

**43A1 VOICE-FREQUENCY CARRIER TELEGRAPH (VFCT) SYSTEM  
(J70112-)**

**TEST PROCEDURES**

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		1. GENERAL	
		1.01 This section describes the test procedures to be followed either after initial installation of or when trying to isolate a trouble in the 43A1 VFCT system.	
		1.02 It is issued to consolidate all the 43A1 VFCT system test sections into one Bell System Practice (BSP) and to add Test A and B which were formerly covered in Section 103-824-502. This practice supersedes the following BSPs:	
		• 312-700-502, 503, 505, 506, 507, and 509	
		• 312-701-500, 504, and 506	
		• 312-702-500 and 501	
		• 312-703-500, 501, 502, and 503	
		• 312-705-501.	
		1.03 The tests covered are as follows.	
		A. <i>Abbreviated Hub or Neutral Channel Terminal Test:</i> This test provides an abbreviated overall test. It permits a rapid preliminary alignment and transmission check of either hub or neutral channel terminals assumed to be in good working order prior to being placed in service.	
		B. <i>Basic Hub or Neutral Channel Terminal Test Using 165C1 TTS:</i> This test checks either the hub or neutral channel terminal under	

a fixed set of conditions on the 165C1 telegraph test set (TTS) for the purpose of trouble isolation.

**C. Filament Voltage Test:** This test provides the procedures for checking and, if necessary, adjusting the channel terminal filament voltage.

**D. Marking Signal Condition Test:** This test checks for the presence of a VF signal from the distant channel terminal or 130-type subscriber set (subset). It also provides the procedures for locally providing this signal when none is present from the distant end.

**E. Channel Sending Level Test Using KS-19935-Type Telegraph Carrier Test Set (TCTS):** This test describes the procedures for using the KS-19935-type TCTS for testing and, if necessary, adjusting the sending level of an individual channel terminal on an in-place basis.

**F. Channel Sending Level Test Using 21A Transmission Measuring Set (TMS):** This test describes the procedures for using the 21A TMS for testing and, if necessary, adjusting the sending level of an individual channel terminal on an in-place basis. It is included in this section for those offices where the KS-19935-type TCTS is not available.

**G. Customer Location Terminal Sending Level Test Using a KS-19935-Type TCTS at the Testboard Location:** This test checks the sending level of a 130-type subset at the customer location from the testboard. It also provides the procedures for adjusting the 130-type subset sending level when necessary. This test is provided in this section for use when no test equipment is available at the customer location. The adjustment procedures require the assistance of a telephone company (telco) employee at the 130-type subset.

**H. Loop Current Test Using no Special Equipment:** This test describes the procedures for checking and, if necessary, adjusting the loop current of a channel on an in-place basis. It requires the use of no special equipment and is provided in this section for those offices where a differential meter, nondifferential meter, or 43A1 test terminating circuit is not available. This test will interrupt customer service and,

therefore, requires a circuit release and is to be performed on an out-of-service basis.

**I. Loop Current Test Using the 43A1 Test Terminating Circuit:** This test describes the procedures for using the 43A1 test terminating circuit (SD-70572-01) for checking and, if necessary, adjusting the loop current of a channel on an in-place basis. It will interrupt customer service and, therefore, requires a circuit release and is to be performed on an out-of-service basis.

**J. Loop Current Test Using Differential Meter:** This test describes the procedures for using a differential meter (SD-70568-01) for checking and, if necessary, adjusting the loop current of a channel on an in-place basis. It will interrupt customer service and, therefore, requires a circuit release and is to be performed on an out-of-service basis.

**K. Loop Current Test Using Nondifferential Meter:** This test describes the procedures for using a nondifferential meter (SD-70566-01) for checking and, if necessary, adjusting the loop current of a channel on an in-place basis. It will interrupt customer service and, therefore, requires a circuit release and is to be performed on an out-of-service basis.

**L. Hub Operational Test:** This test describes the procedures for checking the operation of a channel terminal wired for hub on an in-place basis.

**M. Back-to-Back Operation Test:** This test describes the procedures for testing and, if necessary, adjusting an in-place neutral full-duplex (FDX) channel terminal being used in the back-to-back mode of operation. It will interrupt customer service and, therefore, requires a circuit release and is to be performed on an out-of-service basis.

**N. Supervisory Circuit Test:** This test describes the procedures for checking and, if necessary, adjusting the receive gain of an in-place hub or neutral channel terminal to establish the proper supervisory signaling levels. A test is also made of the carrier fail alarm feature.

**O. Overall Lineup Test:** This test describes the procedures for checking the overall lineup of an in-place hub or neutral channel terminal.

**P. 453-Type Send Network Test:** This test describes the procedures for checking and, if necessary, adjusting the 453-type send network transmitting frequencies of an in-place hub or neutral channel terminal.

#### Installation Testing

**1.04** Previous to installing a channel terminal in the mounting, it should be tested on the 165C1 TTS in accordance with Tests A and/or B.

**1.05** After a channel terminal is installed in the mounting, perform the following tests in the following order:

- (1) Test C—On all installed channel terminals
- (2) Test D—On all installed channel terminals
- (3) Test E or F—On all installed channel terminals
- (4) Test G—On all installed systems, when required
- (5) Test H, I, J, or K—On all installed channel terminals
- (6) Test L—On all installed *hub* channel terminals
- (7) Test M—On all installed back-to-back channel terminals
- (8) Test N—On all channel terminals associated with a supervisory channel alarm
- (9) Test O—On all installed channel terminals.

**1.06** When an installation test requirement is not met, corrective action should be taken as given in parentheses following the requirement; the preceding step should be repeated. If the requirement is still not met, troubleshoot the channel terminal as directed in Section 312-700-300.

#### Maintenance Testing

**Warning:** *When replacing a HIN, make sure all pins are properly aligned before attempting to insert the HIN into the socket. Failure to observe this precaution will result in damaged equipment (blown HINs).*

**1.07** Any or all of the tests in this practice may be used to isolate a trouble in the 43A1 VFCT system. They should be performed as directed in Section 312-700-300.

**1.08** When a step directing that a measurement be recorded is encountered during a maintenance test, the indication obtained in that step can be compared to one recorded during the initial installation tests. When the indication is not within the given tolerance, corrective action should be taken as given in parentheses following the requirement; the preceding step should be repeated. If the indication is still not within the given tolerance, troubleshoot the channel terminal as directed in Section 312-700-300,



**When performing Tests A, B, G, H, I, J, K, and M on in-service channels, service interruptions will occur. Therefore, it is necessary to obtain a circuit release prior to performing these tests so the test may be performed on an out-of-service basis.**

#### Tests A and B

**1.09** Tests A and B will normally be performed at the maintenance center. They are written with the assumption that the user has a working knowledge of the 165C1 TTS and 43A1 channel terminal. This information may be found in the sections entitled 165C1 Telegraph Test Set for Testing 43A1 VFCT System—Channel Terminals—Description and Operation (103-824-102) and 43A1 Voice Frequency Carrier Telegraph (VFCT) System (J70112)—Description and Operation (312-700-100), respectively.

**1.10** When electron tubes are used in a channel terminal under test on the 165C1 TTS (Test A or B), they may be either new or used and, after testing, may or may not be shipped with the channel terminal. Any electron tube used in any channel terminal must meet the requirements given in Test C of the section entitled 165C1 Telegraph Test Set—43A1 Voice-Frequency Carrier Telegraph System—Channel Terminal—Test Procedures (103-824-502).

**1.11** The 429A electron tubes may be replaced by a series of fully transistorized plug-in modules known as 262-type switches (active modules) and 4143-type networks (inactive modules). The

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262-type switches and 4143-type networks are to be used in place of 429A tubes as specified in Table A.

**1.12** The 262-type switches and 4143-type networks are sealed units and are not intended to be repaired. If the channel terminal requirements cannot be met using a specific plug-in module, replace it with a new module.

**1.13** The 407A and 408A tubes may be replaced by the KS-type hybrid integrated networks (HINs) as specified in Table B. The HINs are also sealed units which are not intended to be repaired. If the channel terminal requirements cannot be met using a specific HIN, replace it with a new HIN.

**1.14** Before testing a channel terminal, check the unit for physical defects and make sure that the proper networks, 262-type switch (or 429A tubes), 4143-type network (or 429A tube), and KS-type HINs (or 407A and 408A tubes) are in place.

**1.15** It is assumed that the required dc voltages are applied to the 165C1 and that all supply voltage limits are correctly maintained when the 165C1 is in use.

**1.16** The 165C1 provides a flexibility of arrangements that will permit additional testing as suggested

by local conditions and by the acquisition of skill and familiarity on the part of the operator.

**1.17** When performing Test A or B, install the **reference channel terminal** to be used as the standard unit in position B (B STD) and install the **channel terminal to be tested** in position A (A TST) of the 165C1 TTS.

**1.18 Lettered Steps:** A letter a, b, c, etc, added to a step number in Part 3, indicates a step which may or may not be required depending on the circuit arrangement. The condition under which the lettered step is to be performed is given in the PROCEDURE column. All steps governed by the same condition are designated by the same letter within a test. When a condition does not apply, all steps designated by that letter are to be omitted.

