TROUBLE-LOCATING METHODS—STUCK SENDER ANALYSIS SERVICE IMPROVEMENT GUIDE EVALUATION TEST PROCEDURES NO. 5 CROSSBAR OFFICES

1. GENERAL

1.01 This section is one of a series of Bell System Practices that comprise the No. 5 Crossbar Service Improvement Guide. This section provides manual trouble-locating methods for testing the basic operational features of each type of sender.

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

1.03 Recommendations for changes, additions, and/or deletions to this section should be forwarded as specified in Section 000-010-015.

1.04 Section 218-080-100, General Description of the No. 5 Crossbar Service Improvement Guide, provides a complete table of contents and reference information for using the entire Service Improvement Guide.

2. STUCK SENDER ANALYSIS

2.01 As a tool in locating faults affecting No. 5 crossbar senders, a CTR key per sender is provided in the jack, lamp, and key circuit. A variable percentage of the CTR keys should be operated on an alternating basis so that senders which encounter trouble conditions will stick.

2.02 "Sticking" means that the sender and trunk are locked out of service until the sender's CTR key is manually released. Sticking is the only means a sender has of informing maintenance personnel that a trouble has been detected since the sender has no access to the trouble recorder. Usually, a sender sticks as the result of a time-out of its TM timer.

2.03 Common causes of time-outs are (1) trunk faults such as open tips and rings, reversed trunks, and faulty trunk relays; (2) sender faults such as faulty contacts on digit registration relays; (3) and transverter or recorder faults such as missing wiring. Sender time-outs may also occur if there is a shortage of transverter circuits or a shortage of incoming registers at the called office.

2.04 Each test chart in this section is associated with a particular type of No. 5 crossbar outsender. By referring to the appropriate test chart, the point to which the sender progressed before sticking can be isolated to a fairly short portion of the sender call handling sequence. From there, reference can be made to sequence charts, which begin on sheet E1 of the SD, to pinpoint the fault.

2.05 It is recommended that the procedures furnished be followed in response to a lighted TO sender lamp. In the procedures it is assumed that the office is equipped with the stuck sender trunk identifier circuit, SD-27839-01. In offices not equipped with this circuit, manual tracing is necessary to identify the trunk associated with the stuck sender.

2.06 In offices equipped with the automatic tracing feature (App. Fig. 5) of the stuck sender trunk identifier circuit, the ACTR key at the master test frame may be operated to automatically operate the make-busy relay of any stuck sender and cause a trouble record to be punched identifying the trunk associated with the stuck sender.

2.07 In offices where the automatic tracing feature of the stuck sender trunk identifier circuit is not provided, a No. 322A make-busy plug must be inserted into the make-busy jack associated with the stuck sender. The SSI key at the master test frame must then be operated to identify the trunk associated with the stuck sender via a lamp display.

2.08 The condition of the relays in the stuck sender should be determined by visual inspection according to the sequence described in the appropriate test chart in order to locate the fault.

2.09 When the fault is determined to be either in the trunk or the distant office, the trunk should be made busy, the sender CTR key should be released, and the make-busy plug for the sender removed to free the sender to handle other calls. The trunk may then be tested to determine in which office the fault is located. If the trunk passes all tests, the fault is in the incoming register in the distant office or in the sender or in the sender link connection between the sender and the trunk circuit. The pattern of such faults should indicate where the fault is located.

2.10 When the fault is determined to be in the sender, the fault can be traced to greater precision by using the sequence charts which begin on sheet E1 of the SD. Care must be used in this analysis since locating the precise point at which the sender stuck is complicated by the fact that some sender relays may operate and/or release immediately after a time-out has occurred. For example, the senders transverter release relay, RLT, may be operated by the transverter after a sender time-out has already occurred.

TEST CHART 1

MF SENDER—SD-26051-01 (WIRE SPRING)

There are two general conditions that will cause a stuck sender condition in the multifrequency outgoing sender:

- The receipt of a false off-hook after the sender is prepared to start outpulsing.
- Exceeding the time limit of the overall (TM) timer at any point during the progress of the call.

