FS TERMINATING SENDER

Replaces: Section 222
Dated 9-4-52

CONTENTS

1. GENERAL INFORMATION

1.1 Description of Test

1.11 This section describes a method of testing:

1) SD-25013-01 - FS Terminating Sender Circuit,
2) SD-25053-01 - Miscellaneous Circuit for FS Terminating Sender Circuit, &
3) SD-25289-01 - Terminating Sender RP Interrupter Circuit.

1.12 The greater part of the test is performed by means of the FS sender testing facilities provided in the Terminating Sender Test Circuit, SD-25159-01, which includes means for routine testing of FS Terminating Senders.

1.13 One cycle of routine tests consists of performing the tests described in Paragraph 9 once on each FS sender circuit.

1.14 Refer to Handbook 62, Section 221 for a description of Key Functions and Lamp Indications.

2. RECORDS AND REQUIREMENTS

2.1 Records: Forms SD-4-1313 and SD-4-1315 are required for recording the results of these tests.

2.2 Requirements: The tests of Section 222 must be applied to meet the equipment performance requirements per BSP 816-007-181.

3. TEST EQUIPMENT

3.1 Test Sets and Accessories

Amt	Code	Description	With ITE
As Req.	322A	Make-Busy Plugs	4023
1	ITE-1883	Wheatstone Bridge	
1	ITE-4442	Volt-Ohmmeter	
1	ITE-4029	Pulse Checking Set	
1	ITE-4137A	Continuity Test Set	32A KIT
1	R-3314	Stop Watch	4023
As Req.	ITE-8507	Alligator Clips	4023
1	R-9572	Test Receiver	4023
1	ITE-9650	Opr. Tel. Set	4023

3.2 Cords Required

Amt	Code	Description	With ITE
1	ITE-9627	12' - 3 Conductors, 310 Plug; 508A Key	4023
2	ITE-9639	12' - 3 Conductors, 310 Plug; 3 ITE-2455 Plugs	4023

4. FUSE VERIFICATION

4.1 Test Procedure - General

CAUTION TO ELIMINATE A FIRE HAZARD, VERIFY THAT DIRECT GROUND IS NOT PRESENT ON THE ALARM BAR OR STUD ON A FUSE PANEL BEFORE INSTALLING ITS FEEDER FUSE.

NOTE: Use ITE-4442 Volt-ohmmeter. To avoid damaging the meter, first verify the battery is not present on the alarm bar by using the voltmeter portion of ITE-4442. If clear, switch to the ohmmeter portion for the resistance reading which should be either infinity or approximately 600 ohms.

4.11 Fuse verification is, ordinarily, only required on fuse panels wired by the installer.

4.12 On shop wired and fused fuse panels, inspect the panel for missing or operated fuses. If a fuse is missing or operated, test the fuse terminal for the absence of low resistance ground. Clear any grounded condition and install the proper fuse. At the completion of this test, all fuse panels should be fully equipped with proper fuses. These may be either the proper specified type or a dummy.

4.13 The operation of relays in circuits when fuses or potentials are applied is normal in some circuits. Oscillation, chatter, and signs of overheating should be analyzed and cleared immediately.

4.14 ITE-4442 Volt-ohmmeter should be used to verify all potentials at fused terminals to insure that polarily and voltages are correct. Many errors are caused by the use of the R-9572 Test Receiver on potentials other than -48 Volts. Handbook 100, TMO 4442, provides full instructions for the use of the volt-ohmmeter.

4.15 When the R-9572 Test Receiver is used, avoid placing it directly on the ear.

5. CONTACT PROTECTION

5.1 For those contact protection networks installed on the job, test in accordance with Handbook 61, Section 0.2.

6. TERMINATING SENDER RP INTERRUPTER CIRCUIT, SD-25289-01

NOTE: This circuit is located on the Miscellaneous Relay Rack and is cabled to jacks MN and MX on the Terminating Sender Frames.