**2. APPARATUS**

**2.01** The test equipment required for each test is given in Table C. The details (if required) of each item are covered in the referenced paragraph, indicated in parentheses.

**2.02** J79911B test sentence generator (TSG) [also part of the 911A data test set (DTS) (J79911A)], or equivalent.

**TABLE A**

**262-TYPE SWITCH AND 4143-TYPE NETWORK USE**

UNITS	REPLACES
262B Switch	One 429A tube (V5) in hub channel terminal.
262C Switch	One 429A tube (V5) in neutral channel terminal.
4143A Network	One 429A tube (V7) in hub channel terminal.
4143B Network	One 429A tube (V6) in neutral channel terminal for 62.5-mA loops.
4143C Network	*

\* Neutral channel terminals for 20-mA loops do not use a tube V6. However, when the tube in V5 is replaced by the 262C switch, a 4143 network *must* be installed in the socket V6.

TABLE B

## HIN USE

TYPE CHAN TERM.	SOCKET		REPLACED BY HIN
	407A	408A	
Hub and Neutral	V1	—	KS-21082
	V2	—	KS-21083
	V3	—	KS-21084
	—	V4	KS-21075
Hub	V8		KS-21703

TABLE C

## TEST APPARATUS

APPARATUS	TEST														
	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
911B TSG (2.02)														✓	
911C DMS (2.03)														✓	
Frequency Counter (2.04)															✓
KS-19935-type TCTS (2.05)			✓		✓										
Oscillator (2.06)		✓													
21A TMS (2.07)				✓											
Test terminating circuit (2.08)							✓								
Differential meter (2.09)								✓							
Nondifferential meter (2.10)									✓						
VTVM (2.11)			✓	✓											✓
VOM (2.12)	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DC milliammeter						✓									
600Ω attenuator (2.13)													✓		
367A plug											✓		✓		

Note: Tests A and B use the 165C1 TTS and associated components listed by 2.14.

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- 2.03** J79911-type distortion measuring set (DMS) [also part of the 911A DTS (J79911A)], or equivalent.
- 2.04** Hewlett-Packard 5211A frequency counter, or equivalent.
- 2.05** KS-19935-type Stelma TCTS.
- 2.06** Hewlett-Packard 200-type portable oscillator, or equivalent.
- 2.07** J94021A (21A) TMS, or equivalent.
- 2.08** SD-70572-01 43A1 test terminating circuit.
- 2.09** SD-70568-01 loop adjustment indicating circuit (differential meter), or equivalent.
- 2.10** SD-70566-01 loop adjustment indicating circuit (nondifferential meter), or equivalent.
- 2.11** Hewlett-Packard 403A-type vacuum-tube voltmeter (VTVM), or equivalent.
- 2.12** KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent.
- 2.13** 5A attenuator, or equivalent.
- 2.14** In addition to the 165C1 TTS, the following items are required to properly test 43A1 channel terminals.
- (a) Two 43A1 channel terminals, which are to be used as **reference channel terminals**. One of the reference channel terminals must be single bandwidth (SW) and one must be double bandwidth (DW).
  - (b) A 453-type send and 454-type receive network to match the service provided.
  - (c) One J70120B receive network adapter, one J70120C send network adapter, and one P20E cord.
  - (d) One 144B coupling unit is required as a reference unit with option W, and two 144B coupling units are required as reference units with option V.
  - (e) 21A TMS, or equivalent (600-ohm termination).

### 3. METHOD

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#### STEP

#### PROCEDURE

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##### A. Abbreviated Hub or Neutral Channel Terminal Test Using 165C1 TTS

- 1 Prepare for testing as follows.
  - (a) Install the channel terminal to be tested in the A TST position.
  - (b) Install the reference channel terminal in the B STD position.
  - (c) Set the 165C1 TTS and both channel terminal controls and switches in accordance with Table D. Refer to Fig. 1.

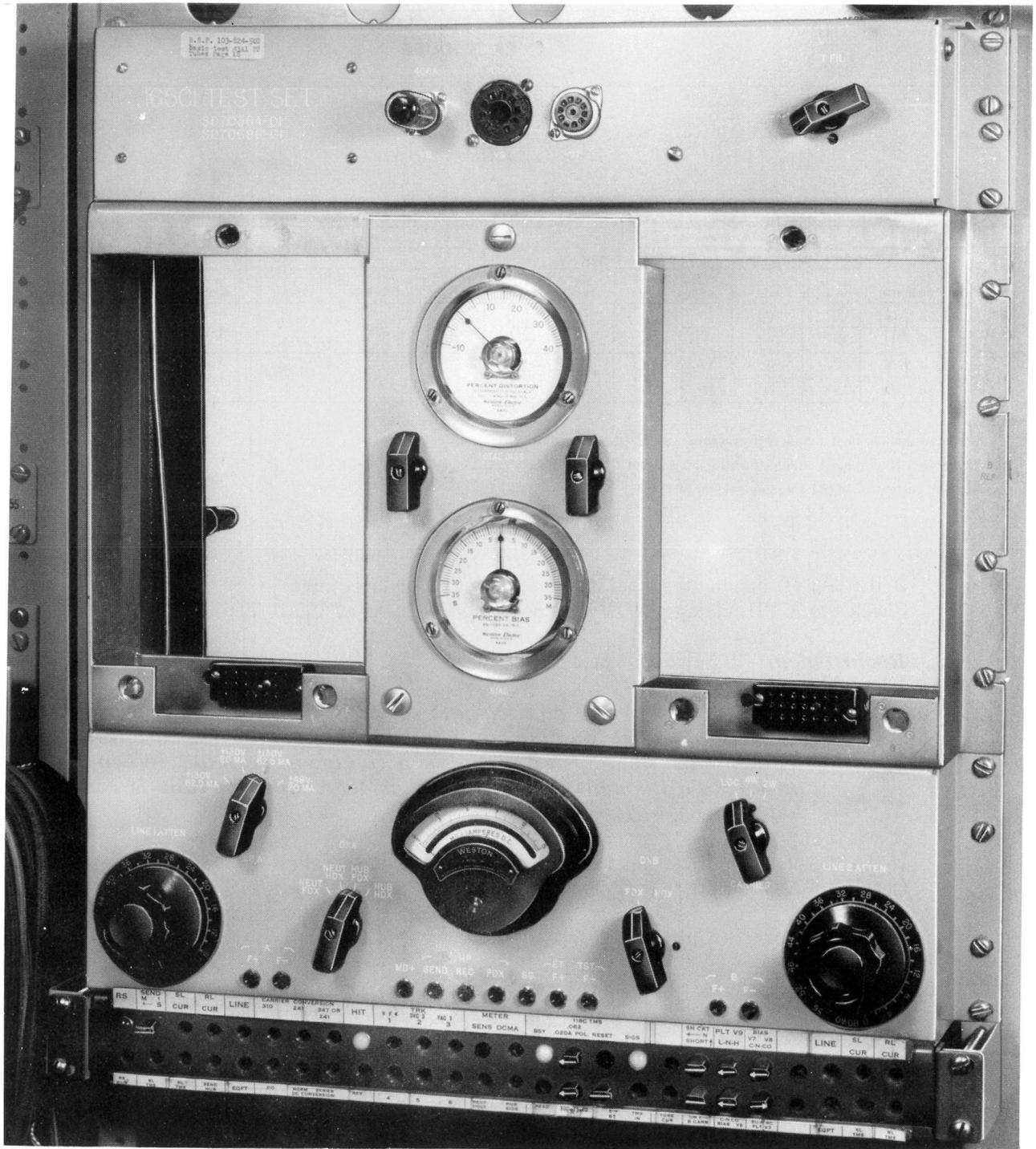


Fig. 1—165C1 Test Set—Front View

STEP	PROCEDURE
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TABLE D  
TEST A  
SWITCH AND CONTROL SETTINGS

TYPE	POSITION	CHANNEL TERMINALS						165C1 TTS						
		SWITCHES			CONTROLS			SWITCHES					LINE 1 ATTEN	LINE 2 ATTEN
		OSC	SEND	REC	SEND LEV	REC GAIN	REC BIAS	LP CUR	CARRIER	DXA	DXB	LPA		
Neutral	A TST	ON	HM	H+	Fully CW	Fully CW	Mid- range	Note 1 & 2	4W	NEUT FDX	FDX	±130V 62.5 mA	For HINs -20 dB	For HINs -20 dB
	B STD	OFF	HM	H+										
Hub	A TST	ON	HM	L+	Fully CW	Fully CW	Mid- range	Note 3	4W	NEUT FDX	FDX	±130V 62.5 mA	For Tubes -12 dB	For Tubes -12 dB
	B STD	OFF	HM	H+										

**Notes:**

1. When channel terminal is equipped with tubes, set LP CUR control to midrange.
2. When channel terminal is equipped with HINs, set LP CUR control fully counterclockwise.
3. Set loop current of 144B1 coupling unit for 62.5 mA.