STEP	PROCEDURE
1	Is relay STS1 operated?
	(a) Yes! This is a "no digit" class call. Go to Step 14.
	(b) No! Go to Step 2.
2	Is relay KP operated?
	(A) Yes! Is relay SP operated?
	(1) Yes! The sender had difficulty when attempting to send the key pulse. Relays PG, PG1, CRS, R1 and R2 may have caused the problem.
	(2) No! Go to Step 3.
	(B) No! Is relay SP operated?
	(1) Yes! Go to Step 5.
	(2) No! The fault is in this office. Is the AV relay operated?
	(a) Yes! See sheet E1 of SD-26051-01, location H-18. Determine to what point the sender progressed. The failure is probably due to a fault with the ATM timer or due to fault with either the KP, ATM or ON1 relay. In older offices the ATM tube may have caused the failure.
	(b) The sender did not recognize an advance signal from the marker. The fault may be associated with the sender AV relay or its operate path. (This includes possible marker faults.) An open TM lead between the completing marker and the originating register can cause this condition by allowing an abandoned call to release the completing marker after the marker has seized a sender but before it has operated the sender AV relay.

TEST CHART 1 (Contd)

STEP	PROCEDURE

3 A seizure signal was probably sent to the distant office as required, but the sender did not recognize the return of the proper supervisory signals requesting it to start outpusling. Senders may stick in this state even when all circuits are performing properly if heavy traffic delays the attachment of an incoming register at the distant office. There are also numerous faults which can cause senders to stick in this condition. Faults in the transmission path or distant office are common causes of this problem. Therefore, it is recommended that a trunk test be conducted at this point as described in Step 15. Proceed with the following sequence only if attempting to trace troubles in circuits known to contain faults or to obtain further information on persistant trouble. Is relay CL2 operated?

(A) Yes! Do office records or experience verify that this trunk is in either a 2-way trunk or an intertoll (1-way or 2-way) trunk group?

(1) Yes! Go to Step 4.

(2) No! The CL2 class mark was incorrectly passed to the sender, possibly due to a completing marker cross-connection error or reversed class leads between the marker and the OSC or between the OSC and the sender.

(B) No! Do office records or experience verify that this trunk is a 1-way non-intertoll trunk group?

(1) Yes! Go to Step 4.

(2) No! The CL2 class mark should have been received by the sender. There is possibly a marker cross-connection error, reversed class leads between the marker and the OSC or between the OSC and the sender, or a faulty CL2 sender relay.

4 Following is a list of the many possible conditions which can stick a sender in this state.

(A) Heavy incoming traffic at the distant office.

(B) An open tip and ring anywhere between the outgoing sender and the distant office incoming register.

(C) A fault preventing the operation of the cut-off relay in the distant office incoming trunk circuit. In a No. 5 crossbar office, the fault could be in either the incoming trunk, the incoming register link, or the incoming register. If it is a trunk fault, the condition will generally repeat itself upon testing. IRL or IR faults of this nature will result in the punching of LR (link release) trouble cards in the incoming office.

(D) A tip and ring reversal anywhere between the outgoing sender and the distant office incoming register. In some cases, reversals may cause the sender to stick, sometimes in the state as described in Step 3 and sometimes in the state described in part (B) of Step 5. Reversals between incoming registers and incoming register links are difficult to isolate without distant office monitoring or testing of incoming registers.

TEST CHART 1 (Contd)

STEP	PROCEDURE
	(E) A sender fault which prevents the operation of any of the following sender relays: OF, OF1, TG, or SP.
	(F) An outgoing trunk circuit fault.
5	Is relay TM operated?
	(A) Yes! Go to Step 6.
	(B) No! The sender observed a change to off-hook supervision while outpulsing. This condition, referred to as an unexpected stop, may be caused by any of several conditions. One condition is a reversed tip and ring anywhere between the outgoing sender and the distant office incoming register as described in part (D) of Step 4. A second condition which could stick a sender, also described in Step 4 and part (B) of Step 5, is a link time-out at the distant office after the trunk cut-off relay has operated. An IR or IRL fault causing a link time-out will result in the punching of an LR (link release) trouble card at the incoming office if it is a No. 5 crossbar office. A third possible consideration is a circuit design fault.
6	Is the EP relay operated?
	(A) Yes! Go to Step 13.
	(B) No! The sender timed out before completing outpulsing. Go to Step 12.
7	Is the CL5 relay provided and operated?
	(A) Yes! Is relay CL3 provided and operated?
	(1) Yes! This is an automatic identified (ANI) class call. Go to Step 8.
	(2) No! This is an operator identified (ONI) class call. Go to Step 9.
	(B) No! Is the AMA relay operated?
	(1) Yes! This is an automatic message accounting (AMA) class call. Go to Step 11.
	(2) No! Is either the RLT or TR relay operated?
	(a) Yes! This is an AMA class call. Go to Step 12.
	(b) No! No transverter is required on this class call. Go to Step 10.
8	Is the CSR relay operated?

