INTERTOLL DIALING
TYPE B CX AND SX SIGNALING CIRCUIT
OVERALL DIALING TRUNK PULSING TEST
USING PULSE REPEATING TEST SET (SD-65450-01)
ON 2-WAY TRUNK TEST JACK

1. GENERAL

1.01 This section describes a method of applying pulsing tests to dialing trunk from 2-way trunk circuit SD-64469-01 and over a type B CX and SX signaling circuit to a distant office. This test will be performed using pulse repeating test set SD-64540-01 and, where available, the pulsing test set SD-31481-01. The method of checking the pulse repeating requirements using the 2B signaling test set can be found in Section 179-708-505 and for the 4A signaling test set in Section 179-708-504.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The tests covered are:

A. Overall Percent Break Pulsing at Sending End Using Pulse Repeating and Pulsing Test Sets: This test applies continuous pulses to the overall signaling circuit so that the distant end can measure the percent break of the CX and SX circuits.

B. Overall Percent Break Pulsing at Sending End Using Pulse Repeating Test Set Only: This test applies pulses, which are generated by a dial that is calibrated to 12 pulses-per-second, to the overall signaling circuit so that the distant end can measure the percent break of the CX and SX circuits.

C. Overall Percent Break Measurements of Continuous Pulses at Receiving End: This test measures the percent break of the overall CX and SX signaling circuits. The pulses are generated at the sending end by the pulsing test set and are continuous pulses.

D. Overall Percent Break Measurements of 12 Pulses-Per-Second at Receiving End: This test measures the percent break of the overall CX and SX signaling circuit. The pulses are generated by a dial calibrated to 12 pulses-per-second and are intermittent in character.

1.04 The test equipment specified in this section is designed to apply proper marginal tests (simulated critical circuit conditions) when the circuit under test and the test equipment have an applied voltage of 48.5 to 50. In those offices where power plants are normally operated at more than 50 volts, the battery voltage should be reduced and maintained within the required limits while the tests are being made.

1.05 The methods involve the sending of dialing pulses of a definite percent break from one end of a CX or SX signaling circuit and of measuring the percent break of the pulses received at the distant end of the trunk. Limits are set for the character of the received pulses and if these limits are exceeded, a trouble condition is indicated.

1.06 The same testing procedures are employed whether the CX or SX signaling circuits consist of a single pulsing link from one office to an adjacent office or of two or more links joined together in a tandem arrangement and involving pulse repetition at one or more intermediate offices.

1.07 Ordinarily, it is expected that the tests described in this section will be performed

on an end-to-end basis and will include all CX and SX pulsing facilities which are permanently wired together and in which no switching points are involved. However, where it is found that the percent break limits are exceeded, pulse measurements may be made at intermediate points as a step in the localization of trouble, using the method described in paragraph 5.06. Typical layouts of Terminal, Toll, and Intermediate offices showing test connections are illustrated in Fig. 1 and 2.

1.08 A tester is required at both ends of the trunk under test.

1.09 At the sending end, the pulse repeating test set SD-64540-01 is located at the 2-way trunk circuit at the relay rack and controls the sending of pulses from the T test jack at this point. The pulsing test set SD-31481-01, if available, is used as the source of pulses, but if not available, the dial in the pulse repeating test set is used for this purpose.

1.10 The pulses are repeated by the P relay in the 2-way trunk SD-64469-01 over the same path as pulses which come from the intertoll selectors. The pulses are not repeated by the P relay in the associated outgoing trunk circuit.

1.11 At the receiving end, another pulse repeating test set SD-64540-01 is located at the signaling circuit at the relay rack, or at the circuit patching bay. The received pulses are measured for percent break by means of the percent break meter in this test set.

1.12 The associated intertoll trunk shall be removed from service in the approved manner at each originating office. Care should be exercised not to send a seizure forward on any trunk which might seize equipment in a distant office prior to opening the E lead. The trunk circuits should be restored to service when the tests are completed, except where an out-of-service failure is encountered.

1.13 On all circuits provided with earth potential compensation, the limits given in this section assume that the EPC lead is properly wired and has continuity.

