MF KEY PULSING SENDERS ARRANGED TO TRANSMIT DIAL PULSES OPERATION TESTS USING MANUAL TEST CIRCUIT SD-95400-01 NO. 1 AND NO. 3 TYPE TOLL SWITCHBOARDS AND NO. 15C SWITCHBOARD STEP-BY-STEP SYSTEMS

1. GENERAL

1.01 This section describes a method of testing by means of manual test circuit SD-95400-01 key pulsing senders which are arranged to receive multi-frequency pulses and to transmit dial pulses. This section is intended primarily for use in step-by-step areas for senders associated with a No. 1, 1B, 3, 3B, 3C or 3CL toll switchboard or a No. 15C switchboard.

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

1.03 The tests covered are:

(A) Sender Operation Test

(B) Closure of Pulsing Leads Test

(C) Single Frequency Digit Test

(D) Delay Pulsing Test

(E) All Paths Busy Test

(F) Test of Stop-Go Feature

(G) Preliminary Disconnect Test

(H) Reorder Tests

(I) Sender Time-Out Test

(J) Pad Control Test

(K) Pulsing Speed Test

(L) Per Cent Break Test

1.04 Tests (D) and (F) need only be made when the features checked by these tests are provided in the sender. Test (J) need only be made when the senders are associated with a No. 3 type toll switchboard.

1.05 Test (D) can only be made in classes not arranged to provide an immediate reorder signal upon simultaneous seizure of the two-way trunk by a distant operator.

1.06 Before proceeding with the tests, determine which features are used in each class such as ringing conditions, digit delay, stop-go, pulsing speed, and number of digits to be keyed. The following chart may be made up locally to serve as a guide for operation of the various combinations of ringing keys which represent the different types of test calls to be made with each class. Check marks can be used to indicate whether or not the OR-O, CR, SX and F-RB keys should be operated on the particular test call.

CLASS	OR-O	CR	SX	No. of digits for class	F-RB
CL___					
CL___					
CL___					
CL___					
CL___					

1.07 The senders are tested individually with the manual sender test circuit. This test circuit is connected to the individual sender by means of a T (test) jack at the test circuit jack and lamp panel.

1.08 Keys are furnished at the test circuit jack and lamp panel to make a check of the features provided in the sender. An OK lamp is provided as a signal (either lighted or extinguished) to indicate a satisfactory completion of an individual test function. A KP lamp is provided to indicate that the sender and receiving circuits are ready for the "gate opener" signal which is sent by the operation of the KP key.

1.09 Checking lamps 1 to 0 are provided on the test circuit jack and lamp panel to check that the number of pulses received from the sender agrees with the number keyed. For example, if the No. 3 key of the test circuit keyset is depressed, the No. 3 checking lamp should remain lighted after the pulsing of this digit.

1.10 Delayed Pulsing: The sender may be arranged so that the first digit registered in the sender will be pulsed out immediately. The second and succeeding digits are not pulsed out by the sender until the next succeeding digit is registered. The last digit registered will not be pulsed out until the ST key is operated. Senders may also be arranged to delay the first digit until the second digit is registered.

1.11 Test Numbers: The number which gives the most comprehensive test of the sender register relays is 1254. In order to test certain other leads in the sender not tested with 1254, the following numbers should be used; 2915, 2090, 0538, 8671, and 9807. For senders requiring more than four digits, the last digit may be repeated for each additional digit required.