2a If the A TST channel terminal is equipped with 3 or more tubes—  
Check the A FIL voltage (VOM to A F+ and F- jacks of 165C1 TTS).

**Requirement:** 19.5 to 20.5 Vdc.



*When a combination of HINs and electron tubes are used, it may not be possible to adjust the filament voltage to 20 Vdc. In this case the filament voltage must be adjusted to as low a voltage as possible. When operated at 24V, the filament life of a 407A or 408A electron tube is reduced by half.*

3b If the B STD channel terminal is equipped with 3 or more tubes—  
Check the B FIL voltage (VOM to B F+ and F- jacks of 165C1 TTS).

**Requirement:** 19.5 to 20.5 Vdc.

4 Check the A TST channel terminal send level (TMS to EQPT A jack).

**Requirement:** -6.0 (SW) or -3.0 (DW) dBm.

5 Check the B STD channel terminal send level (TMS to EQPT B jack).

**Requirement:** -6.0 (SW) or -3.0 (DW) dBm.

6 Check the A TST channel terminal receive gain and supervisory circuit as follows:

Adjust Line 2 ATTN control to:

Tube in V3—22 dB

HIN in V3—30 dB.

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## PROCEDURE

**Requirement:** Either the HIT lamp will light or the RS lamp will extinguish. (When testing a neutral channel terminal, and some hub channel terminals, the RS lamp shall extinguish. All hub channel terminals that do not extinguish the RS lamp shall cause the HIT lamp to light).

7 Check the A TST channel terminal receive loop current (DCMA to A RL CUR A jack).

**Requirement:** DCMA to A RL CUR A—60.0 to 65.0 or 19.0 to 21.0 mA.

8 Check the A TST channel terminal receive bias (DMS to A RL TMS A jack).

**Requirement:** DMS to A RL TMS A jack—+8 to -8 percent.

9 Check the A TST channel terminal send bias (DMS to RL TMS B jack).

**Requirement:** Less than 5 percent.

10 If testing a **hub** channel terminal—  
Check the A TST channel terminal duplex operation (DMS to RL TMS A jack).

**Requirement:** Less than 5 percent.

11 **End of test:** Disconnect all test connections.

#### B. Basic Hub or Neutral Channel Terminal Test Using 165C1 TTS

1 At the 165C1 TTS—  
Set the A FIL control fully CCW.

2 Install the standard reference channel terminal in the B STD position.

3 Install the channel terminal to be tested in the A TST position.

4 Set the 165C1 TTS controls as follows:

- SEND to M
- CARRIER to 4W
- DXA to NEUT FDX
- DXB to FDX
- LPA for type of channel terminal being tested
- LINE 1 ATTEN to:

Tube in V3 of A TST channel terminal—12 dB

STEP	PROCEDURE
	<p>HIN in V3 of A TST channel terminal—20 dB</p> <ul style="list-style-type: none"> <li>● LINE 2 ATTEN to:</li> </ul> <p>Tube in V3 of B STD channel terminal—12 dB</p> <p>HIN in V3 of B STD channel terminal—20 dB.</p>
5	<p>Set the A TST channel terminal controls as follows:</p> <ul style="list-style-type: none"> <li>● OSC to ON</li> <li>● SEND to HM</li> <li>● REC to H+</li> <li>● SEND LEV to fully clockwise (CW)</li> <li>● REC GAIN to fully CCW</li> <li>● REC BIAS to midrange</li> <li>● Neutral channel terminal LP CUR for 60.0 to 65.0 mA for 62.5-mA loops or 19 to 21 mA for 20-mA loops.</li> </ul> <p><b>Note:</b> If a 62.5-mA channel terminal is equipped with the 262C switch and 4143B network, set the LP CUR fully CCW.</p>
6a	<p>If testing a <i>hub</i> channel terminal— Set the 165C1 TTS DXA switch to HUB FDX.</p>
7a	<p>At the A TST channel terminal— Set the REC switch to L+.</p>
8b	<p>If the 144B coupling unit is equipped with tubes— At the 144B coupling unit— Adjust the LP CUR control for 62.5 or 20 mA.</p>
9	<p>Set the A TST channel terminal filament voltage as follows.</p> <p>(a) Connect the VOM per Table E and condition it to measure voltage.</p> <p><b>Requirement:</b> Voltage shall be as specified in Table E.</p> <p>(b) Adjust the A FIL rheostat for a VOM indication of 20 Vdc.</p> <p>(c) Disconnect the VOM leads.</p>

STEP

PROCEDURE

TABLE E  
FILAMENT VOLTAGE TEST REQUIREMENTS

BAY EQUIPPED WITH SD-70552-01 FIG. (SEE NOTES 1, 2, & 3)	CONNECT VOM		METER INDICATION
	+ LEAD TO	- LEAD TO	
L, J, or AF	FA	FB	19 to 21 volts
Q, AD, or AE	FA	FB	19 to 21 volts
	FB	FC	19 to 21 volts
	FA	FC	38 to 42 volts
165C1 Test set	AF+	AF-	19 to 21 volts

- Notes:**
1. When a combination of HINs and electron tubes are used in an arrangement shown by SD-70552-01 Fig. J, it may not be possible to adjust the filament voltage below 21Vdc. In this case the filament voltage shall be adjusted to as low a value as possible. When operated at 24V, the filament life of a 407A or 408A electron tube is reduced by half.
  2. When three or four electron tubes are used in the arrangements shown by SD-70552-01 Fig. L, Q, AD, AE, or AF, it may not be possible to adjust the filament voltage to 24V or less. In this case all of the tubes must be replaced by HINs and the corresponding required option installed in the channel mounting.
  3. When a HIN is mounted in a channel unit arranged as shown by SD-70552-01 Fig. Q, AD, or AE, the first and second channel units must be similarly equipped to obtain satisfactory voltage regulation. For example; if all HINs are used in the first unit, the second unit must also be equipped with HINs.

10c If testing a *neutral* channel terminal—  
Check the loop current as follows.

- (a) At the 165C1 TTS jack field, patch the METER DCMA jack to the SL CUR A jack.

**Requirement:** Meter indicates 60.0 to 65.0 mA (for 62.5-mA channel terminals) or 19 to 21 mA (for 20-mA channel terminals).

STEP	PROCEDURE
	(b) Remove the patch cord from the SL CUR A jack and connect it to the RL CUR B jack.
	<b>Requirement:</b> Meter indicates 60.0 to 65.0 mA (for 62.5-mA channel terminals) or 19 to 21 mA (for 20-mA channel terminals).
	(c) Disconnect the METER DCMA to RL CUR B patch.
11a	If testing a <b>hub</b> channel terminal— Check the hub voltage as follows.
	(a) At the 165C1 TTS, connect the +VOM lead to the HP/SEND pin jack.
	(b) Connect the –VOM lead to the SG pin jack.
	<b>Requirement:</b> VOM indicates 57 to 63 Vdc.
	(c) Disconnect VOM leads.
12	Check the send level as follows.
	(a) At the 165C1 TTS jack field, connect a TMS to the EQPT A jack and measure the send level.
	<b>Requirement:</b> TMS indicates +4 dBm or greater (+5 dBm is greater than +4 dBm).
	(b) Set the A TST channel terminal SEND switch to LM and measure the send level.
	<b>Requirement:</b> TMS indicates +4 dBm or greater.
	(c) Restore the SEND switch to HM.
13	Check the minimum send level as follows.
	(a) Set the A TST channel terminal OSC switch to OFF and measure the send level.
	<b>Requirement:</b> TMS indicates –45 dBm or less (–46 dBm is less than –45 dBm).
	(b) Restore the OSC switch to ON.
14	Check the send level control as follows.
	(a) Turn the A TST channel terminal SEND LEV control fully CCW.
	<b>Requirement:</b> TMS indication increases slightly and then decreases to less than –45 dBm (–46 dBm is less than –45 dBm).
	(b) Adjust SEND LEV control for a TMS indication of –6.0 dBm (SW) or –3.0 dBm (DW).

