district or office multiple appearance. Another test jack is provided for line appearance. For tests of E and M leads of these trunks, see Steps 8e and 9e.◖	ON lamp, if provided, lighted. ***Note:*** Some test circuits are arranged to test for busy at this point. In this case, if the trunk is busy, the busy lamp lights. See preceding caution.
5b	If trunk tested busy in Step 4 (not on service call)— Operate NT key or remove make-busy plug.	Busy lamp extinguished.
Tests A Through E, G, H, J, and K		
6c	Operate SDR key, if provided.	***Note:*** Some test circuits are arranged to test for busy at this point. In this case, if the trunk is busy, the busy lamp lights. See caution on preceding page.
7d	If trunk tested busy in Step 6c (not on service call)— Operate NT key or remove make-busy plug.	Busy lamp extinguished.
◗Test M		
8e	When testing E and M leads of outgoing trunks— Patch MB jack associated with leads to district	

STEP	ACTION	VERIFICATION
	or office multiple to special jack supplying battery on tip and ground on sleeve.	
	Note: If make-busy plug is found in MB jack, remove plug until testing is completed and patching cord is removed.	
9e	Connect test cord to E & M IN or E & M OUT jack as desired.◀	

4. METHOD

STEP	ACTION	VERIFICATION
A.	**Trunks to No. 1 Crossbar, No. 5 Crossbar, ▶No. 1 ESS,◀ or Panel Offices**	
8	Operate DM or PAN key.	
9	Operate COMP keys, as required (Table B).	
10f	If crossbar trunks or incoming selector circuits having 48 volts on the trunk supervisory relay are to be tested— Operate LONG LOOP key.	
11g	When trunk being tested is common to two crossbar office units and it is desired to direct the call to unit requiring high group selection— Operate HF key.	
12h	Where keyset is provided— Write up number of final multiple test line when testing trunks to panel offices, or number of incoming trunk test line when testing trunks to crossbar ▶or ESS◀ offices.	
	Note: Where recording keyset is not provided— Number called is restricted to that associated with DM class relay and key.	
13	Operate and release ST key.	Sender lamp flashes at 120 ipm, then is extinguished (or lights steadily when test circuit ES-226467 is used).
	Note: In some circuits, if the trunk is busy, the busy lamp lights at this time. In such cases, if the trunk is made busy at the testboard, operate NT key or remove the make-busy plug.	
14	Operate talk key.	Ringing tone heard for at least one ringing interval. When incoming trunk test line in crossbar

STEP	ACTION	VERIFICATION
		office or synchronized final multiple test line in panel office is used— Supervisory lamp extinguished for one long period, followed by two shorter periods. These intervals are repeated once, then series of clicks will be heard. ◗When testing No. 5 Crossbar Centrex Phase 2 or 3 trunks, the series of clicks will not be heard. Instead, a busy tone will be heard six seconds after series of clicks is normally heard. Failure to hear busy tone indicates failure of transfer feature.◖ ***Note 1:*** The supervisory lamp may be extinguished momentarily previous to first long dark interval. This occurs when ringing is tripped and does not indicate a trouble condition. When nonsynchronized final multiple test line in panel office is used— Supervisory lamp flashes. ***Note 2:*** Flashing of lamp varies, depending on type of test line used. Signals received on test of first trouble-free circuit will indicate signals that may be expected on successive tests. After supervisory tests are completed—Supervisory lamp remains steadily lighted.
15	Restore test circuit keys to normal.	
16	Momentarily operate DISC key.	
17	Remove all test connections.	
B. Trunks to Crossbar Tandem or Panel Office Selector Tandem		
8	Operate 2W OFF, 1 OFF, or DO key.	
9f	If 2W OFF COMP or 1 OFF COMP keys are provided— Operate, as required, to supply proper resistance value (Table B).	
10g	If keys in Step 9f are not provided— Operate COMP keys, as required, to supply proper resistance value (Table B).	
11h	Where keyset is provided— Operate OB and OG keys, as required, for test line or test trunk circuits.	

STEP	ACTION	VERIFICATION
	Note: Where no keyset is provided, selections are controlled by the DO key.	
12	Operate and release ST key. *Note:* In some circuits, if the trunk is busy, the busy lamp lights at this time. In such cases, if the trunk is made busy at the testboard, operate NT key or remove the make-busy plug.	Sender lamp flashes at 120 ipm, then is extinguished (or lights steadily when test circuit ES-226467 is used). When selections are completed— Supervisory lamp flashes. When testing trunks to crossbar tandem— Supervisory lamp flashes at least ten times.
13	Restore test circuit keys to normal.	
14	Momentarily operate DISC key.	
15	Remove all test connections.	