TEST CHART 1 (Contd)

STEP	PROCEDURE

(A) Yes! The sender received a request from the distant office for the calling number. Go to Step 11.

(B) No! Is the R2 relay operated?

(1) Yes! The called number was sent, but the sender did not detect any off-hook signal from the distant office requesting the calling number. A problem most likely exists in the distant office, possible preventing the attachment of a centralized automatic message accounting (CAMA) sender if the distant office is a No. 5 crossbar office. A possible local office cause of this problem is the reception by the sender of CL3 and CL5 class marks when working with a trunk that does not require this mode of operation. In such a case, it may be assumed that there is a marker cross-connection error or reversed class leads.

(2) No! The sender timed out before requesting the calling number from the ANI transverter. This is due to a sender fault. Go to Step 10.

9 Is the CSR relay operated?

(A) Yes! The sender received a request from the distant office for the ANI information digit. The sender must have encountered difficulty in outpulsing this digit due to a sender fault. Go to Step 10.

(B) No! Is relay R2 operated?

(1) Yes! The called number was sent, but the sender did not detect any off-hook signal from the distant office requesting the ANI information digit. A problem exists as described in part (B) of Step 8.

(2) No! The sender timed out prior to sending the ANI information digit. Go to Step 10.

10 Do the operated RR_ relays consist of either the RR7 relay alone or two and only two RR_ relays?

(A) Yes! The sender stuck due to a time-out, the cause of which cannot be determined with any certainty using this analysis. In some cases it may be due to a delay in receiving service from an incoming register in a distant office due to heavy traffic.

(B) No! There is probably a fault in the sender which caused a failure of the sender's 2/5 check on the RR_ relays (recapture relays). This could be caused by a faulty digit register reed pack, faulty relays such as the RR_, RG1, or PG or faulty wiring or contacts pertaining to these relays. Faults with capacitors PG or PGC or with other elements of the pulse generator portion of the sender could also be responsible for this failure.

TEST CHART 1 (Contd)

STEP	PROCEDURE

11 Is either relay RLT or TR operated?

(A) Yes! Go to Step 12.

(B) No! The sender timed out while waiting to be connected to a transverter. It is possible that this is due to missing wiring or dirty contacts in leads ST, RLT or TR. This could also be caused by delays in receiving transverter service due to heavy traffic.

12 Do the operated RR_ relays consist of either the RR7 relay alone or two and only two RR_ relays?

(A) Yes! The sender stuck due to a time-out, the cause of which cannot be determined with any certainty using this analysis. In some cases it may be due to delays in receiving service from an incoming register in a distant office or from a transverter in this office due to heavy traffic.

(B) No! Go to part (B) of Step 10.

13 A sender time-out occurred due to either heavy traffic or a local office fault. Either a false ground on the D lead or HM lead from the OSL, or a fault in the sender could have prevented it from releasing itself even though all sender functions were completed. A sender fault is probably associated with one of the following relays: EP, CT, LR, ON, or ON1.

14 Is either relay RLT or TR operated?

(A) Yes! There is probably a fault in this office, probably in the sender, which prevented even the simple functions required on this call from being performed by the sender. Some possible causes are listed in Step 13. In addition to those causes, it is possible that the sender time-out is due to a delay in reaching a transverter.

(B) No! Is relay AMA operated?

(1) Yes! Go to part (B) of Step 11.

(2) No! Go to Step 13.