2. APPARATUS

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

APPARATUS	TEST (A) to (I)	(J)	(K)	(L)
No. 258C (dummy) Plug	1	1	1	1
35-type Test Set	-	1	-	1
KS-3008 Stop Watch	-	-	1	-
KS-7361 Per Cent Break Meter	-	-	-	1
No. 298A or No. 310 Plug (2.02)	-	-	1	1
No. 365 Tool	-	2	-	-
Patching Cord (2.03)	-	1	-	1
Patching Cord (2.04)	-	1	-	-
Patching Cord (2.05)	-	-	-	1
Patching Cord (2.06)	-	-	-	1

2.02 No. 298A Plug or a No. 310 Plug with tip and ring short-circuited.

2.03 P3E Cord, six feet long, equipped with two No. 310 Plugs (3P7A).

2.04 W2W Cord, six feet long, equipped at one end with a No. 310 (or 110) Plug and at the other end with No. 360B and No. 360C Tools (2W17A), and a No. 365 Tool attached to each 360-type Tool.

2.05 P2P Cord, ten feet long, equipped at one end with a No. 309 Plug and at the other end with a No. 310 Plug (2P10A).

2.06 W2BC Cord, five and a half feet long, equipped with a No. 310 Plug (2W27A).

3. PREPARATION

3.01 At the test circuit jack and lamp panel insert a No. 258C plug into the T jack associated with the sender to be tested.

3.02 Operate the H (hold) key. If the sender is idle or when it becomes idle, the OK lamp should light. This is a check of the H lead circuit. The H key should be left operated until all the tests of a sender are completed.

3.03 On the test circuit operate the following keys, when they are provided, as specified in 4. METHOD.

Key	Purpose
H	Hold: To hold the sender connected to the test circuit and make it busy to hunting links.
CL-	Class: To simulate the different classes for which the sender may be arranged.
SX	Simplex: To be operated when testing a simplexed DC ringing class when the sender is expected either to ring or cut through without ringing.
CR	Cancel Ring: To be operated in conjunction with the OR-O or OR-O and SX keys when testing a class where the sender cancels the ring in certain digits or all digits even though the operator rings.
PT	Pulsing Test: To check pulsing speed and per cent break.
SF	Single Frequency: To send a single frequency to the MF receiving circuit.
F-OF	Open Fundamental: To open the fundamental tip and ring.
F-RB	Reverse Battery: To reverse the potential on the FR and FT leads to represent a "line seizure" signal.
PD-O	Preliminary Disconnect - Operate: To test the operate of the PD relay in the sender.

Key	Purpose
PD-NO	Preliminary Disconnect - Non-Operate: To test the non-operate of the PD relay in the sender.
TO-A	Time-Out A: To test the TA relay time-out feature in the sender.
TO-B	Time-Out B: To test the TB relay time-out feature in the sender.
SC	Sender Control: To impose an operate test on the SC, OF and class relays in the sender depending on the CL key operated.
K	Keyset: To connect the test circuit keyset to the sender.
SD	Sender Delay: To give a reverse battery signal to delay the outpulsing in a stop-go class.
FT	Fundamental Test: To open the pulsing leads to the sender for checking delayed outpulsing until class registration is completed.
OR-O	Operator Ring Operate: To simulate a ring from the operator. This key is operated when a 20-cycle AC ringing signal is expected from the sender in the class under test. It is also operated in conjunction with the SX key when a simplexed DC ring is expected from the sender in the class under test. When an immediate cut-through (without ringing) test is to be made, leave the OR-O key normal.
OR-NO	Operator Ring Non-Operate: To make a non-operate test of the SR relay in the sender.
KP	Key Pulsing: To send a key pulsing "gate opener" signal which prepares the receiving circuit for the reception of digit pulses.
RLS	Release: To extinguish the checking lamp after each digit is keyed and checked.

4. METHOD

(A) Sender Operation Test

4.01 This test checks that the sender performs its functions in handling the different classes of calls for which it may be arranged. In doing so, it checks the MF receiving circuit, the SC lead, class registration, the operation of the proper registration relays, that the number of pulses pulsed out by the sender agrees with the digit keyed in, and that the sender performs its proper ringing and cut-through functions.

4.02 Operate a CL key. Then operate keys OR-O, SX, and CR, when necessary, to set up the proper ringing condition for the test and class being checked.