C. Trunks to Crossbar Tandem, Test of Remote Control Registration Pulses

8	Operate 2W OFF or 1 OFF key.	
9	Operate OFF COMP, COMP keys, as required (Table B).	
10	Operate OB, OG, and numerical keys to direct call to number required.	
11f	For panel or crossbar terminating offices— Operate DM or PAN key.	
12g	For panel call indicator terminating offices— Operate PCI or RCI key.	
13h	In area having both universal and nonuniversal pulsing— When universal pulsing is required— Operate UNIV key.	
14	Momentarily operate ST key.	BUSY or BY lamp may flash. Disregard this indication for this test. When call has been completed and answer condition established— Supervisory lamp extinguished. REG lamp lighted and is extinguished to correspond with number of registration pulses required for initial charge.
15	Restore test circuit keys to normal.	
16	Momentarily operate DISC key.	

STEP	ACTION	VERIFICATION
17	Remove all test connections.	
D.	**Trunks to Panel Call Indicator (Including Offical PBX Trunks Requiring Call Indicator Pulses)**	
8	Operate PCI or RCI key.	
9f	In areas having both universal and nonuniversal pulsing— When universal pulsing is required— Operate UNIV key.	
10	Operate COMP keys, as required, for trunk being tested (Table B).	
11g	When testing call indicator trunks— Where keyset is provided— Write up number of call indicator test line or busy line, as required.	
12h	When testing official PBX Trunks— Where keyset is provided— Write up an 4-digit number. ***Note:*** Where a keyset is not provided, the number called is restricted to that associated with the RCI key.	
13	Operate and release ST key. ***Note:*** In some circuits, if the trunk is busy, the busy lamp lights at this time. In such cases, if the trunk is made busy at the testboard, operate NT key or remove the make-busy plug.	Sender lamp flashes at 60 ipm.
14	Operate talk key.	When testing call indicator trunks— Sender lamp extinguished (or lights steadily when ES-226467 is used). When call indicator test line is called— Ringing tone heard, then supervisory lamp flashes several times, followed by series of clicks. When busy line is called— Supervisory lamp flashes at busyback rate and busy tone heard (see 1.21). When testing official PBX trunks— Sender lamp extinguished (or lights steadily when ES-226467 is used). Supervisory lamp lighted. Ringing tone heard until operator answers.

STEP	ACTION	VERIFICATION
15	Restore test circuit keys to normal.	
16	Momentarily operate DISC key.	
17	Remove all test connections.	
	E. Call Indicator Trunks to Panel Call Indicator Tandem, Panel Sender Tandem, or Crossbar Tandem (non-CAMA)	
8	Operate TAN or MECH T key.	
9f	In areas having both universal and nonuniversal pulsing— When universal pulsing is required— Operate UNIV key.	
10	Operate COMP keys, as required, for trunk being tested (Table B).	
11g	Where keyset is provided— Write up number of test line or busy line, as required. ***Note:*** Where keyset is not provided, the called number is restricted to that associated with the MECH T key.	
12	Momentarily operate ST key. ***Note:*** In some circuits, if the trunk is busy, the busy lamp lights at this time. In such cases, if the trunk is made busy at the testboard, operate NT key or remove the make-busy plug.	Sender lamp flashes during pulsing. At completion of pulsing— Sender lamp extinguished (or lights steadily when test circuit ES-226467 is used).
13h	When tandem office test line or final multiple test line is called— Operate talk key.	Supervisory lamp flashes in accordance with test line used. Interrupted signals heard.
14h	Restore talk key.	
15i	When busy line is called— Operate talk key.	Supervisory lamp flashes at busyback rate. Busy tone heard (see 1.23).
16i	Restore talk key.	
17	Restore test circuit keys to normal.	
18	Momentarily operate DISC key.	
19	Remove all test connections.	