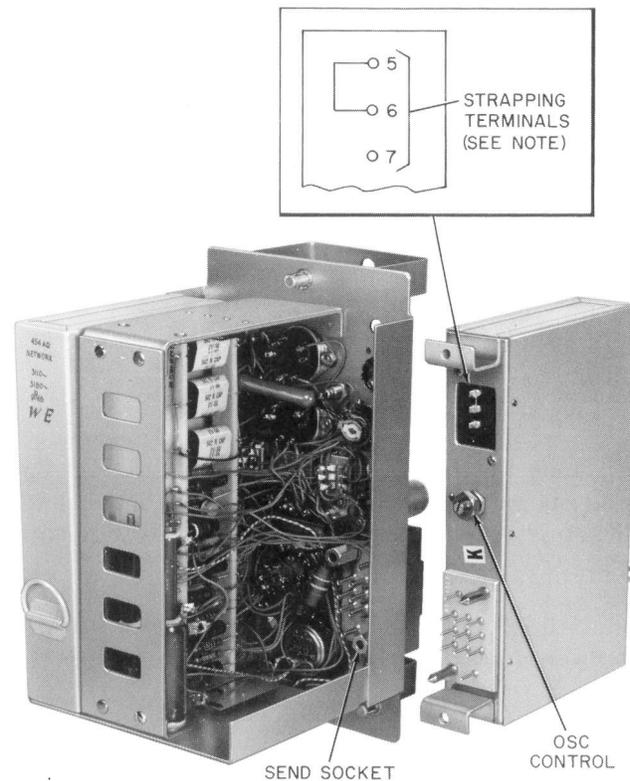
STEP	PROCEDURE
15	<p>(c) Record the TMS indication as the SEND REF LEV.</p> <p>(d) Disconnect the TMS.</p> <p>Check the send frequency as follows.</p> <p>(a) At the 165C1 TTS jack field, connect the frequency counter to the 165C1 TTS EQPT A jack or the A TST channel terminal SA jack.</p> <p>(b) Using Table F, locate and record the high- and low-channel frequencies for the 453-type send network used in the A TST channel terminal.</p> <p>(c) Observe the frequency counter.</p> <p><b>Requirement:</b> Frequency counter indicates high-channel frequency <math>\pm 1</math> Hz (eg, high-channel frequency for the 453A network is 630 Hz; therefore, the frequency counter must indicate between 629 and 631 Hz).</p> <p>(d) Set the A TST channel terminal SEND switch to LM and observe the frequency counter.</p> <p><b>Requirement:</b> Frequency counter indicates the low-channel frequency <math>\pm 2</math> Hz.</p> <p>(e) Set the 165C1 TTS SEND key to S and observe the frequency counter.</p> <p><b>Requirement:</b> Frequency counter indicates the high-channel frequency <math>\pm 1</math> Hz.</p> <p>(f) Set the A TST channel terminal SEND switch to HM and observe the frequency counter.</p> <p><b>Requirement:</b> Frequency counter indicates the low-channel frequency <math>\pm 2</math> Hz.</p> <p> <i>If the requirements for (c), (d), (e), or (f) are not met, adjust the A TST channel terminal OSC control for the proper channel frequency. If the frequency cannot be brought into tolerance with the OSC control, change the strapping on the send network as described in Fig. 2 and repeat this test. If the network still does not meet the requirements, replace it with another network of the same type and repeat this test.</i></p> <p>(g) Set the 165C1 TTS SEND key to M.</p> <p>(h) Disconnect the frequency counter.</p>
16	<p>Check the mark-space turnover as follows.</p> <p>(a) At the 165C1 TTS jack field, connect the TMS to the EQPT A jack.</p> <p><b>Requirement:</b> TMS indicates SEND REF LEV recorded in Step 14(c) <math>\pm 1</math> dB.</p>

**TABLE F**  
**NETWORK HIGH AND LOW**  
**CHANNEL FREQUENCIES**

TYPE CHANNEL	NETWORK CODE	CHANNEL FREQUENCIES (Hz)	
	453- OR 454-TYPE	HIGH	LOW
SW	AE	460	390
	A	630	560
	B	800	730
	C	970	900
	D	1140	1070
	E	1310	1240
	F	1480	1410
	AA	1650	1580
	G	1820	1750
	H	1990	1920
	J	2160	2090
	K	2330	2260
	L	2500	2430
	M	2670	2600
	AB	2840	2770
	AC	3010	2940
	AD	3180	3110
DW	AK	1430	1290
	AL	1770	1630
	AM	2110	1970
	AN	2450	2310
	AP	2790	2650
	AR	3130	2990

STEP

PROCEDURE



## NOTE:

TERMINALS 5 AND 6 ARE STRAPPED AT FACTORY.  
 REMOVE THIS STRAP TO INCREASE THE FREQUENCY.  
 STRAPPING TERMINALS 5 AND 6 OR 5, 6, AND 7  
 TOGETHER WILL DECREASE FREQUENCY.

**Fig. 2—Rear of 43A1 Channel Terminal—(Send Network Removed, Receive Network in Place) Frequency Strapping**

(b) Alternately operate the 165C1 TTS SEND key between the M and S positions.

**Requirement:** TMS indication does not vary more than 3.5 dB between the mark (SEND key in M) and space (SEND key in S) signals.

**Note:** Leave the 165C1 TTS SEND key in the M position.

(c) Disconnect the TMS.

17 Check the supervisory circuit and receive gain as follows.

## STEP

## PROCEDURE

- (a) Set the OSC switch of both channel terminals to ON.
- (b) At the 165C1 TTS jack field, connect the TMS to the EQPT A jack and adjust the SEND LEV control of the A TST channel terminal for a  $-6.0$  dBm indication on the TMS.

**Note:** The send level on the reference channel must be verified for this test to be valid.

- (c) Disconnect the TMS.
- (d) Set the 165C1 TTS LINE 2 ATTEN control to:

Tube in V3 of A TST channel terminal—22 dB

HIN in V3 of A TST channel terminal—30 dB.

**Requirement:** Either the HIT lamp will light or the RS lamp will extinguish. (When testing a neutral channel terminal, and some hub channel terminals, the RS lamp shall extinguish. All hub channel terminals that do not extinguish the RS lamp shall cause the HIT lamp to light.)

- (e) At the 165C1 TTS jack field, patch the METER DCMA jack to the RS CUR jack (*neutral channel terminals*) or RL CUR A jack (*hub channel terminals*).

**Requirement:** DCMA meter indicates 0 mA.

- (f) At the A TST channel terminal, adjust the REC GAIN control CW until the RS lamp just lights (neutral channel terminals or hub channel terminals) or HIT lamp just extinguishes (hub channel terminals).

**Requirement:** DCMA meter indicates 60 to 65 or 19 to 21 mA.

18 Check the send-to-receive crosstalk as follows.

- (a) Adjust the 165C1 TTS LINE 2 ATTEN control to:

Tube in V3 of A TST channel terminal—12 dB

HIN in V3 of A TST channel terminal—20 dB.

- (b) At B STD channel terminal, set OSC switch to off.

**Requirement:** Either the HIT lamp will light or the RS lamp will extinguish. (When testing a neutral channel terminal, and some hub channel terminals, the RS lamp shall extinguish. All other hub channel terminals that do not extinguish the RS lamp shall cause the HIT lamp to light.)

- (c) Operate the B STD channel terminal OSC switch to ON and disconnect the METER DCMA patch.

## STEP

## PROCEDURE

- 19c If testing a *neutral* channel terminal—  
Check the receive loop current control as follows.
- (a) At the 165C1 TTS jack field, patch the METER DCMA jack to the RL CUR A jack.
  - (b) Set the A TST channel terminal LP CUR control fully CCW and record the DCMA meter indication.



*When V6 of the A TST channel terminal is equipped with the 4143B network, the DCMA meter will indicate 60.0 to 65.0 mA. When V6 of the A TST channel terminal is equipped with the 4143C network, the DCMA meter will indicate 19 to 21 mA.*

- (c) If the A TST channel terminal is equipped with 429A tubes, adjust the LP CUR control for a DCMA meter indication of 62.5 or 20 mA.

**Requirement:** At least 7-mA difference between the indication recorded in (b) and the setting established in this step.

- (d) At the 165C1 TTS jack field, insert a dummy plug into the SL CUR B jack.

**Requirement:** DCMA meter indicates less than 3 mA.

- (e) At the A TST channel terminal, operate the REC switch to L+.

**Requirement:** DCMA meter indicates 60.0 to 65.0 mA (for 62.5-mA channel terminals) or 19 to 21 mA (for 20-mA channel terminals).

- (f) At the 165C1 TTS jack field, remove the dummy plug from the SL CUR B jack.

**Requirement:** DCMA meter indicates less than 3 mA.

- (g) At the A TST channel terminal, set the REC switch to H+.

**Requirement:** DCMA meter indicates 60.0 to 65.0 mA (for 62.5-mA channel terminals) or 19 to 21 mA (for 20-mA channel terminals).

- (h) Disconnect the METER DCMA to RL CUR A patch.

- 20 When testing a hub channel and a test of the directional control circuit is required, refer to the BSP entitled 165C Telegraph Test Set Method of Operation for Maintenance Center Tests of 43A1 Channel Terminals (103-824-502) and perform the required test.

- 21c If testing a *neutral* channel terminal—  
Check the mark hold feature as follows.

- (a) At the 165C1 TTS jack field, patch the METER DCMA jack to the RL CUR A jack.
- (b) At B STD channel terminal, set the OSC switch to OFF.

