SOTUS TEST SET PER SM-10411-SD

TESTING PROCEDURES FOR BS2D, BS3C, AND BS6L SOTUS UNITS

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1. GENERAL

1.01 This issue supersedes Issue B, and Addendum. This section is reissued to add information to point out the possible improper adjustment of the printer cuton levers blocking bail which might go undetected during test procedure described in 3.03.

1.02 This section describes procedures for testing BS3C and BS6L SOTUS units used in 81-type switching systems and BS2D units used in other services with the test set covered by drawing SM-10411-SD.

1.03 The test set provides for tests of the following types.

(a) Connect-disconnect (station cuton).

(b) Transmitter start and answer-back.

(c) Receiving distortion tolerance.

(d) Transmission measurement of the H signal.

Extended tests of the connect-disconnect, transmitter start, and answer-back features may be made on an unattended basis.

1.04 The set is intended for use in Telephone Company maintenance centers for testing units which have been removed from service because of troubles which could not be cleared at the stations. It may also be used at outlying stations on 81-type systems when the distance between the station control cabinet and the 19 ASR teletypewriter permits patching to the test set, and when the resulting interruption to service is not excessive. In either case it provides a means of operating the units under normal conditions during the trouble clearing work, and subsequently of making extended tests without attention to assure that satisfactory repairs have been made. Both transmitter start and cuton tests are made at a rate many times faster than encountered in service.

1.05 The testing arrangements and procedures included for BS2D units apply specifically to those which have been modified for Long Lines use per drawing EA-10469-T-30, Fig. 5.

2. DESCRIPTION

2.01 Tests of the connect-disconnect, transmitter start, and answer-back features are made by sending test signals from a 14-type transmitter-distributor to the SOTUS under test and recording the results on a page teletypewriter. Receiving tolerance tests are made by transmitting distorted signals from a 1A or 100A test distributor to the SOTUS and observing the RY indicator for failures. The H answer-back may be measured with either a 1A test distributor or a telegraph transmission measuring set.

2.02 The test set is assembled in a portable case, and contains jacks and receptacles for connection of the SOTUS and the associated equipment. It includes a timing circuit for obtaining start patterns with accurately timed

pauses, signaling and control relays, and a rectifier which supplies direct current for the signaling and control circuits. No external direct current supply is required. The test circuit is arranged for operation on a 115-volt, 60-cycle supply.

2.03 Equipment required for testing at both maintenance centers and stations is listed below. Tests made at the station utilize the 19 ASR teletypewriter on the sending side of the circuit and require that the transmitter-distributor be equipped with auxiliary contacts. These may be permanently installed without interfering with normal use of the unit. Specific apparatus codes for equipment required at maintenance centers is not given in all cases because it is anticipated that equipment provided for other purposes will be employed when available. All motor driven apparatus must be equipped with gears for operation at the same speed, and in this connection it is suggested that start and cuton tests be made at 75 speed (in maintenance centers) to secure a more rapid and rigid test. The normal operating speed is recommended for receiving tolerance tests.

REQUIRED FOR TRANSMITTER START AND CUTON TESTS

Test set per SM-10411-SD using:

1 — 14-type Transmitter-Distributor Mounting Plate E/W power cord and plug

3 — 2W20A-Cords (As indicated on SM-10411-SD.)

Testing at Maintenance Centers using additional items:

1 — BSP2 Selector Panel E/W power cord and plug

1 — Motor Unit for SOTUS

1 — Set of SOTUS Gears

1 — 14-type Transmitter-Distributor E/W TP-84593 Set of Parts

1 — Code Levers (See Part 3.)

1 — Page Teletypewriter arranged for 60-milliampere operation E/W line relay.

1 — Patch Cord per SM-10411-SD, Fig. F (For BS2D tests.)

Testing at Station using additional items:

1 — TP-84593 Set of Parts (One set required for each station tested.)

1 — P33A Cord E/W KS-8585, List 26 Plug and KS-8586, List 16 Socket (For BS3C tests.)