1.14 It is necessary that talking connections be established between the two testers, which may be accomplished by means of talking trunk circuits to the testboards at each office and therefore over an intertoll trunk.

1.15 ***Lettered steps:*** A letter a,b,c, etc, added to a step number in Parts 3 and 4 of this section, indicates an action which may or may not be required, depending 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

ALL TESTS

2.01 Pulse Repeating Test Set J64722A (SD-64540-01).

2.02 One 2P9A cord assembly (P2J cord equipped with two 310 or 110 plugs).

TEST A

2.03 Pulsing Test Set J34717A (SD-31481-01).

2.04 36B Remote Control Test Set.

2.05 One 2P9A cord assembly (P2J cord equipped with two 310 or 110 plugs).

TESTS A AND B

2.06 Two 4P2A or 5P3A cord assemblies (P3H cords equipped with two 310 plugs and one 240B plug) for use with auxiliary trunk circuits equipped with 447A T jacks or two 6P4B cord assemblies (P3H cords equipped with two 310 plugs and one 240C plug) for use with auxiliary trunk circuits equipped with 448A T jacks.

TESTS A AND C

2.07 One 4P8A cord assembly (P4N cord equipped with two 289A plugs).

2.08 One 110 or 310 plug with tip and ring short-circuited for use only where the pulse repeating test set is provided with an SC key.

TESTS C AND D

2.09 One 3P6F cord assembly (P3E cord, equipped with two 310 plugs).

2.10 One 258C (dummy) plug. When testing at circuit patching bay two additional 258C plugs are needed.

2.11 One 3P7A cord assembly (P3E cord equipped with two 310 plugs) modified as shown in Fig.3.

2.12 One 3W3A cord assembly (W3A cord equipped with one 310 plug and one 59 cord tip on the sleeve) for use only when testing at the equipment bay on equipment not having a PLS jack.

3. PREPARATION

STEP	ACTION	VERIFICATION
SENDING END		
All Tests		
1	Establish a talking path from testboard over intertoll trunk to distant office. ***Note:*** To avoid 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.	
2	Verify that no plugs are plugged into the jack block located on the bottom end of the pulse repeating test set SD-64540-01.	
3	At pulse repeating test set— Rotate ADJ, LK, LP, MIN, and MAX potentiometers to a fully CCW position.	
4	At pulse repeating test set SD-64540-01— Connect one end of 2P9A cord to the BAT jack.	
5	At equipment bay— Connect other end of 2P9A cord to 48-volt battery supply.	
6	At pulse repeating test set SD-64540-01— Check percent break meter for zero current setting of 100.	
7a	If meter does not indicate 100— Rotate zero adjuster screw on face of meter until pointer indicates 100 and then slightly rotate adjuster screw in opposite direction without disturbing meter pointer.	

STEP	ACTION	VERIFICATION
Test A		
8	At pulsing test set SD-31481-01— Connect one end of 2P9A cord to BAT-G jack.	
9	At equipment bay— Connect other end of 2P9A to 48-volt supply battery jack.	
10	At pulsing test set— Connect one end of 4P8A cord to jacks A and B.	
11	At pulse repeating test set— Connect other end of 4P8A cord to jacks A and B.	
12	Connect one end of 3P7A cord to INT jack.	
13	At pulsing test set— Connect other end of 3P7A cord to TL jack.	
14	At pulse repeating test set— Connect cable from 36B remote control test set into jacks A1 and B1.	
15b	If pulse repeating test set is not equipped with SC key— At pulse repeating test set— Operate and hold ADJ key.	
16c	If pulse repeating test set is equipped with SC key— At pulsing test set— Insert 310 plug with tip and ring shorted, into SW jack.	
17	Operate the PR or CHK PLS key, whichever is provided.	
18	At pulse repeating test set— Operate the DS and PLS CK keys.	
19	At remote control set— Momentarily operate LP key.	
20	At pulse repeating test set— Adjust the ADJ potentiometer until meter indicates 0.	