15 When possible, test calls should be set up using the master test frame, since this is the only way to test the sender, the sender link, and the outgoing trunk circuit in addition to the transmission path and the incoming trunk circuit. The desired test is a miscellaneous class test. In instances in which use of the master test frame for stuck sender testing is not practical, the voltmeter test circuit can be used to test the transmission path and the incoming trunk circuit. The voltmeter test circuit can be used to test for continuity and proper polarity by the successive operation of the RG, FEMF and VMT2 keys and possibly the T2REV key. One must know whether the trunk being tested is normally on-hook or normally off-hook before drawing conclusions about the polarity test. In offices equipped

TEST CHART 1 (Contd)

STEP	PROCEDURE

with an OGT bay, a wink signal being returned can be observed on the S lamp on the VM test panel if the VMT1/VMT2, T and T1REV/T2REV keys are successively operated.

TEST CHART 2

DP SENDER—SD-26050-01

There are only three general conditions that will cause a stuck sender condition in the dial pulse outgoing sender.

The receipt of an off-hook signal from a senderized office when the sender checks the supervision of the tip and ring leads.

A one-out-of-five registration of any digit or any malfunction of the pulse generating and counting circuitry which causes an overcount.

Exceeding the time limit of the overall (TM) timer at any point during the progress of the call.

STEP	PROCEDURE

1 Is the TT1 relay operated?

(A) Yes! Go to Step 2.

(B) No! Is relay BD operated?

(1) Yes: A seizure signal was most likely sent to the distant office as required, but the sender did not recognize the return of the proper supervisory signals requesting it to start outpulsing. Senders may stick in this state even when all circuits are performing properly if heavy traffic delays the attachment of an incoming register at the distant office. There are also numerous faults which can cause senders to stick in this condition. Faults in the transmission path or distant office are common causes of this problem. Therefore, it is recommended that a trunk test be conducted at this point as described in Step 15 of Test Chart 1. Proceed with the following sequence only if attempting to trace troubles in circuits known to contain faults or to obtain further information on persistant troubles. Do office records or experience verify that the proper CL-relay or relays are operated?

TEST CHART 2 (Contd)

STEP	PROCEDURE

(a) Yes! See Test Chart 1, Step 4, for a list of the many possible causes of this problem.

(b) No! The wrong class mark was passed to the sender, possibly due to a and the OSC or between the OSC and the sender.

(2) No! The fault is in this office. Is the AV relay operated?

(a) Yes! See sheet E1 of SD-26050-01; location G-14. Determine to what point the sender progressed. The failure is probably due to a fault with the ATM timer or due to a fault with either relay KP, ATM or ON1. In older offices the ATM tube may have caused the failure.

(b) No! The sender did not recognize an advance signal from the marker. The fault may be associated with the sender AV relay or its operate path. (This includes possible marker faults.) An open TM lead between the completing marker and the originating register has caused this condition by allowing an abandoned call to release the completing marker after the marker has seized a sender but before it has operated the sender AV relay.

2 Is the TM relay operated?

(A) Yes! Go to Step 3.

(B) No! The sender may have stuck in this state for any of the following reasons:

(1) A one-out-of-five-digit registration. Check the digit registration reed packs for this condition. If the sender is equipped with option ZP, this condition can be more precisely detected by checking the RR_ (recapture relays) for one-of-five registration.

(2) A trouble preventing the SP relay from operating at the proper time.

(3) A second off-hook (false off-hook) which occurs prior to the outpulsing of the first digit on calls in which neither relay CL2 nor CL3 is operated (step-by-step class calls). Note that if option SP is not provided, the sender will not stop outpulsing upon detecting such a trouble. Thus, one must be cautious about determining the number of digits outpulsed by examining the steering relay(s) operated. The delete information (DL relays) must also be considered before reaching a conclusion on this matter.

3 Is the SG relay operated?

(A) Yes! The sender received a second off-hook signal (a stop signal). Does the trunk used on this call either go to a step-by-step tandem point, from which such a stop is normal (class relays CL2 and CL3 should be normal) or to a 2-way trunk with the

TEST CHART 2 (Contd)

STEP	PROCEDURE

antiglare feature (class relays CL2 and CL6 should be operated) from which such a stop is normal.

(1) Yes! Is the SG1 relay operated?