1 — TP-122967 Cable Assembly E/W an additional connector, KS-14453, List 3 Socket (For BS6L tests.)

1 — 2W20A Cord E/W 218A Jack and 148 Jack Mounting or

A permanently installed trunk terminating in 218A jacks with 148-jack mountings at both ends. One jack should be located in the rear of the 19-type table and the other jack in the station control unit cabinet.

Additional items required for Receiving Tolerance Test using:

1 — 1A Teletypewriter Test Set or

1 — 100A Test Distributor

Additional items required for measurement of H signal using:

1 — 1A Teletypewriter Test Set (Should have both regular gears and gears for viewing H signal) or

1 — Portable Telegraph Transmission Measuring Set

2.04 Operation of the test set for a cuton test is similar to that of the station control circuit. The monitoring teletypewriter is connected by the SOTUS on receipt of valid connect codes and disconnected by the End-of-Message Code (EOM), FIGS H LTRS. Messages used in the test are received on the monitoring machine as a typed pattern which may be scanned for abnormal SOTUS operation.

2.05 For the BS3C transmitter start tests, the SOTUS is activated for receipt of start codes by BLANK PAUSE SPACE in the usual

way. Marking pauses after BLANK and SPACE are introduced by stopping the transmitter associated with the test set under control of the timing circuit. However, the timing circuit is disabled by operation of the SOTUS space contacts and subsequent characters in the start pattern are transmitted at normal speed. On receipt of a valid start code, operation of the SOTUS transmitter start contacts results in connection of the monitoring teletypewriter. The start code is then repeated by the transmitter and typed on the monitor to indicate that the SOTUS has functioned properly. These operations occur during rotation of the SOTUS timer shaft. When the SOTUS blank pause contacts close at the end of the timer run the monitor is disconnected, the test circuit is restored to normal, and the SOTUS is in condition to receive subsequent start patterns.

2.06 The arrangement of the test set for transmitter start tests of BS6L SOTUS units provides for a marking pause after each operation of the associated transmitter. The SOTUS is activated by BLANK PAUSE SPACE, and the monitor is connected after the SOTUS blank pause contacts close. The SPACE and all start codes register on the monitor, each valid start code followed by the H answer-back signal sent from the SOTUS. The typing unit is disconnected and the SOTUS deactivated for start codes by a LTRS signal sent from the transmitter at the end of the start pattern.

3. TEST TAPES

3.01 Test tapes recommended for general use are covered below. These tapes have been arranged to include checks for specific troubles which have occurred in service, and to produce typed patterns on the monitoring teletypewriter which can be scanned rapidly for SOTUS failures. Nearly all troubles will be indicated by irregularities in the right-hand margin of the typed copy, although in some cases SOTUS troubles result in omitted or added characters, and transmission of a letter other than H, which may not affect the margin.

3.02 To reduce the number of test tapes required in a maintenance center handling a number of stations, code levers with the characters indicated above may be kept on hand and used for general testing of all units. This method will indicate any SOTUS troubles except those involving defects in specific code levers. As there is no testing advantage in employing the particular characters specified, substitutions may be made to utilize levers which may be available. However, it is desirable that the first character of all two character cuton codes be the same.

BS2D	BS3C	BS6L	CAT. NO.
	10	4	TP117473(X)
1	2	2	TP117450(A)
1	2	2	TP117451(B)
1	1	2	TP117452(C)
1	1	2	TP117453(D)
1	1	1	TP117454(E)
1	1	1	TP117455(F)
1	1	1	TP117456(G)
1	1	1	TP117458(I)
1	1	1	TP117459(J)
1	1	1	TP117460(K)

3.03 For testing at stations when it is desired to make tests with codes normally used in service, the appropriate codes should be substituted for those shown. In making such changes for units with a different number of codes then included in the samples, it is recommended that the tapes be arranged to produce a uniform right-hand margin on the typed copy because this provides for rapid and accurate scanning. Codes may be repeated in the tapes to fill out lines which otherwise would be short. It is suggested in order to check for the proper adjustment of the blocking bail, the codes be staggered to take in the complete width of the printer cuton levers blocking bail.