STEP	ACTION	VERIFICATION
F. Call Announcer Trunks		
6	Operate COMP keys, as required (Table B).	
7	Operate SDR key.	ON1 lamp lighted.
8	Operate CA key.	
9	Momentarily operate ST key.	S1, CA-DL lamps lighted.
10	Operate talk key. Announce called number.	CA-DL lamp extinguished. If test line was called— S1 lamp flashes several times, then series of clicks heard. If busy line was called— S1 lamp flashes at busyback rate, busy tone heard (see 1.23).
11	Restore test circuit keys to normal.	
12	Momentarily operate DISC key.	
13	Remove all test connections.	
G. Outgoing Trunks from Panel Sender Tandem Selectors to Operator		
8	Operate COMP keys, as required (Table B).	
9	Operate OPR key.	
10	Momentarily operate ST key.	
11	When order tone is heard— Announce number of test line or busy line, as required.	S1 lamp flashes in accordance with line called (see 1.23).
12	Restore test circuit keys to normal.	
13	Momentarily operate DISC key.	
14	Remove all test connections.	
H. Trunks to Step-by-Step Office		
8	Operate COMP keys, as required (Table B).	
9	Operate SXS key.	
10	Momentarily operate ST key.	CA-DL lamp lighted.

STEP	ACTION	VERIFICATION
11	Dial number of connector multiple test line or busy line.	
12	Operate talk key.	CA-DL lamp extinguished. S1 lamp flashes, tone heard, depending upon type of test line installed in terminating office (see 1.23).
13	Restore test circuit keys to normal.	
14	Momentarily operate DISC key.	
15	Remove all test connections.	

I. Operator Trunks

Caution: If the trunk to be tested is busy on a service call, the test circuit may not make a busy test. If conversation is heard, immediately restore the talk key. Proceed in accordance with local instructions.

6 Operate key or keys in accordance with test circuit used, as shown in the following table. — See following table.

TEST CIRCUIT	KEYS		VERIFICATION
ES-226467 ES-207571	T, VM, TEST, then operate ST momentarily	S lamp lights	Special service, repair service, information, intercepting, and some local test desk trunks — Ringing induction heard until call is answered.
ES-20015-01 SD-21154-01 SD-21610-01 SD-21941-01	T	S1 lamp lights	Vacant code trunk — Vacant code tone heard. Vacant code or overflow trunk — Vacant code announcement heard.

7 When call is answered (except to vacant code)— Inform operator test is being made. — See following table.

STEP	ACTION	VERIFICATION

TRUNK	NOTE
Special Service	2
Repair Service	1, 3
Information (No. 3, 4, 6A, 6B)	2
Information (No. 2)	3
Intercepting	1, 3
Local Test Desk	1, 2
Official PBX	1, 3
Vacant Code	4
Vacant Code or Overflow	5
Operating Desk No. 19	3

Note 1: When some older type test circuits are used, the busy lamp lights when call is answered. In this case, operate NT key.

Note 2: When call is answered — supervisory lamp is extinguished.

Note 3: When call is answered — supervisory lamp remains lighted.

Note 4: Vacant code tone heard.

Note 5: Vacant code announcement heard.

8f	◗If vacant code or overflow trunk provided with voice alarm feature is being tested— At voice alarm circuit SD-95959-01— Momentarily open 9B contacts of ALM relay.	At vacant code or overflow trunk equipment frame— VCA lamp lighted. Aisle pilot lamp lighted. Major alarm sounds.
9f	At vacant code or overflow trunk equipment frame— Momentarily operate RST key.	VCA lamp extinguished. Aisle pilot lamp lighted. Major alarm silenced.◖
10a	If coin special service trunks arranged for dial tone first operation are being tested— Without releasing T key, operate in sequence, VM TLK, REV, and VM keys.	SV lamp dark.
11a	Release VM TLK, REV, and VM keys.	S_ lamp associated with test cord lighted.
12	Restore test circuit to normal.	

STEP	ACTION	VERIFICATION
13	Momentarily operate DISC key.	All lamps extinguished.
14g	If disconnect test is required— Operate REV, FEMF keys.	
15g	While observing voltmeter— Operate VM or TEST key.	Reading and timing of deflections on meter indicate return of trunk to normal.
16	Restore test circuit keys to normal.	
17	Remove all test connections.	

J. Call Indicator Trunks to Crossbar Tandem Operator Identified CAMA

Caution: If the trunk has previously been made busy at request of the distant office, do not attempt to make a test call, since this can result in an incomplete or false entry on the tape at the CAMA office.