4.03 Operate the SC key. The OK lamp should be extinguished and the KP lamp should light. Momentarily operate the KP key. The OK lamp should relight and the KP lamp should be extinguished.

> Note: If the CL, SC and KP keys are operated quickly in sequence, the KP lamp may appear as a flicker and will not stay lighted. The OK lamp will be momentarily extinguished.

4.04 Operate the K key. By means of the numerical digit keys of the keyset register one of the test numbers. Check that the digits keyed in are received on the proper checking lamps and in the proper sequence. The RLS key may be operated between digits if desired. Operate the ST key after the last digit is keyed. The OK lamp will be extinguished after the ST key is operated until the ringing test or the immediate cut-through test is made as covered in 4.05.

4.05 If 20-cycle AC ringing is expected from the sender, operate the F-RB key. The OK lamp should relight if the ringing and cut-through test is satisfactory. In all other types of tests including immediate cut through without ringing, simplexed DC ringing, and canceled ring, the OK lamp should relight immediately after the ringing and cut-through test is made.

4.06 Restore all keys to normal except the H key.

4.07 Repeat this test, using all test numbers, covering all types of calls and all classes for which the sender is arranged. It is not necessary to use each test number with each class. In classes requiring canceling the ringing in certain digits and ringing in other digits, test all digits with the proper ringing keys operated. Tests (B), (C), and (D) may be combined with these repeat tests.

4.08 Non-Operate Test of SR Relay: On one of the test calls covered in 4.07, where ringing by the operator is required, operate

the OR key to the NO position. The OK lamp should relight after the last digit is outpulsed, indicating that the sender did not ring.

4.09 If no other tests are to be made on the sender, restore all keys to normal and remove the plug from the T jack. If other tests are to be made, restore all but the H key and leave the plug in the T jack. The OK lamp should remain lighted indicating that the sender is being held connected to the test circuit.

(B) Closure of Pulsing Leads Test

4.10 This test checks that if the pulsing leads are open to the sender during digit registration, the sender will not pulse out the digits, when keyed, until these leads are closed.

4.11 Operate the F-OF key. Make a test call as covered in Test (A). Key in several digits and note that no pulses are received from the sender. Restore the F-OF key and note that the sender then pulses out the digits properly.

4.12 Release the circuits as in 4.09.

(C) Single Frequency Digit Test

4.13 This test checks that the MF receiving circuit will recognize a single frequency and will not register in the sender.

4.14 Make a test call as in Test (A), and during the keying of digits momentarily operate the SF key. This should not register in the sender and the test should proceed as in any normal call.

4.15 Release the circuits as in 4.09.

(D) Delay Pulsing Test

4.16 This test checks a sender arrangement to delay outpulsing until connecting equipment is attached in the distant office and ready to receive the pulses.

4.17 Operate the F key to the OF position. Operate a class key not arranged for reorder on simultaneous seizure of two way trunks. Make a test call as covered in Test (A). Key one or two digits, then operate the F key rapidly to the RB position. No pulses should be received from the sender.

4.18 Restore the F key to normal and note that the pulses are then received from the sender.

4.19 Release the circuits as in 4.09.

(E) All Paths Busy Test

4.20 This test checks that the sender will cut through immediately upon receiving a reversal on the FT and FR leads representing an all paths busy signal. This test is only to be made on a class not equipped for stop-go.

4.21 Operate a class key for a class not equipped for stop-go. Make a test call as covered in Test (A). Key in several digits and note that the pulses are received properly. Operate the F-RB key and note that the OK lamp is momentarily extinguished. Release the F-RB key and key in an additional digit. Note that no more pulses are received, indicating that the sender has cut through.

4.22 Release the circuits as in 4.09.

(F) Test of Stop-Go Feature

4.23 This test checks the stop-go feature of the sender. A battery and ground reversal over the FT and FR leads is given the sender as an indication to-stop pulsing. When pulsing is to be resumed, the battery and ground is again reversed as a signal to resume outpulsing of the remainder of the digits. Any further battery reversals during pulsing indicate an "all paths busy" condition.