STEP	PROCEDURE
	<b>Requirement:</b> DCMA meter indicates more than 50 mA (for 62.5-mA channel terminals) or 15 mA (for 20-mA channel terminals).
	(c) Set OSC switch to ON.
	<b>Requirement:</b> DCMA meter indicates 60.0 to 65.0 mA (for 62.5-mA channel terminals) or 19.0 to 21.0 mA (for 20-mA channel terminals). RS lamp lighted.
22c	Check the duplex operation as follows.
	(a) At the 165C1 TTS, set the DXA switch to NEUT HDX.
	(b) Ensure that the 165C1 TTS SEND key is set to M.
	<b>Requirement:</b> DCMA meter indicates 60.0 to 65.0 mA (for 62.5-mA channel terminals) or 19 to 21 mA (for 20-mA channel terminals).
	(c) Insert a dummy plug into the 165C1 TTS SL CUR B jack.
	<b>Requirement:</b> Same as (b).
	(d) Remove the dummy plug from the SL CUR B jack and set the SEND key to S.
	<b>Requirement:</b> DCMA meter indicates less than 3.0 mA.
	(e) Restore the SEND key to M and DXA switch to NEUT FDX.
	<b>Requirement:</b> Same as (b).
	(f) Disconnect all test connections.
23	Check the discriminator output voltage as follows.
	(a) At the A TST channel terminal, connect the VTVM — test lead to pin jack D and the + test lead to pin jack C.
	(b) Set the REC switch to L+ and the REC BIAS control fully CCW.
	<b>Requirement:</b> VOM indicates 40 to 65 Vdc.
	(c) Set the REC BIAS control fully CW.
	<b>Requirement:</b> VOM indicates 10 to 20 Vdc.
	(d) Restore the REC switch to H+, set the REC BIAS control to original position, and disconnect the VOM.
24	Check the <i>receive</i> bias and distortion as follows.

## STEP

## PROCEDURE

- (a) Condition the 911-type TSG to send 100 WPM/5-level (SW channel terminal) or 150 WPM/8-level (DW channel terminal) undistorted data test signals.
- (b) At the 165C1 TTS jack field, connect the 911-type TSG output to the SL CUR B (HUB SEND B) jack.
- (c) Patch the TMS IN jack to the RL TMS A (HUB REC A) jack.
- (d) At the A TST channel terminal, observe the TMS indication and vary the REC BIAS control from fully CCW to fully CW and back.

**Requirement:** Bias range for both SW and DW channel terminals must vary from at least  $-8$  percent to a maximum of at least  $+8$  percent. The arithmetic difference between the maximum  $-$  and  $+$  bias (average bias) must not exceed 15 percent for DW channel terminals. The total distortion measured must be the average bias  $\pm 5$  percent.

- (e) Ensure that the B STD channel terminal SEND switch is set to HM.
- (f) At the A TST channel terminal, set the REC switch to H+ (for neutral channel terminals) or L+ (for hub channel terminals).
- (g) Adjust the REC BIAS control for minimum bias.
- (h) At the 165C1 TTS, set the LINE 2 ATTEN control to:

Tube in V3 of B STD channel terminal—6 dB

HIN in V3 of B STD channel terminal—14 dB.

**Requirement:** PERCENT BIAS meter indicates  $-5$  to  $+5$  percent for single width channel or  $-10$  to  $+10$  percent for double width channel.

- (i) Set LINE 2 ATTEN control to:

Tube in V3 of B STD channel terminal—18 dB

HIN in V3 of B STD channel terminal—26 dB.

**Requirement:** PERCENT BIAS meter indicates  $-5$  to  $+5$  percent for single width channel or  $-10$  to  $+10$  percent for double width channel.

- (j) Set LINE 2 ATTEN control to:

Tube in V3 of B STD channel terminal—12 dB

HIN in V3 of B STD channel terminal—20 dB.

- (k) Disconnect all test connections.

STEP	PROCEDURE
25	<p>Check the <i>send</i> bias and distortion as follows.</p> <p>(a) Condition the 911-type TSG to send 100 WPM/5-level (SW channel terminal) or 150 WPM/8-level (DW channel terminal) undistorted data test signals.</p> <p>(b) At the 165C1 TTS jack field, connect the 911-type TSG output to the SL CUR A (HUB SEND A) jack.</p> <p>(c) Patch the TMS IN jack to the RL TMS A (HUB REC A) jack.</p> <p><b>Requirement:</b> PERCENT BIAS meter indicates <math>-5</math> to <math>+5</math> for a single width channel and <math>-10</math> to <math>+10</math> for a double width channel.</p> <p>(d) Disconnect all test connections.</p>
26	<b>End of test.</b>
<b>C. Filament Voltage Test</b>	
1a	<p>If the FIL ADJ rheostat is provided— Determine which circuit arrangement is used and condition the VOM to measure the dc voltage indicated in the METER INDICATION column of Table E.</p>
2a	<p>Connect the VOM to terminals FA, FB, and FC in accordance with Table E.</p> <p><b>Requirement:</b> See Table E.</p>
3b	<p>If the requirement for Step 2a is not met— Adjust the FIL ADJ rheostat for the proper filament voltage.</p> <p>(If the channel terminal does not contain HINs and the filament voltage cannot be properly adjusted, troubleshoot the filament supply circuit per the appropriate SD.)</p>
4a	<p>If the FIL ADJ rheostat is provided— Disconnect the VOM and repeat Steps 1a through 3b for all other channel terminals to be tested.</p>
5c	<p>If the common filament supply circuit is provided per SD-70626-01— Condition the VOM to measure 20 Vdc.</p>
6c	<p>Connect the positive VOM lead to the FG terminal and the negative lead to the Y bus bar on the filament supply panel at the top of the bay.</p> <p><b>Requirement:</b> Meter indicates 19 to 21 volts.</p>
7d	<p>If the requirement for Step 6c is not met— Proceed as follows:</p> <p>(1) Refer to Table G to determine the current drain of each 43A1 channel terminal.</p>

STEP

PROCEDURE

TABLE G

## CHANNEL TERMINAL CURRENT DRAIN

CHANNEL TERMINAL EQUIPPED WITH	CURRENT DRAIN
Four 407A tubes One 408A tube Two 429A tubes	730 mA*
Four 407A tubes One 408A tube One 262-type switch	450 mA
Five KS-type HINs One 262-type switch	Negligible

\* 630 mA if BAL LP, or if FDX module is used.

- (2) Multiply current drain from Step 7d (1) by the number of channels in the bay to determine the total bay current drain.

**Example:** Channel terminal drain = 450 mA  
 Number of channel terminals in bay = 10  
 $.450 \times 10 = 4.5$  amps

- (3) Locate the total current drain on Table H and check strapping of filament supply panel at the top of the bay.
- (4) If the bay is not properly strapped, restrap according to Table H and Fig. 3.

**Caution:** Always add straps before removing straps, otherwise the filament supply will be opened and service will be interrupted on all channels in the bay.

(If the proper voltage level cannot be achieved, troubleshoot the filament supply circuit per SD-70626-01.)

- 8 **End of test:** Disconnect the VOM.

#### D. Marking Signal Condition Test

- 1 Condition the VOM to measure 20 (SW channels) or 40 (DW channels) Vdc.
- 2 At the channel terminal under test—  
 Connect the VOM as follows to obtain C-D voltage.

- **Hub channel terminal**—Connect positive (+) VOM lead to pin jack C and negative (–) VOM lead to pin jack D.

**TABLE H**  
**SD-70626-01 FILAMENT VOLTAGE SUPPLY**  
**STRAPPING**

TOTAL BAY DRAIN (AMPS)	STRAP BUS X TO	STRAP BUS Y TO	RESISTANCE ADDED (OHMS)
11.11	A&C	F&H	0.405
11.25	A&E	B&F	0.40
11.75	A&C	G&H	0.383
12.26	A&E	D&F	0.367
12.86	E	H	0.35
13.2	A&E	F	0.341
13.47	C&G		0.334
13.98	E&G		0.322
15.0	E	G&H	0.3
15.46	A&E	B&H	0.291
15.85		D&H	0.284
16.54		F&H	0.272
16.85	C&E	H	0.267
17.44	A&G	D&F	0.258
18.0	A&E	G&H	0.25
18.83	C&E	F&H	0.239
20.0	E&F	H	0.225
20.74	C&E	G&H	0.217
21.53	C&G	E&F	0.209
22.5	G	H	0.2
23.56	A&E		0.191
24.46	C&G	H	0.184
25.71	A&G	D&H	0.175
	E&F	G&H	
26.79	C&G	D&H	0.168
27.61	A&G	F&H	0.163
28.85	C&G		0.156
31.25	E&G		0.144

TABLE H (Cont)

SD-70626-01 FILAMENT VOLTAGE SUPPLY  
STRAPPING

TOTAL BAY DRAIN (AMPS)	STRAP BUS X TO	STRAP BUS Y TO	RESISTANCE ADDED (OHMS)
2.25	A	B	2
3.0		C	1.5
3.38	A&C	B	1.333
3.6	A	F	1.25
3.75	A&E	B	1.2
3.86	A	D&F	1.167
4.0		E&F	1.125
4.09		H	1.1
4.12	A&G	B	1.091
4.15	A	D&H	1.084
4.2		F&H	1.072
4.29		G&H	1.05
4.5	C	D	1.0
5.4	A&C		.833
6.0	C	F	0.75
6.43	A&E	D	0.70
6.75	C&E		0.667
7.2	C	E&F	0.625
7.5		H	0.60
7.61	A&G	D	0.591
7.71	C	D&H	0.584
7.72	A&C	F	0.583
7.87	C	F&H	0.572
8.18		G&H	0.55
8.44	A&C	B&F	0.533
9	E	F	0.50
9.83	A&C	E&F	0.458
10.0	A&E	F	0.45
10.39	A&C	H	0.433
10.61	A&C	B&H	0.424
10.79	C&E	F	0.417