6.1 Using ITE-1883, Wheatstone Bridge, verify the resistance across terminals on the DPTS Terminal Strip for Terminating Senders is:

Terminals	Minimum	Maximum
T and R	3082 Ohms	3147 Ohms
R and Ground	31150 Ohms	31779 Ohms
T1 and R1	1024 Ohms	1076 Ohms

6.2 Using ITE-4442, Volt-Ohmmeter, make a continuity and cross check from terminals (T and R) and (T1 and R1) on the DPTS Terminal Strip to the Tip and Ring of jack MX and MN respectively.

6.3 Repeat Paragraph 6.2 for each appearance of these jacks.

7. MISCELLANEOUS CIRCUIT FOR FS TERMINATING SENDER CIRCUIT, SD-25053-01

7.1 Verify the below listed features of the Miscellaneous Circuit, not checked on other tests, as follows:

7.11 Test Battery Jack and Supply

7.111 Verify presence of 48 volts on 48V test battery terminal and tip of jack A.

7.112 Verify presence of direct ground on test terminal G.

7.113 Verify presence of high resistance ground (12,000 ohms) on test terminal HRG.

7.114 Verify presence of direct ground on sleeve of jack A.

7.12 Spare Jack

7.121 Verify presence of continuity and absence of cross for leads T, R, and S of jack B to all associated jack B appearances and to the M.D.F.

7.13 Frame Line Jack

7.131 Jack TEL (A and B) - Verify presence of continuity and absence of cross for the leads on the tip and sleeve of jack TEL (A and B) to all associated jack TEL appearances and to the M.D.F.

7.132 Jack D - Verify presence of continuity and absence of cross for leads T and R of jack D to all associated jack D appearances.

7.14 Remote Control Jacks

7.141 Jack C - Verify presence of continuity and absence of cross for leads T, R, and S of jack C to all associated jack C appearances.

7.142 Jacks (MX and MN) and (MX-D and MN-D)- Verify presence of continuity and absence of cross for the leads on the tip and ring of jacks (MX and MN) and (MX-D and MN-D) to all associated appearances of these jacks.

7.143 Jack E - Verify presence of continuity and absence of cross for leads RC, RC1, RC2, and RC3 to all associated appearances of these leads.

7.144 Jack TEL 1 (A and B) - Verify presence of continuity and absence of cross for the leads on the tip and sleeve of jack TEL 1 (A and B) to all associated jack TEL 1 appearances.

7.15 Fuse Alarm

7.151 Connect 48V battery through test receiver R-9572 to the alarm bar of the 20 ampere frame fuse. Observe that the major alarm sounds, lamps 20A and the associated red aisle pilot light, relay A operates in the Floor Alarm Fuse and Time Alarm Circuit, and lamp FA does not light.

7.152 Disconnect the battery from the alarm bar. Observe that the alarm is silenced, the lighted lamps are extinguished, and relay A is released.

7.153 Verify the 20A resistance shunt by removing lamp 20A and repeating the tests of Paragraphs 7.151 and 7.152. Replace lamp 20A at the completion of this test.

7.154 To verify the presence of the 350 ohm resistance between the 20 ampere alarm bar and lamp 20A:

1) Connect 48V battery through test receiver R-9572 to the alarm bar for the 20A fuse.

2) Using another test receiver R-9572, connect to the same point on the alarm bar and to the fuse mounting side of lamp 20A.

3) Verify an appreciable click in both receivers, and

4) Disconnect both test receivers.

7.155 Connect 48V battery through test receiver R-9572 to the frame fuse panel alarm bar. Observe that the major alarm sound, lamps FA and the associated red aisle pilot light, relay A operates in the Floor Alarm Fuse and Time Alarm Circuit, and lamp 20A does not light.

7.156 Disconnect the battery from the alarm bar. Observe that the alarm is silenced, the lighted lamps are extinguished, and relay A is released.

8. SUPPLEMENTARY TESTS

NOTES:

(1) For General Description, Test Call Progress, and Test Set-Up information, refer to Paragraphs 9.1, 9.3, and 9.4 respectively,

(2) Keys PCR and PCS may be used to advance the test frame to the particular sender to be tested.

8.1 Tell Tale Call

8.11 Refer to TABLE B for Test Call set-up. Operate key TT-SC. Originate the test call and verify lamps IB and D are lighted and the call completes satisfactorily.