3.04 It is suggested that KS-9781, List 1 tape be used in preparing the test tapes as it will withstand repeated use. Each tape should be spliced with paper cement to form a continuous ring, using 5 LTRS signals at the end to overlap the first five perforations at the start of the sequence.

3.05 Only the characters or functions indicated below in writing should be perforated in the tapes. The abbreviations used are listed as follows.

(BLK) BLANK	(CR) CARRIAGE RETURN
(SP) SPACE	(LF) LINE FEED
(LTRS) LETTERS	(FIGS) FIGURES

3.06 ***BS3C Transmitter Start Test Tape — For Codes A and B:***

(BLK) (SP) A (LTRS) A (SP) (6 LTRS)

(BLK) (SP) B (LTRS) B (SP) (6 LTRS)

(Repeat above three times)

(BLK) (SP) A (LTRS) A (SP) (6 LTRS)

(BLK) (SP) B (LTRS) B (CR) (LF)

(10 LTRS)

3.07 Explanation of above tape.

CHARACTERS	FUNCTION OR RESPONSE
BLANK PAUSE SPACE	Activates SOTUS for start codes. Timing circuit in test set disabled on receipt of space.
A (or B)	Start code — On receipt SOTUS connects monitor.
LTRS	For timing, and to prevent typing of extraneous character when monitor is cut on.
A (or B)	Types on monitor to indicate correct SOTUS operation.
SPACE, CR and LF	To produce uniform typed pattern on monitor.
6 LTRS	For timing, and to prevent typing of extraneous characters when monitor is cut off by operation of blank-pause contacts.

3.08 ***BS6L Transmitter Start Test Tape — For Codes A, B, C and D:***

(BLK (SP) A B C D (LTRS) X (BLK)

(SP) A B C D (LTRS) X

(BLK) (SP) A B C D (LTRS) X (BLK)

(SP) A B C D (LTRS) X

(BLK) (SP) A B C D (CR) (LF) (LTRS) X

(Repeat above twice) (5 LTRS)

3.09 Explanation of above tape.

CHARACTERS	FUNCTION OR RESPONSE
BLANK PAUSE SPACE	Activates SOTUS for start codes. Monitor connected when SOTUS blank pause contacts close.
A (or B, C, D)	Start code — Correct operation of SOTUS indicated on monitor by typing of H answer-back signal.
CR and LF	To produce uniform typed pattern on monitor.
LTRS	Deactivates SOTUS for start codes. Monitor disconnected when SOTUS space contacts open.
X	Normally should not appear on monitor, but when typed indicates failure to deactivate for start codes on LTRS signal or failure of the blank pause contacts to unlatch.

3.10 ***BS3C and BS6L Connect-Disconnect Test Tape — For Codes XA, XB, XC, XD, XE, XF, XG, XI, XJ and XK:***

(5 LTRS) (FIGS) H (LTRS) XA (LTRS) R (LTRS) (CR) (LF) (LTRS) (3 FIGS) 1 (FIGS) H (LTRS) (LF) (LTRS) H (LTRS) XA (LTRS) XA XA XA XA XA TROUBLE (FIGS) H (LTRS) XB (LTRS) (LF) (LTRS) (FIGS) 2 (FIGS) H (LTRS) X (LTRS) A (LTRS) B (LTRS) C (LTRS) D (LTRS) E (LTRS) F (LTRS) G (LTRS) I (LTRS) J (LTRS) K (LTRS) (LF) (LTRS) XA (LTRS) TROUBLE (FIGS) H (LTRS) XC (LTRS) (LF) (LTRS) (FIGS) 3 (FIGS) H (LTRS) XD (LTRS) (LF) (LTRS) (FIGS) 4 (FIGS) H (LTRS)