## STEP

## PROCEDURE

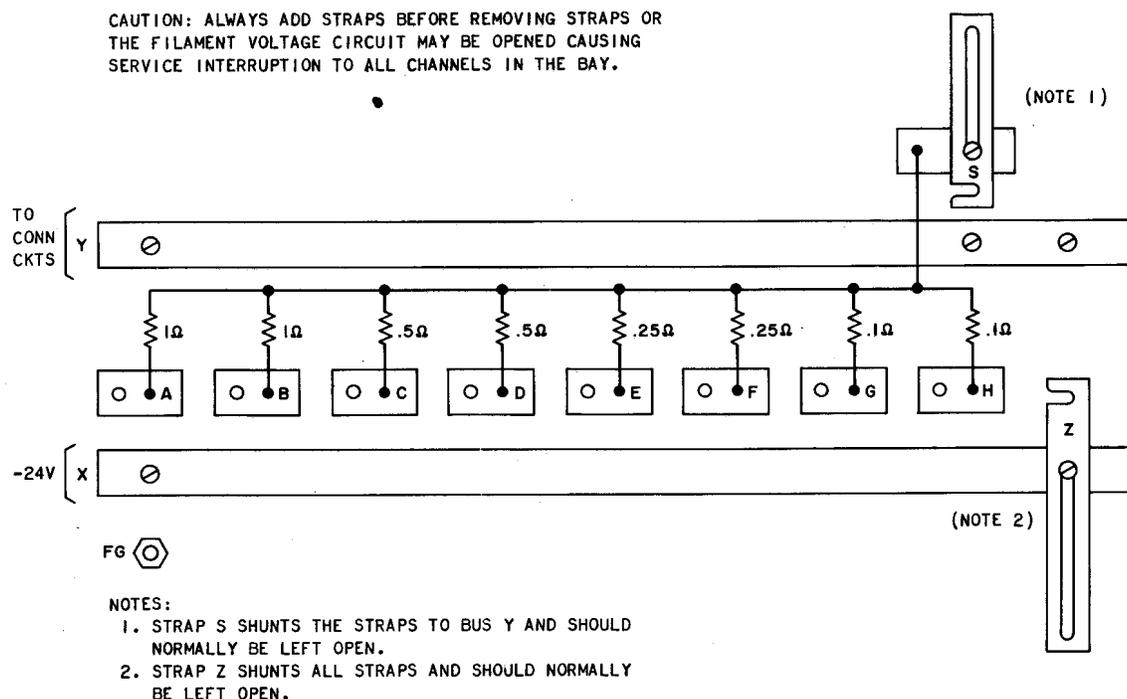


Fig. 3—SD-70626-01 Filament Voltage Panel Diagram

- **Neutral (BAL LP) channel terminal**—Connect positive (+) VOM lead to pin jack D and negative (−) VOM lead to pin jack C.

**Requirement:** SW channel terminals—no less than 20 volts.  
 DW channel terminals—no less than 40 volts.

(Failure to meet the requirement for Step 2 indicates that a marking signal is not being received and/or detected. In this case, proceed to Step 4b to locally establish the required marking signal or establish the marking condition in accordance with local procedures.)

- 3a If the requirement for Step 2 *is* met—  
 Proceed to Step 15.
- 4b If the channel terminal being tested is on an in-service channel—  
 Obtain a circuit release.
- 5 Apply power to the test oscillator and allow sufficient warm-up time.
- 6 On the channel terminal under test—  
 Set the REC GAIN control fully clockwise.

STEP	PROCEDURE
7	Set the REC BIAS control to mechanical center.
8	Operate the REC switch as required (H+ for high-frequency mark or L+ for low-frequency mark).
9	Adjust the test oscillator to produce the appropriate marking frequency per Table I.  (Use FREQUENCY/HIGH column if REC switch is set to H+ and FREQUENCY/LOW column if REC switch is set to L+.)
10	Adjust the test oscillator for a 0-dBm output.
11	At the channel terminal under test— Connect the ground side of the test oscillator to pin jack G and the high side to pin jack A1.  <b>Requirement:</b> SW channel terminal—VOM indicates no less than 20 volts. DW channel terminal—VOM indicates no less than 40 volts.  (If the requirement for Step 11 is not met, it could be because the test frequency is not correct. In this case, vary the oscillator frequency control to see if the requirement can be met. If not, replace the channel terminal and repeat this test.)
12c	If the requirement for Step 11 <i>is</i> met— Continue as follows:  (1) Installation testing—Proceed to Step 15.  (2) Maintenance testing—  (a) Disconnect the test oscillator.  <b>Requirement:</b> SW channel terminal—VOM indicates no less than 20 volts. DW channel terminal—VOM indicates no less than 40 volts.  (b) If the requirement for Step 12c (2)(a) is met, proceed to Step 15.
13d	If the requirement for Step 12c (2)(a) <i>is not</i> met— Repeat Step 11.  <b>Requirement:</b> Same as Step 12c (2)(a).
14d	Report trouble on facility and distant channel terminal.
15	End of test, disconnect VOM.



**BE SURE to disconnect the test oscillator when testing is complete or the trouble in the facility for distant channel terminal has been located and cleared.**

TABLE I  
SEND AND RECEIVE NETWORKS

NETWORKS		CHANNEL FREQUENCIES (HZ)			CHANNEL NUMBERS
SEND	RECEIVE	HIGH	LOW	SHIFT	
<i>SW Voiceband Channels</i>					
453AE	454AE	460	390	70	1
453A	454A	630	560		2
453B	454B	800	730		3
453C	454C	970	900		4
453D	454D	1140	1070		5
453E	454E	1310	1240		6
453F	454F	1480	1410		7
453AA	454AA	1650	1580		8
453G	454G	1820	1750		9
453H	454H	1990	1920		10
453J	454J	2160	2090		11
453K	454K	2330	2260		12
453L	454L	2500	2430		13
453M	454M	2670	2600		14
453AB	454AB	2840	2770		15
453AC	454AC	3010	2940		16
453AD	454AD	3180	3110	70	17
<i>DW Voiceband Channels</i>					
453AK	454AK	1430	1290	140	51
453AL	454AL	1770	1630		52
453AM	454AM	2110	1970		53
453AN	454AN	2450	2310		54
453AP	454AP	2790	2650		55
453AR	454AR	3130	2990	140	56

## STEP

## PROCEDURE

**E. Channel Sending Level Test Using KS-19935-Type TCTS**

- 1 At the KS-19935-type TCTS control unit—  
Set the controls as follows:
- LEVEL dBm—26 (Local engineering of special layouts may have specified a different level requirement.)
  - HI-M/LO-M—HI-M
  - AM/FM—FM
  - CHANNEL SELECT—channel to be tested.
- 2 Bridge the KS-19935-type TCTS to the system and monitor the channel terminal send signal in accordance with local procedures.
- 3a If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D before proceeding with the test. If not, establish a marking condition in accordance with Test D or local procedures.
- 4b If testing a SW channel terminal—  
Set the DW-F/SW control to SW.
- 5b Operate the READ switch and record the DB meter indication.

**Requirement:** DB meter indicates 0 dB.

(If this requirement is not met, verify that office wiring and pads are acceptable. The channel terminal under test can be adjusted by the SEND LEV control for a 0-dB indication on the DB meter. If the required adjustment exceeds 2 dB, the channel terminal must be checked to determine the cause of trouble. Refer to Section 312-700-300 for maintenance and trouble location information.)

- 6c If testing a DW channel terminal—  
Set DW-F/SW control to DW-F.



*The new KS-19935-type TTS (identified by a dual-range scale on the LEVEL dBm control) provides a 3-dB pad when the DW-F/SW switch is in the DW-F position. When the new KS-19935 TTS is used, the 5-dB PAD is not required and shall not be provided in Step 7c; the requirement in 7c now becomes 0 dB when the 19935 TTS is used.*

- 7c Simultaneously operate the 5-dB PAD and READ switches and record the DB meter indication.

**Requirement:** DB meter indicates -2 dB.

## STEP

## PROCEDURE

(If this requirement is not met, verify that the office wiring and pads are acceptable. The channel terminal under test can be adjusted by the SEND LEV control for the correct indication on the DB meter. If the required adjustment exceeds 2 dB, the channel terminal must be checked to determine the cause of trouble. Refer to Section 312-700-300 for maintenance and trouble location information.)

- 8 **End of test:** Disconnect all test equipment and report channel ready for service or continue installation testing.