8	Operate TAN or MECH T key.	
9	Operate COMP keys, as required (Table B).	
10f	When testing to test line in tandem office— Where keyset is provided— Write up test code, followed by any four digits. ***Note:*** Where a keyset is not provided, the number called is restricted to that associated with MECH T key.	
11g	When testing through tandem office to terminating office— Where keyset is provided— Write up office code and busy or test line number. ***Note:*** Where a keyset is not provided, the number called is restricted to that associated with MECH T key.	
12	Operate and release ST key.	Sender lamp flashes at 60 ipm. When pulsing is completed— Sender lamp extinguished (or lights steadily when test circuit ES-226467 is used).
13	After pulsing is completed— Operate talk key.	In accordance with test line called— Supervisory lamp flashes, clicks, or ringing

STEP	ACTION	VERIFICATION
	If requested— Give operator calling number.	tone and clicks heard. If busy line was called— Supervisory lamp flashes at busyback rate, busy tone heard (see 1.23). ***Note:*** CAMA trunks may be arranged not to return supervision (reversed battery) to panel offices whose circuits districts do not have a talking no-charge position. In this case, there will be no flashing supervisory lamp indications from the test circuit. Busy tone or ringing tone and clicks may still be heard from the busy line or from the test line called.
14	Restore test circuit keys to normal.	
15	Momentarily operate DISC key.	
16	Remove all test connections.	

K. Multifrequency Trunks

Caution: If the trunk to be tested is to a CAMA office and has previously been made busy at request of the distant office, do not attempt to make a test call, since this can result in an incomplete or false entry on the tape at the CAMA office.

8	Operate COMP RES 0 key.	
9f	Operate OFF COMP RES 0 key, if provided.	
10	Operate A RY OPR COMP RES keys, as required (see 1.14).	
11g	If trunk to be tested is to terminating crossbar office— Operate XB key.	
12h	If ANI trunk is to be tested— Operate ANI key, if provided.	
13	Operate keys, shown in the following table in accordance with test call being made.	

STEP	ACTION	VERIFICATION

TEST CALL	RECORDING KEYS	TRUNKS WITH WINK START PULSING SIGNAL	TRUNKS WITH DELAY DIAL START PULSING SIGNAL
To crossbar tandem or 4A toll office test line	Tandem office test code, followed by any four digits	Operate MF key	Operate DPL (if provided) and MF keys or — Operate MFD key (if provided)
To terminating office through crossbar tendem or 4A toll office	Office code and test line or busy line number		
To crossbar office			

14i If trunk being tested is common to two crossbar units—
Write up office indicating digit on TAN U row.

15 Momentarily operate ST key.

Sender lamp flashes during pulsing.
At completion of pulsing—
Sender lamp extinguished (or lights steadily when test circuit ES-226467 is used).

16 Operate T key.
(On operator identified CAMA trunk, give operator number according to local practice.)

See following table.

NUMBER CALLED	SUPERVISION	AUDIBLE SIGNAL
Busy line	Supervisory lamp flashes at busyback rate	Busy tone
Test line, non-CAMA tandem or crossbar office	Supervisory lamp flashes	Ringing tone followed by clicks
Test line, crossbar No. 5 centrex, phase 2 or 3 office	Supervisory lamp flashes.	Ringing tone followed in six seconds by busy tone
Test line, CAMA tandem office	Supervisory lamp lights steadily (see note)	Ringing tone or clicks

Note: CAMA trunks may be arranged not to return supervision to panel offices whose district circuits do not have a talking no-charge position. In this case, the supervisory lamp will not light, but tone or clicks may still be heard.

17 Restore test circuit keys to normal.

18 Momentarily operate DISC key.

19 Remove all test connections.

STEP	ACTION	VERIFICATION
L.	**Dial Coin Zone Service Trunks to Panel Selector Tandem or Crossbar Tandem**	
6	Operate COMP keys, as required (Table B).	
7	Operate TAN or MECH T key, as provided.	
8f	In areas having both universal and nonuniversal pulsing— When universal pulsing is required— Operate UNIV key.	
9g	Where keyset is provided— Write up number of test line or busy line, as required. ***Note:*** Where keyset is not provided, the called number is restricted to that associated with the MECH T key.	
10	Momentarily operate ST key. ***Note:*** In some circuits, if the trunk is busy, the busy lamp lights at this time. In such cases, if the trunk is made busy at the testboard, operate NT key or remove the make-busy plug.	Sender lamp flashes during pulsing. At completion of pulsing— Sender lamp extinguished (or lights steadily when test circuit ES-226467 is used).
11	Operate talk key.	Ringing tone heard until operator answers.
12	Advise operator that this is a test call.	
13a	If coin special service trunks arranged for dial tone first operation are being tested— Without releasing talk key, operate in sequence VM TLK, REV, and VM keys.	SV lamp dark.
14a	Release VM TLK, REV, and VM keys.	S_ lamp associated with test cord lighted.
15	Operate TN key for a few seconds.	
16	Operator disconnects.	Test call established. Busy tone or ringing tone and clicks heard, depending on number called.
17	Restore test circuit keys to normal.	
18	Momentarily operate DISC key.	
19	Remove all test connections.	