STEP	ACTION	VERIFICATION
21d	If Step 15b was performed— At pulse repeating test set— Release the ADJ key.	***Note:*** Percent break meter will now indicate the output of the pulse repeating test set.
22e	If Step 16c was performed— At pulsing test set— Remove 310 plug from SW jack.	Same as Step 19d.
23	At pulse repeating test set— Adjust LK potentiometer until percent break meter indicates 59.	
24	Restore PLS CK key to normal.	
Test B		
	Note: Before starting test, verify that dial in connector block of pulse repeating test set has been calibrated to a speed of 12 pulses-per-second.	
25	At pulse repeating test set— Operate the DS-RLS key to DS position.	
26	Operate PLS CK key.	
27	Operate the ADJ key and hold.	
28	Rotate the ADJ potentiometer until the percent break meter indicates 0.	
29	Release the ADJ key.	
30	Operate the MIN-MAX key to MAX position.	
31	Rotate MAX potentiometer for percent break meter indication of 59.	
32	Operate the LK-LP key to LK. ***Note:*** If LK key is nonlocking, hold key operated.	
33	Dial 0. ***Note:*** Rotate LK potentiometer in clockwise direction to compensate for fall of meter pointer.	Meter pointer may rise or fall during return of dial. ***Note:*** Disregard possible slight kick of meter pointer at beginning and ending of dial operation.

STEP	ACTION	VERIFICATION
34	Dial 0 and rotate LK potentiometer until meter pointer shows little or no tendency to rise or fall from preset value of 59.	
35	Restore PLS CK key.	

RECEIVING END

All Tests

Note: To avoid 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.

36 Verify that no plugs are plugged into the jack block located on the bottom end of the pulse repeating test set SD-64540-01.

37 At pulse repeating test set—
Rotate ADJ, LK, LP, MIN, and MAX potentiometers to a fully CCW position.

38 At pulse repeating test set SD-64540-01—
Check percent break meter for zero current setting of 100.

39a If meter does not indicate 100—
Rotate zero adjuster screw on face of meter until pointer indicates 100 and then slightly rotate adjuster screw in opposite direction without disturbing meter pointer.

40 At pulse repeating test set—
Connect one end of 2P9A cord to BAT jack.

41b If pulses are to be received at equipment bay—
Connect other end of 2P9A cord to 48-volt jack on testboard.

42b At pulse repeating test set—
Connect one end of 3P6F cord to RLY jack.

43f At signaling circuit—
Connect other end of 3P6F cord to PLS jack.

44g If pulses are being received at the equipment bay and PLS jack is not provided—
At signaling circuit—
Disconnect E lead at terminal strip.

STEP	ACTION	VERIFICATION
45g	At pulse repeating test set— Disconnect 3P6F cord from RLY jack.	
46g	Connect 310 plug of 3W3A cord to RLY jack.	
47g	At signaling circuit— Connect other end of 3W3A cord to E lead.	
48h	If pulses are to be received at circuit patching bay— Connect other end of 2P9A cord to MISC -48V jack.	
49h	At pulse repeating test set— Connect 310 plug of 3P7A cord (see Fig. 3) to RLY jack.	
50h	At circuit patching bay— Connect other end of 3P7A cord to SIG LINE or DSL jack. ***Note:*** In some offices the F lead is wired through the DSL jack to ground.	
51i	When pulses are being received at circuit patching bay and F lead is connected to DLS jack— At pulse repeating test set— Insert 258C plugs (dummy) in LP OUT and SX OUT jacks to provide ground.	
52	If no plug is in INT jack of pulse repeating test set— At pulse repeating test set— Insert 258C plug (dummy) in INT jack.	
53j	If measurements are made at intermediate point of the auxiliary pulse link circuit not equipped with pulse repeating relay— At CX signaling circuit— Ground F lead.	

4. METHOD

A. Overall Percent Break at Sending End Using Pulse Repeating and Pulsing Test Sets

25k	If 2-way trunk to be tested is equipped with 447A T jacks— At pulse repeating test set— Insert 310 plug of 6P4B cord in SX OUT jack.	