#### F. Channel Sending Level Test Using 21A TMS With the System Out of Service

- 1 When testing a channel terminal, obtain a circuit release for the system and channel terminal under test.
- 2 At the channel terminal under test—  
Ensure that the SEND switch is in the proper position (HM or LM).
- 3 At the testboard; connect the 21A TMS to the system equipment jack and terminate the line jack with a 600Ω termination.
- 4 Check to make sure the OSC switch for the channel terminal being tested is set to the ON position. All other OSC switches must be in the OFF position.
- 5 Record the dB indication of the 21A TMS.

**Requirement:** 21A TMS indicates a send level of:  
 SW channel—26 ±2 dB  
 DW channel—23 ±2 dB.

(If this requirement is not met, verify that office wiring and pads are acceptable. The channel terminal under test can be adjusted by the SEND LEV control for the proper indication. If the required adjustment exceeds 2 dB, the channel terminal must be checked to determine the cause of trouble. Refer to Section 312-700-300 for maintenance and trouble location information.)

- 6 **End of test:** Disconnect all test equipment and return the channel to service.

#### G. Customer Location Terminal Sending Level Test Using a KS-19935-Type TCTS at the Testboard Location



*This test may be performed when no test equipment is available at the customer location. The settings and measurements obtained will be approximate. Therefore, when accurate settings and measurements are required, this test should be omitted and the 130-type subset sending level should be set in accordance with the section entitled 130-Type Teletypewriter Subscriber Set—Tests and Adjustments (570-303-503).*

- 1 Refer to the CLRC to determine the signal power level that should be received at the testboard.

## STEP

## PROCEDURE

**Requirement:**  $-26$  dB (SW)  $\pm 4.5$  dB or  $-23$  dB (DW)  $\pm 4.5$  dB. If this requirement is not met, check the 130-type subset sending level and verify the circuit loss is within the specified circuit design limits.

- 2 At the testboard—  
Set the controls on the KS-19935-type TCTS as follows:

- LEVEL dBm—Position closest to value obtained in Step 1
- HI-M/LO-M—HI-M
- AM/FM—FM
- CHANNEL SELECT—Channel to be tested
- DW-F/SW—SW for single-bandwidth channel or DW-F for double-bandwidth channel

- 3 Bridge the KS-19935-type TCTS to the system in accordance with local procedures.



**Be sure to bridge the TCTS in such a manner so as to monitor the signal from the 130-type subset.**

- 4 Operate the READ switch and record the DB meter indication.

**Requirement:**  $-26 \pm 4.5$  dB (SW) or  $-23 \pm 4.5$  dB (DW). If this requirement is not met, check the 130-type subset sending level and verify the circuit loss is within the specified circuit design limits.



**When the AML of the line is great enough to require the 130-type subset sending level to be set higher than 0 dBm, report the line for maintenance procedures.**

- 5 **End of test:** Disconnect all test equipment and return the channel to service.

#### H. Loop Current Test Using no Special Equipment

- 1a If testing an in-service channel—  
Obtain a circuit release for the channel to be tested.
- 2b If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D, before proceeding with this test. If not, establish a marking condition in accordance with Test D or local procedures.
- 3 At the testboard—  
Patch the dc milliammeter to the DROP 1 (or LOOP A) jack (see Fig. 4) in accordance with local procedures.

## STEP

## PROCEDURE

**HDX Loops or FDX Receive Loops**

4 At the channel terminal under test—  
Connect the positive (+) VOM lead to pin jack LP and the negative (–) VOM lead to pin jack C (see Fig. 4).

5c If testing a 62.5-mA loop less than three miles long—  
Condition the VOM to measure 80 Vdc and record the VOM indication as the ***LP-C reference voltage.***

***Requirement:*** 75 to 85 volts.

6c Record the dc milliammeter as the ***loop current.***

***Requirement:*** 60 to 65 mA.

(If the requirement for Step 5c or 6c is not met, alternately adjust the LOOP PAD control and the channel terminal LP CUR control for the proper LP-C voltage and loop current.)



***When V5 and V6 are equipped with the 262-type switch and 4143-type network, the channel terminal LP CUR control is to be set fully counter-clockwise (CCW) and all references to the adjustment of the LP CUR control are to be ignored.***

7d If testing a 20-mA or 62.5-mA loop over three miles long—  
Condition the VOM to measure 300 Vdc.

8d Operate the REC switch to the position opposite the normal position (ie, if channel normally operates with the REC switch in the HM position, operate the REC switch to LM.)

***Note:*** The channel terminal is now in the spacing condition.

9d Record the VOM meter indication.

10d Restore the REC switch to the normal operating position.

11d Locate the VOM indication recorded in Step 9d in the LP-C SPACING VOLTAGE column on Table J and record its corresponding MARKING VOLTAGE ***and*** CURRENT.

***Requirement:*** VOM indicates voltage given in LP-C MARKING VOLTAGE column of Table J. DC milliammeter indicates current given in MARKING CURRENT column of Table J.

(If this requirement is not met, adjust the LOOP PAD control and channel terminal LP CUR control for the proper voltage.)



***When V5 and V6 are equipped with the 262-type switch and 4143-type network, the channel terminal LP CUR control is to be set fully CCW and all references to the adjustment of the LP CUR control are to be ignored.***

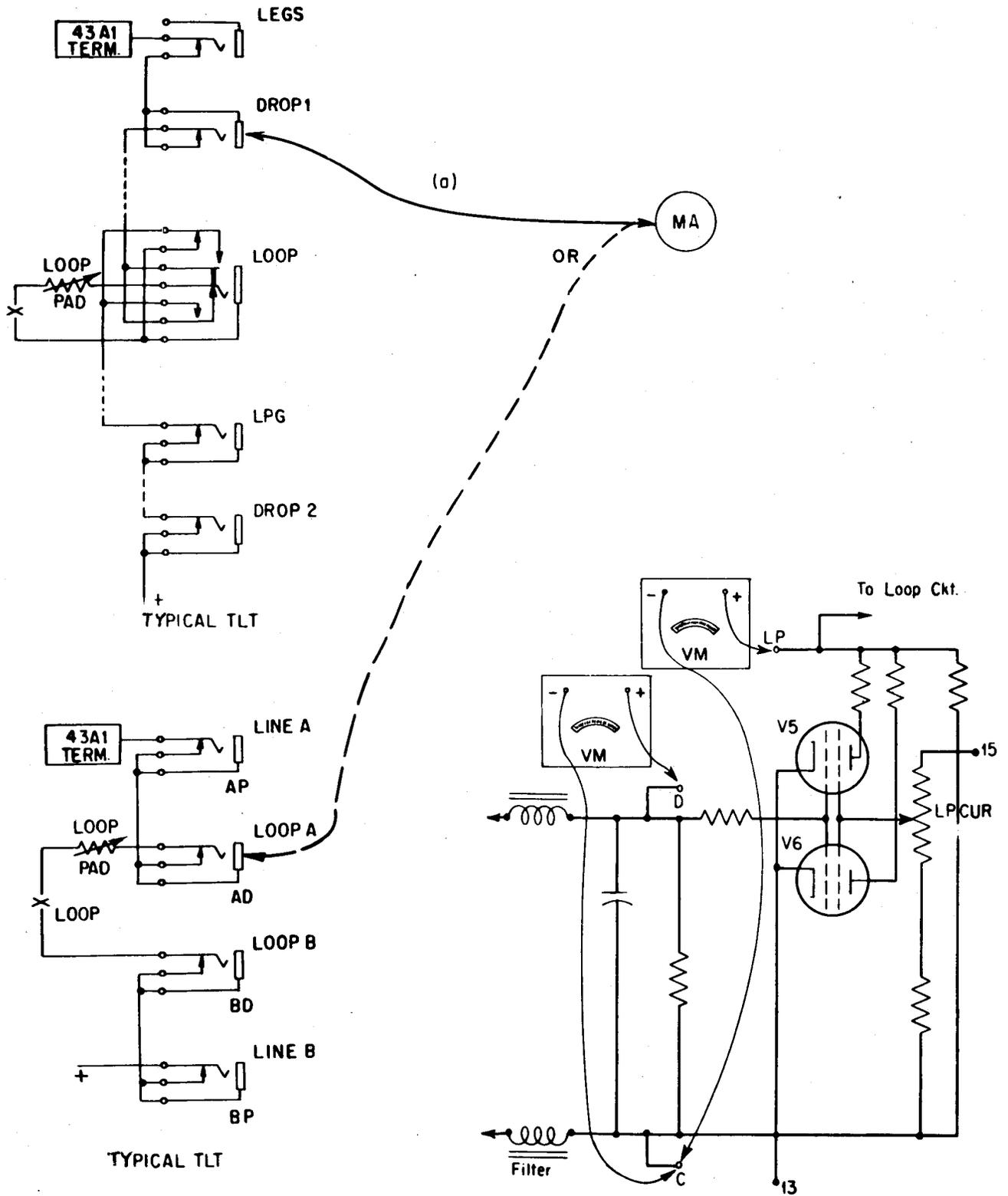


Fig. 4—Test H Connections

STEP

PROCEDURE

TABLE J  
LOOP CURRENT AND VOLTAGE  
FOR TEST H

TYPE LOOP	LP-C SPACING VOLTAGE	LP-C MARKING VOLTAGE	LOOP CURRENT	
			62.5-MA LOOP	20-MA LOOP
±130 Volt	250 to 270	79 to 81	60 to 65	—
+130 Volt/−48 Volt	170 to 185	79 to 81	60 to 65	19 to 21
+130 Volt/Ground	125 to 135	79 to 81	60 to 65	19 to 21

**FDX Send Loops**

- 12 Record the dc milliammeter indication.