STEP	ACTION	VERIFICATION
M. Voltmeter Tests of Trunks		
Continuity and Polarity Test		
10f	If trunk normally has battery on tip— Operate VM, REV, FEMF keys.	Proper voltage reading.
11f	Restore VM, REV, FEMF keys.	
12g	If trunk normally has battery on ring— Operate VM, FEMF keys.	Proper voltage reading.
13g	Restore VM, FEMF keys.	
14h	If no further tests are to be made— Disconnect test circuit cord from test jack of trunk.	ON lamp extinguished.
Short-Circuit, Cross, or Ground Test		
15	Arrange to have trunk battery and ground opened at distant end.	
16	Operate VM key.	
17	Operate G, FEMF, REV, VM REV keys, as required, for indications shown in Table D.	Voltmeter indications, as shown in Table D.
18	Restore all keys.	
19h	If no further tests are to be made— Disconnect test circuit cord from test jack of trunk.	
20h	Have trunk restored to normal at distant end.	
Resistance Measurement		
21	Repeat Steps 15 and 16.	
22i	To measure loop resistance of trunk facility— Have tip and ring conductors shorted at distant end.	
23i	Operate G key.	Voltage reading.
	Note: 100-volt test battery is now connected in series with voltmeter 100,000-ohm winding and trunk loop.	***Note:*** If reading is greater than midscale, proceed as in Step 25k.

STEP	ACTION	VERIFICATION
24j	To measure resistance to trouble short or ground— Operate keys, as shown in Table D, line 3, 4, or 5 (see note, Step 23i).	Voltage reading (see Table E and note, Step 23i).
25k	▶If reading is greater than midscale◀ Operate and restore in succession 20,000,1000, and AM keys. Note meter deflection as each key is operated. Leave operated key which gives nearest to midscale deflection. *Note:* Value of the resistance in ohms can be determined from the meter reading by consulting Tables E through H. For accurate results, verify the value of test battery voltage.	Voltage reading or, with AM key operated, milliampere reading.
26	Restore all keys.	
27	Disconnect test circuit cord from test jack of trunk.	
28	Have trunk restored to normal at distant end.	

TABLE D

LINE	KEYS G	KEYS FEMF	KEYS REV	KEYS VM REV	VOLTMETER READING	CONDITION INDICATED
1	–	–	–	–	Zero	Ring Clear
2	–	–	√	–	Zero	Tip Clear
3	√	–	–	–	100V or Less	Tip and Ring Short Circuit
4	–	–	–	–	100V or Less	Ring Grounded or Crossed with Positive Battery
5	–	–	√	–	100V or Less	Tip Grounded or Crossed with Positive Battery
6	√	√	–	–	Left of Zero	Ring Crossed with Positive Battery
7	√	√	–	√	Voltage	Value of Foreign Battery on Ring
8	√	√	√	–	Left of Zero	Tip Crossed with Positive Battery
9	√	√	√	√	Voltage	Value of Foreign Battery on Tip
10	–	–	–	–	Over 100V	Ring Crossed with Negative Battery
11	√	√	–	–	Voltage	Value of Foreign Battery on Ring
12	–	–	√	–	Over 100V	Tip Crossed with Negative Battery
13	√	√	√	–	Voltage	Value of Foreign Battery on Tip