XE (LTRS) (LF) (LTRS) (FIGS) 5 (FIGS) H (LTRS) XF (LTRS) R (LTRS) (CR) (LF) (LTRS) (FIGS) 6 (FIGS) H (LTRS) XG (LTRS) (LF) (LTRS) (FIGS) 7 (FIGS) H (LTRS) XI (LTRS) (LF) (LTRS) (FIGS) 8 (FIGS) H (LTRS) XJ (LTRS) (LF) (LTRS) (FIGS) 9 (FIGS) H (LTRS) XK (LTRS) (LF) (LTRS) (FIGS) (ZERO) (5 LTRS)

3.11 Explanation of cuton test tape.

CHARACTERS	FUNCTION OR RESPONSE
5 LTRS	Start test on any of these LTRS signals.
FIGS H LTRS	Activate SOTUS disconnect monitor.
XA LTRS	Connect monitor.
R LTRS	Check for blocking lever wedge in R or Y positions. If installed monitor will be disconnected and message No. 1 not received.
CR LF LTRS	Deactivate SOTUS and position carriage of monitor.
3 FIGS	To shift monitor to upper case and check that H code lever is in place in SOTUS activate position. If H lever is missing, SOTUS will activate and disconnect monitor, and message No. 1 will not be received.
1	Text of message No. 1.
FIGS H LTRS	Activate and disconnect monitor. Upper case H types on monitor.
LF LTRS	Deactivate — If SOTUS fails to deactivate, monitor will be connected after next connect code and type the code five times followed by word TROUBLE.
H LTRS	False activate signal to check that FIGS code lever is in SOTUS activate position. If not installed monitor will be connected and type the code five times followed by word TROUBLE.
XA LTRS	Valid connect code but monitor should not be connected, see above.
XA (five times)	Test of sixth vane against its detents. SOTUS should remain deactivated, but if not monitor will be connected, type balance of codes and word TROUBLE. Part or all of typing may be garbled because of lack of synchronization.
TROUBLE	Indication of trouble, as above.
FIGS H LTRS	Activate and disconnect.
XB LTRS	Valid code, but monitor should connect.
LF LTRS	Deactivate.
FIGS 2	Text of message No. 1.
FIGS H LTRS	Activate and disconnect.
X LTRS to K LTRS	Nonvalid single letter codes, but monitor will be connected if a code lever is missing. Characters following that for missing lever will be typed, possibly garbled.
LF LTRS	Deactivate.
XA LTRS	Valid code but monitor should not connect.
TROUBLE	Indication that SOTUS connected on a single letter code or failed to deactivate.
FIGS H LTRS	Activate, and to disconnect monitor if connected falsely.

FIG H LTRS (Cont) Balance of tape consists of valid codes, test messages, activate and deactivate signals except after fifth message where a check is made for a blocking wedge in R or Y positions.

3.12 ***BS2D Connect-Disconnect Test Tape — For Codes A, B, C, D, E, F, G, I, J, and K:***

(5 LTRS) (FIGS) H (LTRS) A (LTRS) R (LTRS) (CR) (LF) (LTRS) (LF) (3 FIGS) 1 (FIGS) H (LTRS) (CR) (LF) (LTRS) H (LTRS) A (LTRS) A A A A A TROUBLE (FIGS) H (LTRS) B (LTRS) (CR) (LF) (LTRS) (FIGS) 2 (FIGS) H (LTRS) Z (LTRS) (CR) (LF) (LTRS) A (LTRS) TROUBLE (FIGS) H (LTRS) C (LTRS) (CR) (LF) (LTRS) (FIGS) 3 (FIGS) H (LTRS) D (LTRS) (CR) (LF) (LTRS) (FIGS) 4 (FIGS) H (LTRS) E (LTRS) (CR) (LF) (LTRS) (FIGS) 5 (FIGS) H (LTRS) F (LTRS) R (LTRS) (CR) (LF) (LTRS) (LF) (FIGS) 6 (FIGS) H (LTRS) G (LTRS) (CR) (LF) (LTRS) (FIGS) 7 (FIGS) H (LTRS) I (LTRS) (CR) (LF) (LTRS) (FIGS) 8 (FIGS) H (LTRS) J (LTRS) (CR) (LF) (LTRS) (FIGS) 9 (FIGS) H (LTRS) K (LTRS) (CR) (LF) (LTRS) (FIGS) (ZERO) (5 LTRS)

3.13 Characters in the cuton test tape for the BS2D unit are generally similar and have similar functions to those covered in 3.10 and 3.11. Both CR and LF signals follow connect codes because the BS2D unit deactivates on CR only. As is the case for the other units, the monitor should be cuton for each of the ten valid codes in the tape.