4.24 Operate a class key arranged for stop-go. Make a test call as in Test (A), and after a digit is pulsed out, following which a stop signal is expected, operate the SD key. Key another digit and note that the sender does not pulse out the digit. Release the SD key and the sender should then pulse out the digit.

4.25 To check the release of the TT relay to permit an "all paths busy flash" after a stop-go signal, operate the SD key again. Key another digit and note that no pulsing takes place. Release the SD key and note that pulsing still does not take place.

4.26 Release the circuits as in 4.09 and repeat this test on all stop-go classes.

(G) Preliminary Disconnect Test

4.27 This test applies a non-operate, operate, and release test to the PD relay in the sender.

4.28 Non-Operate: Operate the F-OF and SC keys. Note that the OK lamp is momentarily extinguished. Operate the PD-NO key. Observe that the OK lamp remains lighted.

4.29 Operate: Operate the PD key to the O position. Observe that the OK lamp is extinguished but relights immediately.

4.30 Release: Restore the PD key to normal. Observe that the OK lamp is extinguished but relights immediately. Release the circuits as in 4.09.

(H) Reorder Tests

4.31 The following tests check the ability of the sender to return a reorder signal to the operator under various trouble conditions.

Three Frequency Digit

4.32 Operate any class key and the SC key. The OK lamp should be extinguished and the KP lamp should light. Momentarily operate the KP key. The KP lamp should be extinguished and the OK lamp should relight. Operate the K key and the TO key to position B. The OK lamp will be extinguished.

4.33 Key one or two digits and observe that the sender outpulses properly. Then press simultaneously, digit keys 1 and 2 in order to send three frequencies to the MF receiving circuit. Observe that the OK lamp lights. Restore all keys to normal except the H key.

Note: Other combinations of digit keys which will send three frequencies may be used when a more extensive test of the receiving circuit is desired.

Two KP Keys

4.34 Proceed as in 4.32. Momentarily operate the KP key a second time. Observe that the OK lamp lights. Restore all keys to normal except the H key.

Premature Start

4.35 Proceed as in 4.32, except operate the CR and PD-NO keys before operating the TO key. Key one or more digits and then depress the ST key after a digit where it is not intended to be depressed. Observe that the OK lamp lights. Release the circuits as in 4.09. On successive test cycles, depress the ST key after a different number of digits to check all digits arranged to recognize a misplaced ST key.

(I) Sender Time-Out Test

4.36 This test checks the time-out alarm relays in the sender and the audible and visual alarms associated with the sender.

4.37 Operate the SC key, then operate the TO key, first to position A, then to position B and release it. The OK lamp will be extinguished but should immediately relight. The MB lamp associated with the sender should also light. Release the circuits as in 4.09.

4.38 Test of Visual and Audible Alarms: Once during the cycle of testing all of the senders, following 4.37, block the ON relay operated in the sender under test. Then remove the plug from the T jack. Wait the time-out period and observe that the associated visual and audible alarms are operated.

4.39 Reinsert the plug into the T jack and remove the blocking tool from the ON relay. Observe that the alarms are retired. Release the circuits as in 4.09.

(J) Pad Control Test

4.40 This test provides a means for testing the PC (pad control) resistances in the sender. It also provides a resistance balance test of the SR and SRA relays.

4.41 Operate a CL key for the maximum number of digits for which the sender is equipped. Operate the SC, KP, K, and then the F-OF keys.

4.42 Block the CT relay in the sender non-operated, and insulate the 5B contact of the ON relay and the 3B contact of the CT relay.

4.43 Key in a maximum digit number and operate the ST key. No pulsing will be received by the test circuit and the OK lamp should be extinguished when the ST key is operated.