8.2 Sender Lamp S

8.21 At the TTI, operate key BAT. On one of the test calls to each FS sender, verify that the associated lamp S, on the TTI, lights momentarily when the sender is seized.

8.3 Jacks MB

8.31 At the TTI, insert a make-busy plug into jack MB of each FS sender. Operate keys APB and TS.

8.32 Refer to TABLE B for test call set-up of any Regular test call. Originate the test call. Observe that sender locating lamp lights for the first FS sender to be tested and that all FS senders are passed.

8.33 Remove all make-busy plugs from jacks MB.

8.4 Lead BS

8.41 Block operated the Terminating Sender Link relay SB associated with the sender under test. Refer to TABLE B. Originate any Regular test call. Observe lamp SEL lights.

8.42 At the TTI, observe lamp S associated with the next preferred sender, as determined by the Terminating Sender Link and Controller Circuit, lights.

8.43 Verify the major alarm sounds after 5 to 12 seconds.

8.44 Operate key RN, restore relay SB to normal, and verify major alarm is silenced.

8.5 Jack HLD

8.51 Refer to TABLE B for test call set-up. Without operating key TH-, originate any Regular test call. Verify that the Sender Test Frame blocks with lamp TH lighted, lamp RC is lighted while the sender times out in 28-58 seconds, lamp S at the test frame and the associated lamp TL at the TTI light, and the alarm sounds 5-12 seconds later.

8.52 At the TTI, insert a make-busy plug into jack HLD. Restore the Sender Test Frame to normal and silence the alarm.

8.53 With all digits keyed, repeat the test call. Verify that the test frame blocks with lamp BY lighted.

8.54 Repeat tests of Paragraphs 8.51 through 8.53 on each FS Sender.

8.55 Restore the sender and test frame to normal. Remove the make-busy plug from jack HLD.

8.6 Time Out

NOTES:

(1) This test holds the sender group busy continually. Notify other testers attempting to use these senders, and

(2) Do not use the TTI when making time out tests.

8.61 At the TTI, insert a make-busy plug into jack HLD of the first sender to be tested. At the Sender Test Frame, operate keys CL-6, TH-0, H-0, T-0, U-0, LRB, TS, and TA. Originate a test call.

8.62 Using stop watch R-3314, verify that lamp RB is lighted for 28-58 seconds.

8.63 After lamp RB is extinguished, verify lamp TC lights, lamp S at the test frame and lamp TL at the TTI light, and the alarm sounds 5-12 seconds later.

8.64 Operate key MGB and remove the make-busy plug from jack HLD. Verify that the alarm is silenced and lamp TL is extinguished.

8.65 Operate and release key AV. The test frame advances to the next sender to be tested. Release key MGB.

8.66 Repeat tests of Paragraph 8.6 on each FS sender.

8.67 Restore the test frame to normal.

8.7 Relays STP and GR

8.71 Using cord ITE-9639, insert plug 310 into jack T of the FS sender under test. Block operated relays L1 and L2.

8.72 Using another cord ITE-9639, insert plug 310 into jack MN or MX of the RP Interrupter Circuit, SD-25289-01.

8.73 Using alligator clips ITE-8507, connect the tip of the first cord to ring of the second and the ring of the first cord to the tip of the second.

8.74 Using a spade tip, connect the sleeve of the jack T cord to binding post P of the Pulse Checking Set ITE-4029. Connect 48V battery and ground to jack A of ITE-4029.

8.75 Proceed with the test as outlined in Handbook 50, Section 5, Paragraph 4.

8.76 Verify that the percent break and pulse speed reading are within the limits specified in the circuit requirements of the FS sender.

8.8 Interrupters

8.81 TS

8.811 Block operated relay ON1. Verify relay TM1 locks operated within 29 seconds and relays TM2, TM3, and TM4 operate 29, 30, and 59 seconds later respectively, lamp TL lights at the TTI, and the alarm sounds.

NOTE: When leads A and B to the interrupters are reversed, relay TM2 will operate about 1 second after relay TM1.

8.812 Restore to normal relay ON1. Verify relays TM1, TM2, TM3, and TM4 release, lamp TL is extinguished, and the alarm is silenced.