3.14 The patterns which should be typed on the monitoring teletypewriter when the SOTUS is operating normally are given in Part 4.

4. TEST PROCEDURES AND LOCATION OF TROUBLES

4.01 Tests made at 81 system stations require use of the 19 ASR teletypewriter normally used on the sending side of the circuit, and this machine should be removed from service in accordance with established procedures. Arrangements for testing BS2D units at stations are not included in this section. On 81D1 systems, the station or stations controlled by the SOTUS should be placed on SKIP, but this action need not be taken at 81C1 stations unless required by instructions covering the system involved. On either type of system, service should be maintained on the receiving side of the circuit by operating the MAN. CUTON key to connect the station to receive all messages. In connecting the typing portion of the 19 ASR to the test set, remove both the black and red cords from the table jacks, and then connect the black cord to the D jack of the test set, using the extension cord or a permanently installed trunk as required. The red cord should be left disconnected while tests are in progress. The transmitter-distributor should be removed from the 19 ASR and placed on the mounting plate associated with the test set. On conclusion of the tests, care should be taken to restore the station equipment to normal.

4.02 Suggestions for locating indicated troubles are included in the test procedures where feasible. Analysis of the monitoring copy, and reference to the make-up of the test tapes covered in Part 3, will also prove helpful. Definite evidence of the trouble location should be obtained before adjustments are disturbed or mechanisms disassembled for examination. If this evidence is not secured by analysis of the copy and the tapes, observation of the unit in operation may indicate the cause or general location. Observation may be facilitated by operating the tape stop arm of the transmitter so as to produce long pauses between characters, when this does not interfere with the pause after the blank signal in start patterns.

4.03 In some instances, it may be found that trouble occurs during a certain portion of the test tape or that failures are more likely to occur under some specific condition. In these cases, testing may be accelerated by preparing test tapes which contain the desired signals and exclude those not likely to cause failure.

BS3C TRANSMITTER START TEST

4.04 At maintenance centers, place the SOTUS on the selector panel used for testing and connect the following.

(a) Connect the SOTUS Jones plug to the corresponding receptacle in the test set. Manually latch any cuton code contact operating lever except No. 31.

(b) Connect the monitoring teletypewriter to the TTY D jack of the test set.

(c) Connect the transmitter-distributor cords to the test set jacks as follows.

(1) Start magnet to START MAG A jack.

(2) Sending face to TD FACE B jack.

(3) Auxiliary contacts to AUX CONT C jack.

(d) Place a loop of BS3C transmitter start test tape in the transmitter gate, with a BLANK signal over the sensing pins.

(e) Operate K1 of the test set to the BS3C TRANS START position.

(f) Operate all power switches to the ON position.

(g) Operate the transmitter tape stop switch to ON.

4.05 The transmitter should start, and after the first line which may be short, the following copy should appear repeatedly on the monitoring teletypewriter when the tapes covered in Part 3 are used.

A B A B A B A B A B A B A B etc.

4.06 Each letter typed indicates a normal transmitter start operation and proper functioning of the SOTUS, including the blank pause, space, and transmitter start contacts. Failures will result in loss of a letter or reception of extraneous characters, and an irregular right-hand margin.