TABLE E
100,000-OHM WINDING — 120-VOLT SCALE

METER READING (Volts)	RESISTANCE TEST BATTERY VOLTAGE 99	100	101
101			0
100		0	1,000
99	0	1,010	2,020
98	1,020	2,040	3,061
97	2,061	3,092	4,123
96	3,125	4,166	5,208
95	4,210	5,263	6,315
94	5,319	6,382	7,446
93	6,451	7,526	8,602
92	7,608	8,695	9,782
91	8,791	9,890	10,990
90	10,000	11,110	12,220
89	11,240	12,360	13,480
88	12,500	13,640	14,770
87	13,790	14,940	16,090
86	15,120	16,280	17,440
85	16,470	17,650	18,820
84	17,860	19,050	20,240
83	19,280	20,480	21,690
82	20,730	21,950	23,170
81	22,220	23,460	24,690
80	23,750	25,000	26,250
79	25,320	26,580	27,850
78	26,920	28,210	29,490
77	28,570	29,870	31,170
76	30,260	31,580	32,890
75	32,000	33,330	34,670
74	33,780	35,140	36,490
73	35,620	36,990	38,360
72	37,500	38,890	40,280
71	39,440	40,850	42,250
70	41,430	42,860	44,290
69	43,480	44,930	46,380
68	45,590	47,060	48,530
67	47,760	49,250	50,750
66	50,000	51,520	53,030
65	52,310	53,850	55,380
64	54,690	56,250	57,810
63	57,140	58,730	60,320
62	59,680	61,290	62,900
61	62,300	63,930	65,570
60	65,000	66,670	68,330
59	67,800	69,490	71,190
58	70,690	72,410	74,140
57	73,680	75,440	77,190
56	76,790	78,570	80,360
55	80,000	81,820	83,640
54	83,330	85,190	87,040
53	86,790	88,680	90,570
52	90,380	92,310	94,230
51	94,120	96,080	98,040

METER READING (Volts)	RESISTANCE TEST BATTERY VOLTAGE 99	100	101
50	98,000	100,000	102,000
49	102,000	104,100	106,100
48	106,300	108,300	110,400
47	110,600	112,800	114,900
46	115,200	117,400	119,600
45	120,000	122,200	124,400
44	125,000	127,300	129,500
43	130,200	132,600	134,900
42	135,700	138,100	140,500
41	141,500	143,900	146,300
40	147,500	150,000	152,500
39	153,800	156,400	159,000
38	160,500	163,200	165,800
37	167,600	170,300	173,000
36	175,000	177,800	180,600
35	182,900	185,700	188,600
34	191,200	194,100	197,100
33	200,000	203,000	206,100
32	209,400	212,500	215,600
31	219,400	222,600	225,800
30	230,000	233,300	236,700
29	241,400	244,800	248,300
28	253,600	257,100	260,700
27	266,700	270,400	274,100
26	280,800	284,600	288,500
25	296,000	300,000	304,000
24	312,500	316,700	320,800
23	330,400	334,800	339,100
22	350,000	354,600	359,100
21	371,400	376,200	381,000
20	395,000	400,000	405,000
19	421,100	426,300	431,600
18	450,000	455,600	461,100
17	482,400	488,200	494,100
16	518,800	525,000	531,300
15	560,000	566,700	573,300
14	607,100	614,300	621,400
13	661,500	669,200	676,900
12	725,000	733,300	741,700
11	800,000	809,100	818,200
10	890,000	900,000	910,000
9	1,000,000	1,011,000	1,022,000
8	1,138,000	1,150,000	1,163,000
7	1,314,000	1,329,000	1,343,000
6	1,550,000	1,567,000	1,583,000
5	1,880,000	1,900,000	1,920,000
4	2,375,000	2,400,000	2,425,000
3	3,200,000	3,233,000	3,267,000
2	4,850,000	4,900,000	4,950,000
1	9,800,000	9,900,000	10,000,000