4.44 With the 35-type test set keys normal and the resistance slides at the right-hand side, connect a P3E cord to the T & R jack of the test set and to the TT jack of the sender test circuit. With the black conductor of the W2W cord connected to 24-volt battery and the white conductor connected to ground, insert the No. 310 plug into the TEST BATT & GRD jack of the test set.

Note: If a 24-volt test battery jack is available, battery and ground can be supplied by patching to the TEST BATT & GRD jack.

4.45 Operate the BATT & GRD C.O. key of the test set and close switch G. Then move the No. 1 resistance slides to the extreme left, so that the resistance in series with the meter will be at a minimum. Operate the short-circuiting switch of telegraph key No. 1 and read the meter. The reading should be between 2.15 and 2.39 milliamperes. Operate the REV key and note that the meter reads the same as before.

4.46 SR and SRA Relay Balance Test: Move the No. 1 slides to the right-hand side and restore all keys of the 35-type set to normal.

4.47 Remove the insulators from 5B of the ON relay and 3B of the CT relay, leaving the CT relay blocked non-operated.

4.48 Move the No. 1 slides to the extreme left and close the short-circuiting switch of telegraph key No. 1. The reading of the meter should be between 22.8 and 27.4 milliamperes. Operate the REV key. The meter should again read between the previous specified limits.

4.49 Remove the blocking tool from the CT relay. Disconnect the test set and release the circuits as in 4.09.

(K) Pulsing Speed Test

4.50 This test provides a means of checking the low speed pulsing of the sender and high speed pulsing when provided.

4.51 Operate the PT key. Operate a class key for low speed pulsing and the SC key.

4.52 Insert a No. 298A plug into the MB jack associated with the sender being tested. The OK lamp will be extinguished and the numerical checking lamps will flash continuously as the sender pulses.

4.53 With the stop watch, count the number of times the 0 lamp flashes in a minute. The number of flashes of the 0 lamp should be between 57 to 66 flashes per minute.

4.54 To check for high speed pulsing, proceed as in 4.51 to 4.53 except that a class key for high speed pulsing should be operated. The number of flashes of the 0 lamp should be between 96 to 126 flashes per minute.

4.55 If the per cent break test is to be made, proceed with 4.59 to 4.64. Otherwise, remove the plug from the MB jack and release the test circuits as covered in 4.09.

(L) Per Cent Break Test

4.56 This test provides a means for checking the per cent break of the low speed pulses and of the high speed pulses when provided.

4.57 Operate the PT key, a class key for low speed pulsing, and the SC key.

4.58 Insert a No. 298A plug into the MB jack associated with the sender being tested. The OK lamp will be extinguished, and the numerical checking lamps will flash continuously as the sender pulses.

4.59 With the 35-type test set keys normal and the resistance slides at the right-hand side, connect the T & R jack of the test set to the PT jack of the sender test circuit with a P3E cord.

4.60 Insert the No. 309 plug of the P2P cord into the TEST BATT & GRD jack of the test set and the No. 310 plug into the BATT supply jack of the sender test circuit.

4.61 With the W2BC cord, connect the per cent break meter to the 4W jack of the test set. Check that the per cent break meter reads 100 on the scale. (This is the no current position.) If necessary bring the reading to 100 by means of the zero adjusting screw on the meter. Operate the CR key of the sender test circuit and close the No. 4 key of the test set. Move the No. 4 resistance slides to the left until the per cent break meter reads zero. (The test set meter will read approximately .012 ampere.)

Note: To ensure proper accuracy of the per cent break meter, it should be located approximately level and should not be closer than 12 inches to magnetic material, such as steel or iron framework or metal test sets.

4.62 Restore the CR key and observe that the per cent break meter reads between 59.5 and 67.5 per cent break.

4.63 To check for high speed pulsing, proceed as in 4.57 to 4.62, except that a class key for high speed pulsing should be operated. The per cent break meter should read between 62 and 70 per cent break.

4.64 Disconnect the per cent break meter and the 35-type test set. Release the circuits as in 4.09.

5. REPORTS

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