(a) Yes! The sender received an on-hook "go" signal as required. Go to Step 4.

(b) No! The sender timed out after receiving a stop signal without ever receiving how many digits were outpulsed before the stop was received. This condition may be caused by (a) a reversed trunk (whether it is the trunk leaving this office or leaving the tandem point should be clear from the steering relay operated), (b) a link time-out at the office beyond the tandem point on step-by-step tandem calls, or (c) a problem preventing the attachment of an incoming register at the point beyond the step-by-step tandem (possibly merely due to heavy traffic).

(2) No! The sender should never have received the stop signal. Refer to part (A) of Step 3 for possible causes of this condition.

(B) No! Go to Step 4.

4 Is the EP relay operated?

(A) Yes! Go to Step 9.

(B) No! The sender timed-out before completing outpulsing. Go to Step 5.

5 Is the AMA relay operated?

(A) Yes! This is an AMA class call. Go to Step 7.

(B) No! Is either the RLT or TR relay operated?

(1) Yes! This is an AMA class call. Go to Step 8.

(2) No! No transverter is required on this class call. Go to Step 6.

6 The sender stuck due to a time-out, the cause of which cannot be determined with any certainty using this analysis. In some cases it may be due to a delay in receiving service from an incoming register in a distant office due to heavy traffic.

7 Is either the RLT or TR relay operated?

(A) Yes! Go to Step 8.

TEST CHART 2 (Contd)

STEP	PROCEDURE
	(B) No! The sender timed out while waiting to be connected to a transverter. It is possible that this is due to missing wiring or dirty contacts in leads ST, RLT or TR. This could also be caused by delays in receiving transverter service due to heavy traffic.
8	The sender stuck due to a time-out, the cause of which cannot be determined with any certainty using this analysis. In some cases it may be due to delays in receiving service from an incoming register in a distant office or from a transverter in this office due to heavy traffic.
9	A sender time-out occurred due to either heavy traffic or a local office fault. Either a false ground on the "D" lead or "HM" lead from the OSL, or a fault in the sender could have prevented it from releasing itself even though all sender functions were completed. A sender fault is probably associated with one of the following relays: EP, CT, LR, ON, or ON1.

TEST CHART 3

RP SENDER—SD-26052-01 (WIRE SPRING)

The only condition which will cause a stuck revertive pulsing outgoing sender is when the time limit of the overall (TM) timer is exceeded at any point during the progress of the call.

STEP	PROCEDURE
1	Is the ND relay operated?
	(A) Yes! This is a "no digit" class call. Go to Step 9.
	(B) No! Go to Step 2.
2	Is the S6 relay operated?
	(A) Yes! Is the FS relay operated?
	(1) Yes! The final units selection was completed. Go to Step 7.
	(2) No! Go to Step 3.
	(B) No! Go to Step 4.

TEST CHART 3 (Contd)

STEP	PROCEDURE

3 Is the TG1 relay operated?

(A) Yes! A fault occurred within the sender. Refer to sheet E1 of SD-26052. The sender stuck after relay TG1 operated but before relay S6 released. Determine to what point in the sequence the sender progressed before sticking. Either the FO, S1, FO1, FO2 or FO3 relay is probably at fault.

(B) No! Is relay FO3 operated?

(1) Yes! The sender probably did not receive the proper supervision signals from the distant office. Some trunk problem most likely exists. A common cause is an open tip or ring. It is recommended that a trunk test be conducted at this point as described in Test Chart 1, Step 15, with the exception that "winks" should not be expected over this type of trunk. If the distant office is a panel office, the incoming selector in that office may be stuck off normal. This condition can also be caused by heavy traffic in the distant office.

(2) No! There is a fault in this office, probably in the sender which has prevented the operation of relay FO3. The failure is probably due to a fault with the ATM timer or with one of the following relays: TRL, FS, ON, FO3, ATM, RC, ST7, ATC, or AV. In older offices the ATM tube may have caused the failure. Also, the ATM and ATMA capacitors may be at fault.

4 Are two and only two of the five RR_ relays (recapture relays) operated?

(A) Yes! Is either the RLT or TR relay operated?