STEP	ACTION	VERIFICATION
26k	At 2-way trunk circuit under test— Insert 240B plug of 6P4B cord in T jack. ***Note:*** If BY lamp of trunk being tested is lighted, the test may be delayed until lamp extinguishes or move to other trunks that are to be tested.	
27l	If 2-way trunk to be tested is equipped with 448A T jacks— At pulse repeating test set— Insert 310 plug of 6P4B cord in SX OUT jack.	
28l	At 2-way trunk circuit under test— Insert 240C plug of 6P4B cord in T jack. ***Note:*** If BY lamp of trunk being tested is lighted, the test may be delayed until lamp extinguishes or move to other trunks that are to be tested.	
29	At pulse repeating test set— Operate SL key.	
30m	When craftperson at receiving end requests continuous pulses to obtain zero setting— At pulse repeating test set— Operate SC key, if provided.	
31b	If pulse repeating test set is not equipped with SC key— Operate and hold ADJ key.	
32n	When craftperson at receiving end indicates zero setting has been obtained and requests continuous pulses— At pulse repeating test set— Restore SC or ADJ key. ***Note:*** Continuous pulses of 59 percent break are being sent to the receiving end.	At pulse repeating test set— Pointer on percent break meter at sending end should be steady and indicating 100. ***Note:*** If the pointer is unsteady or does not indicate 100, a trouble is indicated.
33o	When craftperson at receiving end reports that measurements have been obtained and measurements of other trunks are desired— Repeat PREPARATION Steps 6 through 24 and METHOD Steps 25k through 32n of Test A.	
34p	If test in reverse direction is desired— Perform receiving end PREPARATION Steps	

STEP	ACTION	VERIFICATION
	38 through 53j and METHOD Steps 54 through 58s of Test C.	
35g	If no other tests are to be performed— Disconnect all test connections and restore all keys to normal.	

B. Overall Percent Break Pulsing at Sending End Using Pulse Repeating Test Set Only

	Note: Before starting tests, verify that dial in connector block of pulse repeating test set has been adjusted to a speed of 12 pulses-per-second.	
36k	If 2-way trunk to be tested is equipped with 447A T jacks— At pulse repeating test set— Insert 310 plug of 6P4B cord in SX OUT jack.	
37k	At 2-way trunk circuit under test— Insert 240B plug of 6P4B cord in T jack.	
	Note: If BY lamp of trunk being tested is lighted, the test may be delayed until lamp extinguishes or move to other trunks that are to be tested.	
38l	If 2-way trunk to be tested is equipped with 448A T jacks— At pulse repeating test set— Insert 310 plug of 6P4B cord in SX OUT jack.	
39	At 2-way trunk circuit under test— Insert 240C plug of 6P4B cord in T jack.	
	Note: If BY lamp of trunk being tested is lighted, the test may be delayed until lamp extinguishes or move to other trunks that are to be tested.	
40	At pulse repeating test set— Operate SL key.	
41m	When craftperson at receiving end requests continuous pulses— Dial zero several times until the receiving end reports an accurate reading.	
42n	When craftperson at receiving end reports that measurements have been obtained and	

STEP	ACTION	VERIFICATION
	measurements of other trunks are desired— Repeat Steps 36k through 41m.	
43p	If test in reverse direction is desired— Perform receiving end PREPARATION Steps 38 through 53j and METHOD Steps 54 through 76u of Test D.	
	C. Overall Percent Break Measurements of Continuous Pulses at Receiving End	
54	At pulse repeating test set— Operate CX IN key.	
55	Request steady state closure from sending end.	
56r	If pulse repeating test set percent break meter does not indicate 0— At pulse repeating test set— Rotate ADJ potentiometer for indication of 0 on percent break meter.	
57	Request pulses from sending end.	At pulse repeating test set— Percent break meter should indicate between MIN and MAX percent break as prescribed in Table A, Column A for circuit conditions given in 5.02.
58s	If circuit conditions are not as favorable as those indicated in 5.02 but are within working limits of circuit drawing— At pulse repeating test set— Observe percent break meter.	Percent break meter should indicate between MIN and MAX percent break as prescribed in Table A, Column B. ***Note:*** If percent break is outside of limits specified in Table A, Column B, a definite trouble is indicated. When analyzing cause of pulsing irregularities, conditions in 5.05 should be taken into account.
59t	If test of other trunks is desired— Repeat Steps 38 through 53j of PREPARATION and METHOD Steps 54 through 58s of Test C.	
60p	If test in reverse direction is desired— At pulse repeating and pulsing test sets— Perform PREPARATION Steps 1 through 24 and METHOD Steps 25k through 33o of Test A.	