8.813 Repeat this test using relay ON2.

8.82 IF

8.821 Block operated relays ON2 and L. Verify that relay IF locks operated and relay IF1 locks operated approximately 1.13 seconds later.

NOTE: When leads A and B to the interrupter are reversed relay IF1 will operate about 0.17 seconds later.

8.822 Restore to normal relays ON2 and L. Verify relays IF and IF1 release.

8.83 IDT

8.831 Block operated relay ON2. Connect ground to relay L1, contact 4T. Verify that relay TM3 locks operated and relay TRL locks operated approximately 3 seconds later.

NOTE: When leads A and B to the interrupter are reversed, relay TRL will operate about 0.12 seconds later.

8.832 Restore to normal relay ON2 and remove ground from relay L1, contact 4T. Verify relays TM3 and TRL release.

8.84 Repeat tests of Paragraph 8.8 on all FS senders.

8.9 Miscellaneous

8.91 Unused Crosspoints

8.911 Close cross-points by operating in turn the select and hold magnets for:

1) IB 5-9 (Block operated relay ON2 for IB tests)

2) IG 4 and 9

3) IG 5-8 (When high 5 selections are not required), and

4) FB 5-9.

8.912 Verify relay TT operates when each cross-point is closed.

8.92 Manual

8.921 Verify ground is absent at relay TC1, contact 5 when relay ON2 is normal. Verify ground present when relay ON2 is operated.

8.922 Insulate contact 2B, relay L1 and contact 8B, relay L2. Connect battery to relay RV2, contact 3T. Verify relay STP operates.

1) One at a time:

(a) Operate relay TT and FU, and

(b) Remove insulator from relay L1 and L2.

2) In each case, verify relay STP is shunted down.

3) Remove insulators from relays L1 and L2. Disconnect battery from relay RV2.

8.923 Remove fuse C. Verify that battery is removed from bottom of resistance G. Replace fuse C.

8.924 Block operated relays ON1, ON2, and RV4. Verify ground present on CO punching (46 on unit T.S.).

1) Operate relay TC2. Verify ground absent on CO punching.

2) Restore relays ON1, ON2, and RV4 to normal.

9. OPERATIONAL TESTS

9.1 General Description

9.11 The Terminating Sender Test Frame is used for applying operational tests by simulating various types of calls in the senders and checking the resulting operations.

9.12 On a test call, a connector connects the test circuit to the sender. The sender is first tested for busy and, if idle, the test circuit transmits frame indication and, on senders arranged to serve calls to multi-office terminating units, the office indication.

9.13 The test circuit then completes the fundamental circuit to the sender for incoming brush selection. The sender sends revertive pulses until the test circuit is satisfied for incoming brush selection, in accordance with the TH key setup after which the test circuit opens the fundamental circuit. The corresponding selection is registered on the sender cross-bar switch. The remaining selections, IG, FB, FT and FU are sent and registered in a similar manner.

9.14 After selections are completed and the fundamental has been opened for the proper interval, the test circuit recloses the fundamental for reverse battery.

9.15 The test circuit records the information passed from the sender to the marker and checks that this information corresponds to the selections imposed on the sender by the test circuit. As each digit is being checked, a corresponding lamp is lighted. If any digit does not check with that set up on the keys, the test circuit will block with the corresponding lamp lighted. Frame registration is checked in a similar manner.

9.16 If the sender fails to perform any of its functions, the test circuit blocks and, except in making time out tests, causes an alarm to be sounded. Lamps are provided to indicate which sender is being tested and progress lamps are provided to indicate what function of the sender is being tested at any time.

9.17 The test circuit makes use of regular service circuits in addition to the sender under test. These include the Terminating Marker Connector, Terminating Marker, and the sender selector equipment which is common to the Terminating Sender Links.

9.18 Registers are provided to record the number of circuits tested, the number of repeated single tests, and the number of busy senders passed without testing.

9.2 Test Call Description

9.201 Regular Calls - These calls test:

1) Relay L2 remains operated until relay SM releases,

2) Relay SM is held operated over the back contact of relay HM after relay L2 operates for the next selection,

3) Contacts 6B and 8B of relay L2,

4) Slow operation of relay L2,

5) Operate and release time of relay RA1,

6) A long interval between the opening and closing of the fundamental between incoming brush and incoming group selections and

7) A short selections interval.