(1) Yes! It is possible that the sender timed out while connected to a transverter, due either to a fault or to heavy traffic. It is also possible that the distant office failed to remove reversed battery supervision from the tip and ring, possibly due to selector stuck off normal in the distant office, or the tip and ring may be reversed (reversed trunk). Record the steering relay(s) (S_) operated and the digits registered on the reed packs. Then test the trunk as described in Test Chart 1, Step 15, keeping in mind that "winks" are not sent over this type of trunk.

(2) No! Is the AMA relay operated?

(a) Yes! Go to Step 5.

(b) No.! Go to Step 6.

(B) No! There is a fault in the sender. Check the digit registration relays. Faults with any of the following relays may be responsible for this condition: RR_, CL2, any reed pack, or any S_ relay (steering relay). Therefore, the state of these relays should be recorded.

TEST CHART 3 (Contd)

STEP	PROCEDURE
5	The sender timed out while awaiting connection to a transverter. This may be due to a fault such as open ST or TR and RL leads or faulty contacts or relay coils in the transverter, transverter connector, or recorder.
6	No transverter circuit was required for this non-AMA call. It is likely that the distant office failed to remove reverse battery supervision from the tip and ring due to a stuck selector in the distant office or due to a reversed tip and ring (reversed trunk). Record the steering relay(s) (S_) operated and the digits registered on the reed packs. Then test the trunk as described in Test Chart 1, Step 15, keeping in mind that "winks" are not sent over this type of trunk.
7	Is relay AV1 operated? (A) Yes! The sender received the incoming advance reverse battery signal, and the distant office removed the reverse battery signal as required. Go to Step 8. (B) No! The distant office may not have been able to remove the reverse battery it sent for incoming advance. Record the steering relay(s) (S_) operated and the digits registered on the reed packs.
8	There is a fault in this office. Is the CT relay operated? (A) Yes! There is either a false ground on the D lead or the HM lead from the OSL or a problem associated with one of the following relays: OF4, TRL, or AMA. (B) No! A sender fault has prevented its release even though all sender functions were completed. The LR1, ON, or ON1 relay may be at fault.
9	Is either the RLT or TR relay operated? (A) Yes! There is either a fault in the sender or the sender timed out while connected to an AMA transverter due to a delay in receiving transverter service. (B) No! Is the AMA relay operated? (1) Yes! The sender timed out while waiting for a transverter release signal. This may be due to a delay in receiving transverter service due to heavy traffic or dirty contacts in leads ST, TR or RL, or due to a fault in the transverter, transverter connector, or recorder. (2) No! Go to Step 8.

TEST CHART 4

PCI SENDER—SD-26053-01 (WIRE SPRING)

The PCI outsender will stick only from an overall time-out condition.

STEP	PROCEDURE
1	Is the TTK relay operated?
	(A) No! Is the TR or RLT relay operated?
	(1) No! Is relay AMA operated?
	(a) No! The trouble is in the local office. Likely causes would include malfunctioning AV or ON1 relays. Refer to sheet E1, location G16 of SD-26053 to determine the point to which the sender progressed. If the AV relay was not operated by the marker, there may be a fault in the AV operate path. Also, an open TM lead between the completing marker and the originating register may cause this condition by allowing an abandoned call to release the completing marker after the marker has seized a sender but before it has operated the sender AV relay.
	(b) Yes! Either the sender never seized or was never released from a transverter. This could be the result of either heavy traffic or open ST or RLT and TR leads.
	(2) Yes! The sender probably timed out while being served by a transverter (the sender is always held until the transverter releases), possibly due to heavy traffic.
	(B) Yes! Is the CI1 relay operated?
	(1) Yes! Go to Step 2.
	(2) No! The sender did not detect the initial on hook signal that it should have observed. The tip and ring is probably opened or reversed. The fault may be any where between the sender's TG relay and the distant office trunk circuit. Conduct a trunk test. This fault is a hard fault, not the result of heavy traffic.
2	Is the TG2 relay operated?
	(A) Yes! This trunk has not yet received assignment. This may be caused by heavy traffic, a failure of the TG relay to release, or a trunk problem. This sender is not "stuck" in the sense that it may release if it does eventually receive assignment. Conduct a trunk test to determine if the trunk can receive assignment, preferably using the master test frame for a miscellaneous class trunk test using the sender which stuck.
	(B) No! Is the EP relay operated?