STEP	ACTION	VERIFICATION
61q	If no other tests are to be performed— Disconnect all test connections and restore all keys to normal.	

D. Overall Percent Break Measurements of 12 Pulses-Per-Second at Receiving End

54	At pulse repeating test set— Operate CX IN key.	
55	Request steady state closure from sending end.	
56r	If pulse repeating test set percent break meter does not indicate 0— At pulse repeating test set— Rotate ADJ potentiometer for indication of 0 on percent break meter.	
57	Operate MIN key.	
58	Momentarily operate RESET key.	
59	Adjust MIN potentiometer for expected percent break meter indication as prescribed in Table A, Column A for circuit conditions given in 5.02.	
60s	If circuit conditions are not as favorable as those indicated in 5.02 but are within working limits of circuit drawing— At pulse repeating test set— Adjust MIN potentiometer for expected percent break meter indication as prescribed by Table A, Column B.	
61	Restore MIN key to normal.	
62	Operate MAX key.	
63	Momentarily operate RESET key.	
64	Adjust MAX potentiometer for expected percent break meter indication prescribed in Table A, Column A for circuit conditions given in 5.02.	
65s	If circuit conditions are not as favorable as those indicated in 5.02 but are within working limits of circuit drawing— At pulse repeating test set— Adjust MAX potentiometer for expected percent	

STEP	ACTION	VERIFICATION
	break meter indication as prescribed by Table A, Column B.	
66	Request sending end to dial 0 until accurate meter indication has been recorded. ***Note:*** RESET key must be momentarily operated after each dialing operation.	Percent break meter pointer should remain stationary or show a tendency to fall. ***Note:*** If meter pointer has tendency to rise, the indication is that the percent break of the pulses is above the limit set up on the MAX potentiometer. Disregard possible slight kick of meter pointer at beginning and ending of dialing operation.
67u	If meter pointer rises or falls when Step 66 is performed and actual percent break output is desired— Request sending end to dial 0 until measurement of rise or fall of meter pointer is completed. ***Note:*** RESET key must be momentarily operated after each dialing operation.	At pulse repeating test set— Meter pointer will rise or fall. ***Note:*** Disregard possible slight kick of meter pointer at the beginning and ending of dialing operation.
68u	At pulse repeating test set— Rotate MAX potentiometer so meter pointer moves in same direction indicated by rise or fall of pointer during dialing operation.	
69	Record meter reading.	
70	Restore MAX key.	
71	Operate MIN key.	
72	Momentarily operate RESET key.	
73	Request sending end to dial 0 until accurate meter reading has been recorded. ***Note:*** RESET key must be momentarily operated after each dialing operation.	Percent break meter pointer should remain stationary or show a tendency to rise. ***Note:*** If meter pointer has tendency to fall, the indication is that the percent break of the pulses is below the limit set upon the MIN potentiometer. Disregard a possible kick of meter at beginning and ending of dialing operation.
74u	If meter pointer rises or falls when Step 73 is performed and actual percent break output is desired— Request sending end to dial 0 until measurement of rise or fall of meter is completed.	At pulse repeating test set— Meter pointer will rise or fall. ***Note:*** Disregard possible slight kick of meter pointer at beginning and ending of dialing operation.