9.202 Long Reverse Battery Call - This call tests:

1) Reverse battery is not too long,

2) The speed of relays P,

3) The response of relays L (3-5) to the opening of relay GR contacts, and

4) Contacts 3B and 6B of relay L2.

9.203 Select Bar Restore Call - This call tests the Select Bar Restore Feature.

9.204 Maximum Loop Call - This call tests the release of relay L against a leak and the response of relays L3 and L4 to short closures.

9.205 Relays L and STP Operate - This call tests the operation of relays L and STP.

9.206 Special Marker Call - This is a Regular Call Test performed on Special Markers 0 and 1. The satisfactory completion of test calls and the operation of relay SPL for the marker under test are verified with the other Special Marker made busy.

9.207 Tell Tale Call - This call tests:

1) Lead TT is grounded which causes a tell tale indication to be sent to the sender, and

2) The sender does not maintain too long of a reverse battery closure.

9.208 Trouble Release Call - This call tests:

1) The ability of the sender to release on a trouble release signal from the marker and

2) The premature advance of lead SPF to the next sender. This is indicated by lamp X lighted. The test does not apply when only one sender is provided in the group.

NOTE: Do not use the TTI when making time out tests.

9.210 Trunk Disconnect Call:

1) This call tests the ability of the sender to disconnect without bringing in a marker when a premature disconnect signal is received from the trunk.

2) This requires that a make-busy plug is inserted into jack HLD of the sender under test.

NOTE: This test holds the sender group busy continually. Notify other testers attempting to use these senders.

9.211 Relay L Non-Operate - This tests the non-operation of relay L and the time out period after final units selections.

9.212 DID Call - This call tests that the FS terminating sender functions properly on a DID call to a PBX station. The sender records a DID mark which is an Office Code, Dedicated Trunk Group, and/or Number Series indication and transmits this information to the marker for the completion of a DID call.

9.3 Test Call Progress

9.31 With the proper keys operated for a particular test call, operate key ST. A connector connects the test circuit to the first idle FS sender and to the associated sender subgroup circuit of the Terminating Sender Link.

9.32 When the first sender has been tested, register CT will operate and the test circuit will advance to the next sender. This process will continue until a busy sender is encountered or a test failure occurs or all senders in the group have been tested.

9.33 If a test failure occurs, lamp TA will light and the associated alarm will sound.

9.34 After all FS senders in the first subgroup have been tested, the test circuit advances to the next link subgroup and sequentially tests the FS senders.

9.35 When all FS senders have been tested, lamp EC lights.

9.36 Release key ST. Operate and release key RN.

9.4 Test Set-Up

9.41 Restore all keys to normal. Operate and release key RN.

9.42 When all senders are to be tested without changing the key setting, be sure that a frame indication (F and FA keys) is set up which all senders are equipped to accept. When testing with a frame indication which all senders will not accept, tests should be limited to the group of senders which will accept the frame indication used. Change the frame indication keys for each cycle or part of cycle, to insure a simulated check from each incoming trunk frame.

9.43 Operate key TS to test only FS senders.

9.44 If the sender is arranged to complete calls to multi-office terminating units, operate keys as follows:

Sender Arranged for Calls From Individual Trunk Groups:
Operate the LOA (link office A) key to stimulate a call to one office or LOB (link office B) and OAB (office A or B) keys to simulate a call to the other office.

Sender Arranged for Calls From Common Trunk Groups or for Calls From Common and Individual Trunk Groups:
Operate the LOA key to simulate a call to one office or the LOA, OAB and IG5 (incoming group add 5) or the LOB and OAB keys to simulate a call to the other office.

NOTE: Since two cycles of tests are needed to meet acceptance requirements, it is desirable that all office units served by the senders by represented in any two cycles. In order to do this, the LOA, LOB, OAB, and IG5 keys should be operated, as required, in a definite rotation on one cycle, or on a part of a cycle if necessary, so that a representative number of test calls will be associated with each office unit.

9.45 Refer to TABLES A and B for set-up of test calls to be made.

9.5 Test Calls

NOTES:

(1) If sender is equipped for reverse battery start pulse, operate key SP, and

(2) If sender is equipped for dial tone start pulse, operate key DT.