TEST CHART 4 (Contd)

STEP	PROCEDURE

(1) Yes! The sender was prevented from releasing even though outpulsing was completed satisfactorily. This may be caused by a malfunction in the sender control unit or a false ground on one of the leads (D or HM)) between the sender and the trunk. Heavy traffic may cause this condition.

(2) No! The sender timed-out before completing outpulsing. This must be the result of either heavy traffic, improper digit registration or a sender fault in the pulsing or pulsing control circuitry. Tests should be made on this sender.

TEST CHART 5

MF SENDER: SD-25580-01 (FLAT SPRING)

There are two general conditions that will cause a stuck sender condition in the multifrequency outgoing sender:

- The receipt of a false off-hook after the sender is prepared to start outpulsing.
- Exceeding the time limit of the overall (TM) timer at any point during the progress of the call.

STEP	PROCEDURE

1 Is the ND relay operated?

(A) Yes! This is a "no digit" class call. Go to Step 14.

(B) No! This is not a "no digit" class call if App Fig. M is provided in this sender. Go to Step 2.

2 Is either relay TTK or ATC operated?

(A) Yes! Is the SP relay operated?

(1) Yes! Go to Step 5.

(2) No! Go to Step 3.

(B) No! The fault is in this office. Is the AV relay operated?

TEST CHART 5 (Contd)

STEP	PROCEDURE

(1) Yes! The failure is probably due to a fault with the ATM timer or due to a fault with either the KP, ATM or ON1 relay. In older offices, the ATM tube may have caused the failure.

(2) No! The sender did not recognize an advance signal from the marker. The fault may be associated with the sender AV relay or its operate path. (This includes possible marker faults.) An open TM lead between the completing marker and the originating register has caused this condition by allowing an abandoned call to release the completing marker after the marker has seized a sender but before it has operated the sender's AV relay.

3 A seizure signal was most likely sent to the distant office as required, but the sender did not recognize the return of the proper supervisory signals requesting it to start outpulsing. Senders may stick in this state even when all circuits are performing properly if heavy traffic delays the attachment of an incoming register at the distant office. There are also numerous faults which can cause senders to stick in this condition. Faults in the transmission path or distant office are common causes of this problem. Therefore, it is recommended that a trunk test be conducted at this point as described in Test Chart 1, Step 15. Proceed with the following sequence only if attempting to trace troubles in circuits known to contain faults or to obtain further information on persistant troubles. Is the CL2 relay operated?

(A) Yes! Do office records or experience verify that this trunk is in either a 2-way trunk group or an intertoll (1-way or 2-way) trunk group?

(1) Yes! Go to Step 4.

(2) No! The CL2 class mark was incorrectly passed to the sender, possibly due to a completing marker cross-connection error or reversed class leads between the marker and the OSC or between the OSC and the sender.

(B) No! Do office records or experience verify that this trunk is in a 1-way non-intertoll trunk group?

(1) Yes! Go to Step 4.

(2) No! The CL2 class mark should have been received by the sender. There is possibly a marker cross-connection error, reversed class leads between the marker and the OSC or between the OSC and the sender, or a faulty CL2 sender relay.

4 The following is a list of the many possible conditions which can stick a sender in this state.

(A) Heavy incoming traffic at the distant office.

(B) An open tip and ring anywhere between the outgoing sender and the distant office incoming register.

TEST CHART 5 (Contd)

STEP	PROCEDURE

(C) A fault preventing the operation of the cut-off relay in the distant office incoming trunk circuit. In a No. 5 crossbar office, the fault could be in either the incoming trunk, the incoming register link, or the incoming register. If it is a trunk fault, the condition will generally repeat itself upon testing. IRL or IR faults of this nature will result in the punching of LR (link release) trouble cards in the incoming office.

(D) A tip and ring reversal anywhere between the outgoing sender and the distant office incoming register. In some cases, reversals may cause the sender to stick, sometimes in the state described in Step 3 and sometimes in the state described in part (B) of Step 5. Reversals between incoming registers and incoming register links are difficult to isolate without distant office monitoring or testing of incoming registers.