STEP	ACTION	VERIFICATION
	Note: RESET key must be momentarily operated after each dialing operation.	
75u	At pulse repeating test set— Rotate MIN potentiometer so meter pointer moves in same direction as indicated by rise or fall of meter pointer during dialing operation.	
76u	Record meter reading.	
77t	If test of other trunks is desired— Repeat Steps 38 through 53j of PREPARATION and METHOD Steps 54 through 76u of Test D.	
78p	If test in reverse direction is desired— At pulse repeating test set— Perform PREPARATION Steps 1 through 7a, 25 through 35 of Test B and METHOD Steps 36k through 41m of Test B.	
79q	If no other tests are to be performed— Disconnect all test connections and restore all keys to normal.	

5. OVERALL CIRCUIT REQUIREMENTS

5.01 The percent break output of the CX or SX relay at the receiving end will usually be found to differ from the percent break input applied at the sending end. This difference represents the total distortion introduced by the pulsing relay P in the 2-way trunk, by the circuit networks, by the line or cable, by the relay at the receiving end and, where pulse repetition is involved, by the relay at the intermediate office and the pulse repeating relay when provided in the auxiliary pulse link circuit.

5.02 Observe that the percent break output at the CX or SX relay is between the MIN and MAX limits shown in Column A, Table A when the following conditions prevail on the line:

(a) For circuits which are arranged for earth potential compensation, the earth potential to be not more than 20 percent of the maximum indicated on the circuit drawing for the working limits. Except that on circuits adjusted for a nominal earth potential, the earth potential shall not vary from that nominal earth potential more than an amount equal to 20 percent of the maximum indicated on the circuit drawing for the working limits.

(b) For circuits which are not arranged for ground potential compensation, the ground potential to be not more than 20 percent of the maximum indicated on the circuit drawing for the working limits.

(c) The insulation resistance to be not less than three times that of the working limits shown on the circuit drawing.

5.03 If the conditions which prevail on the line at the time of the test are not as favorable as those indicated in 4.16 but are within the working limits shown on the circuit drawing, observe that the percent break output at the CX or SX relay is between the MIN and MAX limits given in Column B, Table A.

CIRCUIT ANALYSIS

5.04 If the percent break output is outside of the limits specified in Column B, Table A, a definite trouble condition is indicated.

5.05 When analyzing the cause of pulsing irregularities, the following considerations should be taken into account:

(a) The usual pulsing performance of the circuit as shown by the records of previous tests in comparison with the results obtained in the present test.

(b) General weather conditions prevailing at the time of the test. The insulation resistance or the loop resistance may be affected by changes in the humidity or temperature, particularly where open wire lines are involved.

(c) Magnetic disturbances may cause changes in the ground potential of a circuit, affecting the pulsing performance in various degrees.

5.06 In order to further analyze possible trouble conditions, pulsing tests may be made at the sending office of the P relay alone or at the receiving office of the CX or SX relay alone, following in each case the methods covered in appropriate sections of Division 040 of the Bell System Practices on pulse repeating relays. Where the circuit layout involves pulse repetition at one or more intermediate points, the pulsing tests covered in this section may be made between the 2-way trunk and the signaling circuit at any of these intermediate points. Trouble conditions may also be localized by making pulsing tests between CX or SX signaling circuits in different offices, following the methods described in Section 333-122-607 on the overall testing of CX and SX signaling circuit. The section also covers in detail procedures for the location and clearing of trouble conditions on CX and SX signaling circuits.