4.07 Indicated troubles should be traced by inspection of the copy, and observation of the SOTUS and the test equipment while start patterns are being sent. Some troubles will result in improper operation of the test equipment because the test set is arranged so that the timing circuit controlling the transmitter is disabled when the space contacts open, if the blank pause contacts have previously opened. Should these contacts remain closed for any reason it will be noticed that the transmitter pauses after each combination in the test tape, and that the monitoring teletypewriter is not connected to type the second start character in the tape. Where this trouble occurs, checks of the following items are suggested.

(a) Selection of the blank code lever and contact operating lever.

(b) Trip off of the timer mechanism.

(c) Operation (opening) of the blank pause contacts. Check mechanically and electrically.

(d) Selection of the space code lever and contact operating lever.

(e) Operation (opening) of the space contacts. Check mechanically and electrically.

In connection with the above, incomplete or intermittent contact opening might be indicated by reception of extraneous characters for loss of the SPACE, CR, and LF signals used to produce the regular typed pattern on the monitoring teletypewriter.

4.08 If the blank pause and space contacts are operating normally, but the start code is not typed on the monitor, checks of the following items are suggested.

(a) Selection of the code lever and contact operating lever for the start code involved.

(b) Operation of the start code contact. Check mechanically and electrically.

BS6L TRANSMITTER START TEST

4.09 At maintenance centers, place the SOTUS on the selector panel used for testing and connect the following.

(a) Connect the SOTUS cinch plug to the corresponding receptacle in the test set.

(b) Connect the monitoring teletypewriter to the TTY D jack of the test set.

(c) Connect the transmitter-distributor cords to the test set jacks as follows.

(1) Start magnet to START MAG A jack.

(2) Sending face to TD FACE B jack.

(3) Auxiliary contacts to AUX CONT C jack.

(d) Place a loop of BS6L transmitter start test tape in the transmitter gate, with a BLANK signal over the sensing pins.

(e) Operate K1 of the set to BS6L TRANS START position.

(f) Operate all power switches to the ON position.

(g) Operate the transmitter tape stop switch to ON.

4.10 The transmitter should start and after the first line, which may be short, the following copy should appear on the monitoring teletypewriter when the tapes covered in Part 3 are used.

A H B H C H D H	A H B H C H D H
A H B H C H D H	A H B H C H D H
A H B H C H D H	A H B H etc.

4.11 While troubles will usually be indicated by an uneven right-hand margin, a check should also be made for answer-back signals other than H and for reception of a character instead of the SPACE between successive start patterns.

4.12 As the test above does not verify electrical closure of the transmitter start or space contacts, it is suggested that both be checked for several minutes by connecting an ohmmeter to the appropriate terminals on the SOTUS terminal strip. A check of longer duration is not considered necessary since intermittent transmitter start failures are almost always caused by mechanical troubles and will be indicated on the monitor copy.

4.13 If the start code character is not typed on the monitor, it is an indication that the blank pause contacts are not closing since the monitor is not connected unless they are functioning normally. Should the contacts remain closed between successive start patterns, the letter X will be typed. It is suggested that checks of the following items be made.

(a) Selection of the BLANK code and contact operating levers.

(b) Mechanical and electrical closure of the blank pause contacts.

(c) Operation of the timing mechanism.

(d) Selection of the LTRS code and contact operating levers.

(e) Unlatching of the blank pause contacts.

4.14 Numerous transmitter start and answer-back troubles have been caused in the past by double tripping of the selector cam sleeve which results in selection of the LTRS code lever during the marking pause following transmission of BLANK, SPACE or a start code. Reception of LTRS unlatches the space contact operating lever and prevents subsequent start code selections. Where this trouble is observed, check the following items.

(a) Trip latch, trip latch spring, and range scale for latest types.

(b) Adjustments of armature lever spring, trip-off screw, trip latch spring, range scale, and stop pawl.

(c) Wear of trip latch, stop pawl, and cam sleeve stop arm.

4.15 Failure to type the H answer-back signal indicates either that the contact operating lever for the code is not being selected, that there is trouble in the associated answer-back mechanism or the main shaft clutch. Checks of the following are suggested.

(a) Selection of the code and contact operating levers.