TABLE F
20,000-OHM WINDING — 24-VOLT SCALE

METER READING (Volts)	RESISTANCE TEST BATTERY VOLTAGE 19.4	20	20.6	METER READING (Volts)	RESISTANCE TEST BATTERY VOLTAGE 19.4	20	20.6
20.6			0	10.2	18,040	19,220	20,390
20.4			196	10.0	18,800	20,000	21,200
20.2			396	9.8	19,590	20,820	22,040
20.0		0	600	9.6	20,420	21,670	22,920
19.8		202	808	9.4	21,280	22,550	23,830
19.6		408	1,020	9.2	22,170	23,480	24,780
19.4	0	618	1,238	9.0	23,110	24,440	25,780
19.2	208	833	1,458	8.8	24,090	25,450	26,820
19.0	421	1,052	1,684	8.6	25,120	26,510	27,910
18.8	638	1,276	1,914	8.4	26,190	27,620	29,050
18.6	860	1,505	2,150	8.2	27,320	28,780	30,240
18.4	1,086	1,739	2,392	8.0	28,500	30,000	31,500
18.2	1,318	1,978	2,638	7.8	29,740	31,280	32,820
18.0	1,556	2,222	2,888	7.6	31,050	32,630	34,210
17.8	1,798	2,471	3,152	7.4	32,430	34,050	35,680
17.6	2,046	2,727	3,410	7.2	33,890	35,560	37,220
17.4	2,298	2,988	3,678	7.0	35,430	37,140	38,860
17.2	2,558	3,255	3,954	6.8	37,060	38,820	40,590
17.0	2,824	3,529	4,234	6.6	38,790	40,616	42,430
16.8	3,096	3,809	4,524	6.4	40,620	42,500	44,380
16.6	3,374	4,096	4,820	6.2	42,580	44,520	46,450
16.4	3,658	4,390	5,122	6.0	44,670	46,670	48,670
16.2	3,950	4,691	5,432	5.8	46,900	48,970	51,040
16.0	4,250	5,000	5,750	5.6	49,290	51,430	53,570
15.8	4,556	5,316	6,076	5.4	51,850	54,070	56,300
15.6	4,872	5,641	6,410	5.2	54,620	56,920	59,230
15.4	5,194	5,974	6,754	5.0	57,600	60,000	62,400
15.2	5,526	6,315	7,106	4.8	60,830	63,330	65,830
15.0	5,866	6,666	7,466	4.6	64,350	66,960	69,570
14.8	6,236	7,027	7,838	4.4	68,180	70,910	73,640
14.6	6,576	7,397	8,220	4.2	72,380	75,240	78,100
14.4	6,944	7,777	8,612	4.0	77,000	80,000	83,000
14.2	7,324	8,069	9,014	3.8	82,110	85,260	88,420
14.0	7,714	8,571	9,428	3.6	87,780	91,110	94,450
13.8	8,116	8,985	9,856	3.4	94,120	97,650	101,200
13.6	8,530	9,411	10,290	3.2	101,200	105,000	108,800
13.4	8,956	9,850	10,750	3.0	109,300	113,300	117,300
13.2	9,394	10,300	11,210	2.8	118,600	122,900	127,100
13.0	9,846	10,770	11,690	2.6	129,200	133,800	138,500
12.8	10,310	11,250	12,260	2.4	141,700	146,700	151,700
12.6	10,790	11,750	12,700	2.2	156,400	161,800	167,300
12.4	11,290	12,260	13,230	2.0	174,000	180,000	186,000
12.2	11,800	12,790	13,770	1.8	195,600	202,200	208,900
12.0	12,330	13,330	14,330	1.6	222,500	230,000	237,500
11.8	12,880	13,900	14,920	1.4	257,100	265,700	274,300
11.6	13,450	14,480	15,520	1.2	303,300	313,300	323,300
11.4	14,040	15,090	16,140	1.0	368,000	380,000	392,000
11.2	14,640	15,710	16,790	.8	465,000	480,000	495,000
11.0	15,270	16,360	17,450	.6	626,700	646,700	666,700
10.8	15,930	17,040	18,150	.4	950,000	980,000	1,010,000
10.6	16,600	17,740	18,870	.2	1,920,000	1,980,000	2,040,000
10.4	17,310	18,460	19,620				