6. RECORDS

6.01 The required record of this routine should be entered on the proper form.

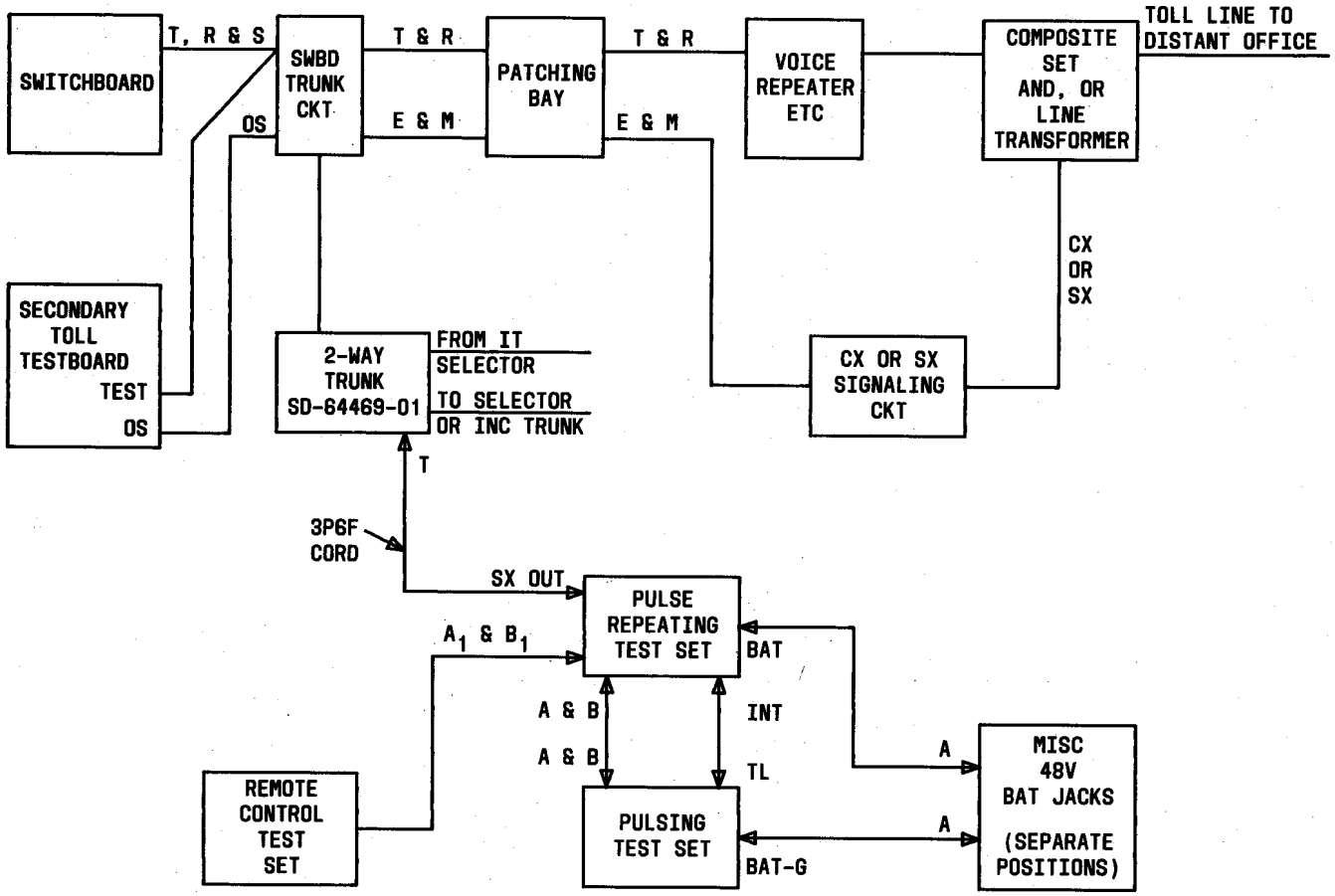

Fig. 1—Typical Layout of Intertoll Trunk Showing Connections for Sending Dial Pulses