(b) Operation of the clutch trip bail and clutch blocking lever.

(c) Engagement of the main shaft clutch.

(d) Operation of the H answer-back mechanism with particular attention to items which might result in failure to unlatch the cam follower. Some of the items suggested are: trip latch bail, transmitter start levers, blocking bail and blade, and the trip and auxiliary latches.

4.16 Transmission of more than one H signal or of an H followed by other letters may result from several causes. Two general types of multiple transmission have been observed. In one case an H signal, and always an H is sent on every other rotation of the shaft, resulting in a repetition rate approximately half the speed of normal signal transmission. In the second

type a character is sent with every rotation of the shaft, and as the shaft is running at a speed higher than for normal sending, the H changes to some other letter after several shaft operations. To identify the type of trouble, it is suggested that the transmitter be stopped immediately after transmission of the start code by raising the tape stop arm. After identification, the following checks are suggested.

(a) ***Slow Repeat H*** — This is caused by bouncing of the clutch blocking lever, permitting multiple tripping of the clutch. Check that the clutch trip lever spring tension is correct and that a spring of the latest type is installed. Also check that requirements for the clutch blocking lever eccentric back-stop post and for engagement of the clutch lever and blocking lever are met.

(b) ***Fast repeat H and other LTRS*** — Check transmitter start levers blocking bail screw adjustment for excessive clearance, transmitter start levers blocking bail blade adjustment for excessive clearance, and the transmitter start levers blocking bail yield spring for adequate tension. Lack of tension may result in incorrect adjustment of the blocking bail screw or failure of the bail to move under the wards of the transmitter start levers.

4.17 If a character other than H is transmitted for the answer-back signal, refer to suggestions included under "Measurement of the H Signal".

BS3C AND BS6L CONNECT-DISCONNECT TEST

4.18 At maintenance centers, place the SOTUS on the selector panel used for testing and connect the following.

(a) Connect the SOTUS Jones or cinch plug to the corresponding receptacle in the test set.

(b) Connect the monitoring teletypewriter to the TTY D jack of the test set.

(c) Connect the transmitter-distributor cords to the test set jacks as follows.

(1) Start magnet to START MAG A jack.

(2) Sending face to TD FACE B jack.

(3) Auxiliary contacts to AUX CONT C jack.

(d) Place a loop of connect-disconnect test tape in the transmitter gate, with any of the 5 LTRS signals at the start of the tape over the pins.

(e) Operate K1 of the set to CUTON TEST position.

(f) Operate all power switches to the ON position.

(g) Operate the tape stop switch to ON.

In the case of BS3C units, contact position 31 should not be used in this test.

4.19 The transmitter should start, and the following copy should appear on the monitoring teletypewriter.

```
R
1 #
  2 #
    3 #
      4 #
        5 # R
6 #
  7 #
    8 #
      9 #
        0 # R
1 # etc.
```

4.20 Where troubles are noticed, it is suggested that the copy be analyzed to determine if it occurs always with the same code or codes. If so, check as follows.

(a) The code lever, blocking lever wedge and bridge nut arrangement to be sure that the unit is properly equipped to respond to all codes included in the test tape.

(b) Selection of the code and contact operating levers. Observe for normal unblocking.

(c) Operation of the contact plunger.

(d) Closure of the contacts. Check mechanically and electrically.

4.21 Determine if the unit is failing to activate or activating falsely by analysis of the copy and reference to 3.11. If so the following checks are suggested.

(a) Mechanical arrangement of the unit for proper code levers, blocking wedges and bridge nuts.

(b) Selection of the FIGS and H Code and contact operating levers.

(c) Unblocking of the H.

(d) Operation of the sixth vane.

(e) Operation of the stripper and latch bails.

4.22 If analysis indicates either failure to deactivate or false deactivation make the following checks.

(a) Selection of the LF, and in BS3C units of the CR, code and operating levers.

(b) Operation of the sixth vane.

(c) Operation of the stripper and latch bails.