9.51 Perform each call of TABLE A on each FS sender.

9.52 Verify that each call of TABLE A completes satisfactorily. This is indicated by lamp RC lighted and then extinguished.

9.53 When DID is furnished, perform each call of TABLE B on each FS sender modified for DID.

9.54 Verify that each call of TABLE B completes satisfactorily. This is indicated by lamp RC lighted and then extinguished.

TABLE A

CALL NBR.	TEST CALL DESCRIPTION	KEYS OPERATED CL	TH	H	T	U	MISC.	LAMP LIGHTED	SEE NOTES
1A	REGULAR	0	1	1	1	1			1
1B	REGULAR	0	2	2	2	2			1
1C	REGULAR	0	3	3	3	3			1
1D	REGULAR	0	4	4	4	4	LST		1
1E	REGULAR	0	5	5	5	5			2
1F	REGULAR	0	6	6	6	6			2
1G	REGULAR	0	7	7	7	7			2
1H	REGULAR	0	8	8	8	8	LST		2
2	LONG REV. BAT.	0	9	9	9	9	RBT		
3	SEL.BAR RESTORE	0	8	0	7	0			1 & 3
3A	SEL.BAR RESTORE	0	6	0	8	0			2 & 3
4	MAX. LOOP	0	9	9	9	9	L		
5	RELAYS L & STP OPR.	0	0	4	9	0	STP-OPR		
6	SPECIAL MARKER	1	1	0	6	0		TC	1 & 3
6A	SPECIAL MARKER	1	3	0	5	0		TC	2 & 3
7	TELL TALE	2	0	0	0	0	LRB	RB	
8	TROUBLE RELEASE	3	8	7	5	4	LTK	RL	
9	MARKER RELEASE	4	0	0	0	0	LTK	TRL	
10	TRUNK DISCONNECT	5	0	0	0	0	REP - 2	D	
11	RELAY NON-OPR.	7	2	3	3	2		RB	

NOTE 1: Make this test on odd numbered cycles,

NOTE 2: Make this test on even numbered cycles, and

NOTE 3: When test call numbers 3, 3A, 6, and 6A are to be made with key IG5 operated, instead of the codes shown, use codes:

Test Call 3, Code 1030; Call 3A, Code 0520; Call 6; Code 1540; Call 6A, Code -12. Since these test calls check (in addition to other features) the select bar restore feature the condition of the IG5 key (operated or non-operated) should not be changed while making these calls on any one cycle of test.

TABLE B

CALL NBR.	TEST CALL DESCRIPTION	KEYS OPERATED C1	TH	H	T	U	MISC	LAMP LIGHTED	SEE NOTES
1	NON-DID								1
2	ASSIGNED DID INDICATION	0	X	X	X	X			2, 3, 4, 6
3	UNASSIGNED DID INDICATION	0	X	X	X	X	RO		2, 5, 6

NOTE 1: After the FS sender has been modified and before returning the sender to service the satisfactory completion of Test Calls 1A-1H and 6-9 of TABLE 4 is required. When the Terminating Sender Link, Terminating Marker Connector, and Terminating Marker have been modified, the satisfactory completion of Test Calls 2 and 3 of TABLE B is required,

NOTE 2: X shows keys, switches, and/or dials to be operated in accordance with information obtained from the Office Records for the test call being made,

NOTE 3: When the ASsigned DID Indication required is an Office Code, operate keys OI- and LOA/LOC or keys LOB and OAB,

NOTE 4: When a Number Series Indication is required, operate key NS- in combination with the keys required to give an Assigned DID Indication. This information is obtained from the cross-connection information of the Office Records,

NOTE 5: When an Unassigned DID Indication is required, operate the appropriate OI-key. This information is obtained from the Office Records for the test call being made, and

NOTE 6: When a DID call is via Dedicated Trunk Group operation, key DD must be operated.

No changes indicated due
to extensive revision

Manager, Crossbar Product Engineering
Control Center

Reason for Reissue:
1) Add information required for No. 1 Crossbar Direct for Dialing
2) Make a general revision to update to current engineering standards