TABLE G
1000-OHM WINDING — 24-VOLT SCALE

METER READING (Volts)	RESISTANCE TEST BATTERY VOLTAGE 19.4	20	20.6	METER READING (Volts)	RESISTANCE TEST BATTERY VOLTAGE 19.4	20	20.6
20.6			0	10.2	902	961	1,020
20.4			10	10.0	940	1,000	1,060
20.2			20	9.8	980	1,041	1,102
20.0		0	30	9.6	1,021	1,083	1,146
19.8		10	40	9.4	1,064	1,128	1,192
19.6		20	51	9.2	1,109	1,174	1,239
19.4	0	31	62	9.0	1,156	1,222	1,289
19.2	10	42	73	8.8	1,205	1,273	1,341
19.0	21	52	84	8.6	1,256	1,326	1,395
18.8	32	63	96	8.4	1,310	1,381	1,452
18.6	43	75	108	8.2	1,366	1,439	1,512
18.4	54	87	120	8.0	1,425	1,500	1,575
18.2	66	99	132	7.8	1,487	1,564	1,641
18.0	78	111	144	7.6	1,553	1,632	1,711
17.8	90	124	158	7.4	1,622	1,702	1,784
17.6	102	136	171	7.2	1,694	1,778	1,861
17.4	115	149	184	7.0	1,771	1,857	1,943
17.2	128	163	198	6.8	1,853	1,941	2,029
17.0	141	176	212	6.6	1,939	2,030	2,121
16.8	155	190	226	6.4	2,031	2,125	2,219
16.6	169	205	241	6.2	2,129	2,226	2,323
16.4	183	220	256	6.0	2,233	2,333	2,433
16.2	198	235	272	5.8	2,345	2,448	2,552
16.0	213	250	288	5.6	2,464	2,571	2,679
15.8	228	266	304	5.4	2,593	2,704	2,815
15.6	244	282	321	5.2	2,731	2,846	2,962
15.4	260	299	388	5.0	2,880	3,000	3,120
15.2	276	316	355	4.8	3,042	3,167	3,292
15.0	293	333	373	4.6	3,217	3,348	3,478
14.8	312	351	392	4.4	3,409	3,545	3,682
14.6	329	370	411	4.2	3,619	3,762	3,905
14.4	347	389	431	4.0	3,850	4,000	4,150
14.2	366	408	451	3.8	4,105	4,263	4,421
14.0	387	428	471	3.6	4,389	4,556	4,772
13.8	406	449	493	3.4	4,706	4,882	5,059
13.6	427	471	515	3.2	5,062	5,250	5,438
13.4	448	493	537	3.0	5,467	5,667	5,867
13.2	470	515	561	2.8	5,929	6,143	6,357
13.0	492	538	585	2.6	6,462	6,692	6,923
12.8	516	563	613	2.4	7,083	7,333	7,583
12.6	540	587	635	2.2	7,818	8,091	8,364
12.4	565	613	661	2.0	8,700	9,000	9,300
12.2	590	639	689	1.8	9,778	10,110	10,440
12.0	617	667	717	1.6	11,130	11,500	11,880
11.8	644	695	746	1.4	12,860	13,290	13,710
11.6	672	724	776	1.2	15,170	15,670	16,170
11.4	702	754	807	1.0	18,400	19,000	19,600
11.2	732	786	839	.8	23,250	24,000	24,750
11.0	764	818	873	.6	31,330	32,330	33,330
10.8	796	852	907	.4	47,500	49,000	50,500
10.6	830	887	943	.2	96,000	99,000	102,000
10.4	865	923	981				

TABLE H
MILLIAMMETER SCALE
24-VOLT OFFICE BATTERY

METER READING (Milliamperes)	RESISTANCE CENTRAL OFFICE BATTERY VOLTAGE 22	24	26	METER READING (Milliamperes)	RESISTANCE CENTRAL OFFICE BATTERY VOLTAGE 22	24	26
404			0	200	46	56	66
400			1	196	48	58	69
396			2	192	51	61	71
392			2	188	53	64	74
388			3	184	56	66	77
384			4	180	58	69	79
380			4	176	61	72	84
376		0	5	172	64	76	87
372		1	6	168	67	79	91
368		1	7	164	70	82	95
364		2	7	160	74	86	98
360		3	8	156	77	90	103
356		3	9	152	81	94	107
352		4	10	148	85	98	112
348		5	11	144	89	103	117
344	0	6	12	140	93	107	122
340	1	7	13	136	98	112	127
336	2	7	13	132	103	118	133
332	2	8	14	128	108	124	139
328	3	9	15	124	113	130	146
324	4	10	16	120	119	136	153
320	5	11	17	116	125	143	160
316	6	12	18	112	132	150	168
312	7	13	19	108	140	158	177
308	7	14	20	104	148	167	186
304	8	15	22	100	156	176	196
300	9	16	23	96	165	186	207
296	10	17	24	92	175	197	219
292	11	18	25	88	186	209	232
288	12	19	26	84	198	222	246
284	14	21	28	80	211	236	261
280	15	22	29	76	226	252	278
276	16	23	30	72	242	269	297
272	17	24	32	68	260	289	318
268	18	26	33	64	280	311	342
264	19	27	35	60	303	336	369
260	21	28	36	56	329	365	400
256	22	30	38	52	359	398	436
252	23	31	39	48	394	436	478
248	25	33	41	44	436	482	527
244	26	34	43	40	486	536	586
240	28	36	44	36	547	603	658
236	29	38	46	32	624	686	749
232	31	39	48	28	722	793	865
228	33	41	50	24	853	936	1,020
224	34	43	52	20	1,040	1,140	1,240
220	36	45	54	16	1,310	1,430	1,560
216	38	47	56	12	1,770	1,940	2,110
212	40	49	59	8	2,690	2,940	3,190
208	42	51	61	4	5,440	5,940	6,440
204	44	54	63				