BS2D CONNECT-DISCONNECT TEST

4.23 Install the SOTUS on the selector panel used for testing and connect the following.

(a) Connect the SOTUS Jones plug to the patch cord and the plug of the cord to the receptacle in the test set.

(b) Connect the monitoring teletypewriter to the TTY D jack of the test set.

(c) Connect the transmitter-distributor cords to the test set jacks as follows.

(1) Start magnet to START MAG A jack.

(2) Sending face to TD FACE B jack.

(3) Auxiliary contacts to AUX CONT C jack.

(d) Place a loop of connect-disconnect test tape in the transmitter gate, with any of the 5 LTRS signals at the start of the tape over the pins.

(e) Operate K1 of the set to CUTON TEST position.

(f) Operate all power switches to the ON position.

(g) Operate the transmitter tape stop switch to ON.

4.24 The transmitter should start and the following copy should appear on the monitoring teletypewriter.

R	6 #
1 #	7 #
2 #	8 #
3 #	9 #
4 #	0 # R
5 # R	1 # etc.

4.25 Where troubles are noticed, proceed as covered in 4.20, 4.21, and 4.22, keeping in mind that the BS2D unit deactivates on CR only.

DISTORTION TOLERANCE TEST

4.26 At maintenance centers, place the SOTUS on the selector panel used for testing and connect the following.

(a) Connect the SOTUS Jones or cinch plug to the corresponding test set receptacle.

(b) Connect the signal output of a 1A or 100A test set to the TD face B jack.

(c) Activate the SOTUS by moving the sixth vane to the rear position and set the indicator lever to the down position (white showing).

(d) Arrange the 1A set to send alternate RY signals or the 100A set to send repeated Y signals. On both sets the appropriate switches should be operated so as to short the signal output.

(e) Operate K1 of the set to the CUTON TEST position.

(f) Operate all power switches to the ON position.

(g) On the 1A or 100A test set, remove the short from the signal output.

4.27 Refer to standard instructions for detailed tolerance test procedures and requirements, and for methods of correcting indicated troubles. When it is necessary to calibrate 1A sets, direct current for operating the stroboscope may be obtained by plugging its cord into the TTY D jack of the test set.

MEASUREMENT OF THE H SIGNAL

4.28 Where a 1A set is used for measurement, proceed as follows.

(a) Connect SOTUS cinch plug to test set receptacle.

(b) Connect stroboscope plug of 1A set to the TTY D jack.

(c) Start the SOTUS and 1A set motors.

(d) Proceed with the measurements as outlined in the standard instructions covering SOTUS unit.

4.29 Where a telegraph transmission measuring set is used, set up the SOTUS and test equipment as outlined in 4.09, but connect the measuring set to the TTY D jack in place of the teletypewriter, and measure the H while start patterns are being sent. It will be necessary for the observer to distinguish between the H signal and the transmitter start code LTRS, since both will be transmitted to the measuring set.

4.30 Where transmission requirements are not met, or if a LTR other than H is transmitted check the condition, operation and adjustment of the contacts as covered in standard instructions. In this connection be sure that the requirement for the cam follower is met with the follower on the small cam lobe used for transmitting the No. 3 pulse of the H.

5. TEST SET MODIFICATIONS

5.01 The modifications required to make test sets agree with Issue 8 of the schematic and Issue 4 of the wiring drawings (SM-10411, SD and T) may be done readily in the field, as outlined below. The following material is required.

1 — 400E Varistor

5.02 The varistor should be added across the winding of the P relay to reduce a voltage transient. Connect as follows.

(a) Connect terminal 1 of the varistor to terminal 7T of the P relay.

(b) Connect terminal 2 of the varistor to terminal 6B of the P relay.

5.03 The second modification removes the space contacts from the testing path in order to secure a check of the blank pause contacts for both closing and opening. As originally wired, the contacts were tested only for closure and failures to unlatch were not detected. The change should be made at the KS-14453, L1 socket (cinch), move the wire connecting terminals 6 and 8 from terminal 8 to terminal 16.