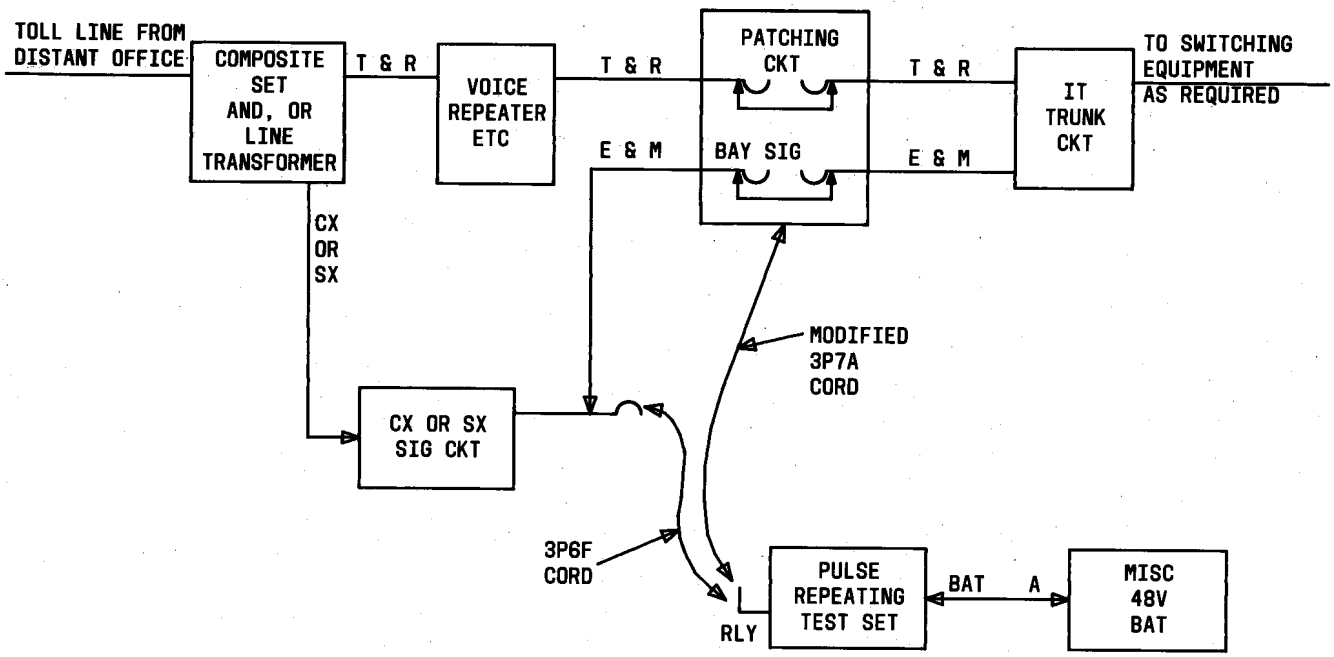

Fig. 2—Typical Layout of Intertoll Trunk Showing Connections for Percent Break Measurements

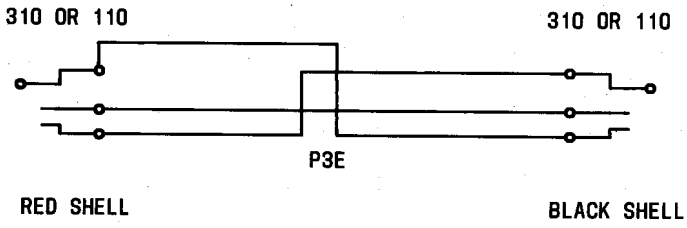

Fig. 3—3P7A Cord Arrangement for Making Connections at the Circuit Patching Bay

TABLE A

PERCENT BREAK OUTPUT AT CX OR SX RELAY (INPUT AT SENDING END, 59 PERCENT)

	A		B	
	CIRCUITS WORKING UNDER FAVORABLE CONDITIONS WITH RESPECT TO WORKING LIMITS		CIRCUITS WORKING UNDER UNFAVORABLE CONDITIONS WITH RESPECT TO WORKING LIMITS	
	MIN	MAX	MIN	MAX
(a) Circuit arrangements involving a single link	56	62	53	65
(b) Circuit arrangements involving two links				
(1) Auxiliary pulse link circuit not equipped with pulse repeating relay	55	63	51	67
(2) Auxiliary pulse link circuit equipped with pulse repeating relay	56	62	53	65
(c) Circuit arrangements involving three or more links				
(1) Auxiliary pulse link circuits not equipped with pulse repeating relay	54	64	50	68
(2) All auxiliary pulse link circuits equipped with pulse repeating relay	56	62	53	65
(3) Auxiliary pulse link circuits, some equipped, some not equipped with pulse repeating relays	55	63	52	66