(E) A sender fault which prevents the operation of any of the following sender relays: OF, OF1, TG, or SP.

(F) An outgoing trunk circuit fault.

5 Is the TM relay operated?

(A) Yes! Go to Step 6.

(B) No! The sender observed a change to off-hook supervision while outpulsing. This condition, referred to as an unexpected stop, may be caused by any of several conditions. One condition is a reversed tip and ring anywhere between the outgoing sender and the distant office incoming register as described in part (D) of Step 4. A second condtion which could stick a sender described in Step 4 and part (B) of Step 5 is a link time-out at the distant office after the trunk cut-off relay has operated. An IR or IRL fault causing a link time-out will result in the punching of an LR (link release) trouble card at the incoming office if it is a No. 5 crossbar office. A third possible condition is a circuit design fault.

6 Is the EP relay operated?

(A) Yes! Go to Step 8.

(B) No! The sender timed out before completing outpulsing. Go to Step 7.

7 Is the CL5 relay provided and operated?

(A) Yes! Is the CL3 relay provided and operated?

(1) Yes! This is an automatic identified (ANI) class call. Go to Step 8.

(2) No! This is an operator identified (ONI) class call. Go to Step 9.

(B) No! Is the AMA relay operated?

TEST CHART 5 (Contd)

STEP	PROCEDURE

(1) Yes! This is an AMA class call. Go to Step 11.

(2) No! Is either relay RLT or TR operated?

(a) Yes! This is an AMA class call. Go to Step 12.

(b) No! No transverter is required on this class call. Go to Step 10.

8 Is the CSR relay operated?

(A) Yes! The sender received a request from the distant office for the calling number. Go to Step 11.

(B) No! Is the R2 relay operated?

(1) Yes! The called number was sent, but the sender did not detect any off-hook signal from the distant office requesting the calling number. A problem most likely exists in the distant office, possibly preventing the attachment of a CAMA sender if the distant office is a No. 5 crossbar office. A possible local office cause of this problem is the reception by the sender of CL3 and CL5 class marks when working with a trunk that does not require this mode of operation. In such a case, a marker cross-connection error or reversed class leads may have caused the problem.

(2) No! The sender timed out before requesting the calling number from the ANI transverter. This is due to a sender fault. Go to Step 10.

9 Is the CSR relay operated?

(A) Yes! The sender received a request from the distant office for the ANI information digit. The sender must have encountered difficulty in outpulsing this digit due to a sender fault. Go to Step 10.

(B) No! Is the R2 relay operated?

(1) Yes! The called number was sent; but the sender did not detect any off-hook signal from the distant office requesting the ANI information digit. A proglem exists as described in part (B) of Step 8.

(2) No! The sender timed out prior to sending the ANI information digit. Go to Step 10.

10 The sender stuck due to a time-out, the cause of which cannot be determined with any certainty using this analysis. In some cases it may be due to a delay in receiving service from an incoming register in a distant office due to heavy traffic.

11 Is either relay RLT or TR operated?

TEST CHART 5 (Contd)

STEP	PROCEDURE
	(A) Yes! Go to Step 12.
	(B) No! The sender timed out while waiting to be connected to a transverter. It is possible that this is due to missing wiring such as an open ST lead or open RLT and TR leads. This could also be caused by delays in receiving transverter service due to heavy traffic.
12	The sender stuck due to a time-out, the cause of which cannot be determined with any certainty using this analysis. In some cases it may be due to delays in receiving service from an incoming register in a distant office or from a transverter in this office due to heavy traffic.
13	A sender time-out occurred due to either heavy traffic or a local office fault. Either a false ground on the D lead from the OSL, or a fault in the sender could have prevented it from releasing itself even though all sender functions were completed. A sender fault is probably associated with the EP, CT, LR, ON, or ON1 relay.
14	Is either the RLT or TR relay operated?
	(A) Yes! There is probably a fault in this office, most likely in the sender, which prevented even the simple functions required on this call from being performed by the sender. Some possible causes are listed in Step 13. In addition to those causes, it is possible that the sender timed out due to a delay in reaching a transverter.
	(B) No! Is the AMA relay operated?
	(1) Yes! Go to part (B), Step 11.
	(2) No! Go to Step 13.