**Requirement:** 62.5-mA loop—60 to 65 mA  
20-mA loop—19 to 21 mA.

(If this requirement is not met, adjust the LOOP PAD control for a dc milliammeter indication of 62.5 or 20 mA).

- 13 **End of test:** Disconnect all test equipment and report the channel ready for service or continue installation testing.

**I. Loop Current Test Using 43A1 Test Terminating Circuit**

- 1a If testing an in-service channel terminal—  
Obtain a circuit release for the channel terminal to be tested.
- 2b If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D. If not, establish a marking condition in accordance with Test D or local procedures.
- 3 At the channel terminal under test—  
Connect the positive (+) VOM lead to pin jack LP and the negative (−) VOM lead to pin jack C (see Fig. 5).

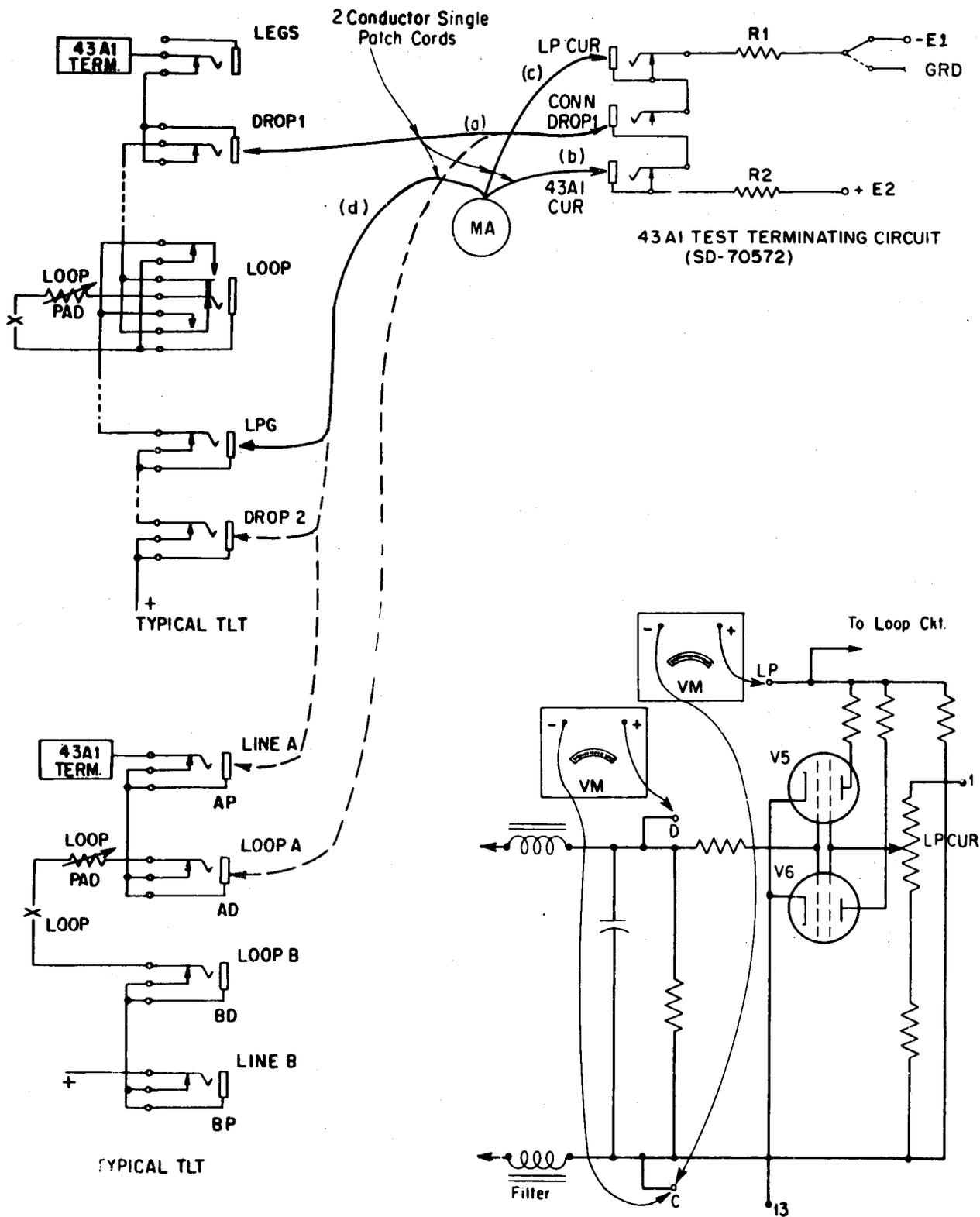


Fig. 5—Test I Connections

STEP

PROCEDURE

**HDX Loops and FDX Receive Loops**

- 4 At the testboard—  
Refer to Fig. 5 and connect patch (a) between the CONN DROP 1 jack of the 43A1 test terminating circuit and the DROP 1 (or LOOP A) jack in accordance with local procedures.
- 5 Patch the dc milliammeter to the 43A1 CUR jack of the 43A1 test terminating circuit [patch (b) of Fig. 5].
- 6 Using the VOM, measure and record the voltage on test point E1 of the 43A1 test terminating circuit.

**Requirement:** See Table K.

- 7 Ensure that R2 of the 43A1 test terminating circuit is the proper value in accordance with Table K.
- 8c If testing a 62.5-mA loop less than three miles long—  
Record the loop current indicated on the dc milliammeter.

**Requirement:** 62.5 mA.

(If this requirement is not met, adjust the LP CUR control of the 43A1 channel terminal for the correct indication.)



**When V5 and V6 are equipped with the 262-type switch and 4143-type network, the channel terminal LP CUR control is to be set fully CCW and all references to the adjustment of the LP CUR control are to be ignored.**

- 9c Disconnect the dc milliammeter from the 43A1 CUR jack, connect it to the LP CUR jack of the 43A1 test terminating circuit [patch (c) of Fig. 5], and record the meter indication.

**Requirement:** 62.5 mA.

(If this requirement is not met, adjust the LOOP PAD control for the correct indication.)

STEP	PROCEDURE
------	-----------

TABLE K

## 43A1 TEST TERMINATING CIRCUIT R2 REQUIREMENTS

TYPE LOOP	E1 (VOLTS)	E2 (VOLTS)	R1 (OHMS)	R2 (OHMS)
62.5 mA	-130	+130	1280*	2875*
	GRD		1280	795*
	-48		1280*	1560*
20 mA	GRD		2110	2460*
	-48		2460	4900*

\* Including bat. tap. resistor

10c Disconnect the dc milliammeter from the LP CUR jack of the 43A1 test terminating circuit and connect it to the TLT LPG DROP 2, or LINE A jack [patch (d) Fig. 5].

11c Record the dc milliammeter indication and the VOM indication at the channel terminal.

**Requirement:** DC milliammeter indicates 60 to 65 mA.  
VOM indicates 75 to 85 volts.

(If this requirement is not met, repeat Steps 8c, 9c, and 10c until this requirement is met. If the requirement still cannot be met, troubleshoot in accordance with Section 312-700-300.)

12d If testing a 20-mA or 62.5-mA loop over three miles long—  
Condition the VOM to measure 300 Vdc.

13d At the channel terminal under test—  
Operate the REC switch to the position opposite the normal operating position (ie, if the channel normally operates with the REC switch in the HM position, operate the REC switch to LM).

**Note:** The channel terminal is now in the spacing condition.

14d Record the VOM indication.

15d Restore the REC switch to the normal operating position.

16d Locate the VOM indication recorded in Step 14d in the LP-C SPACING VOLTAGE column of Table J and record the corresponding MARKING VOLTAGE and CURRENT.

STEP	PROCEDURE
	<p><b>Requirement:</b> VOM indicates voltage given in LP-C MARKING VOLTAGE column of Table J. DC milliammeter indicates current given in MARKING CURRENT column of Table J.</p>

(If this requirement is not met, adjust the LOOP PAD control and channel terminal LP CUR control for the proper voltage.)



**When V5 and V6 are equipped with the 262-type switch and 4143-type network, the channel terminal LP CUR control is to be set fully CCW and all references to the adjustment of the LP CUR control are to be ignored.**

#### FDX Send Loops

- 17 Connect the dc milliammeter in series with the TLT LPG jack and record the meter indication.

**Requirement:** 62.5-mA loop—60 to 65 mA  
20-mA loop—19 to 21 mA.

(If this requirement is not met, adjust the LOOP PAD control for 62.5 or 20 mA.)

- 18 **End of test:** Disconnect all test equipment and report the circuit ready for service or continue installation testing.

#### J. Loop Current Test Using Differential Meter

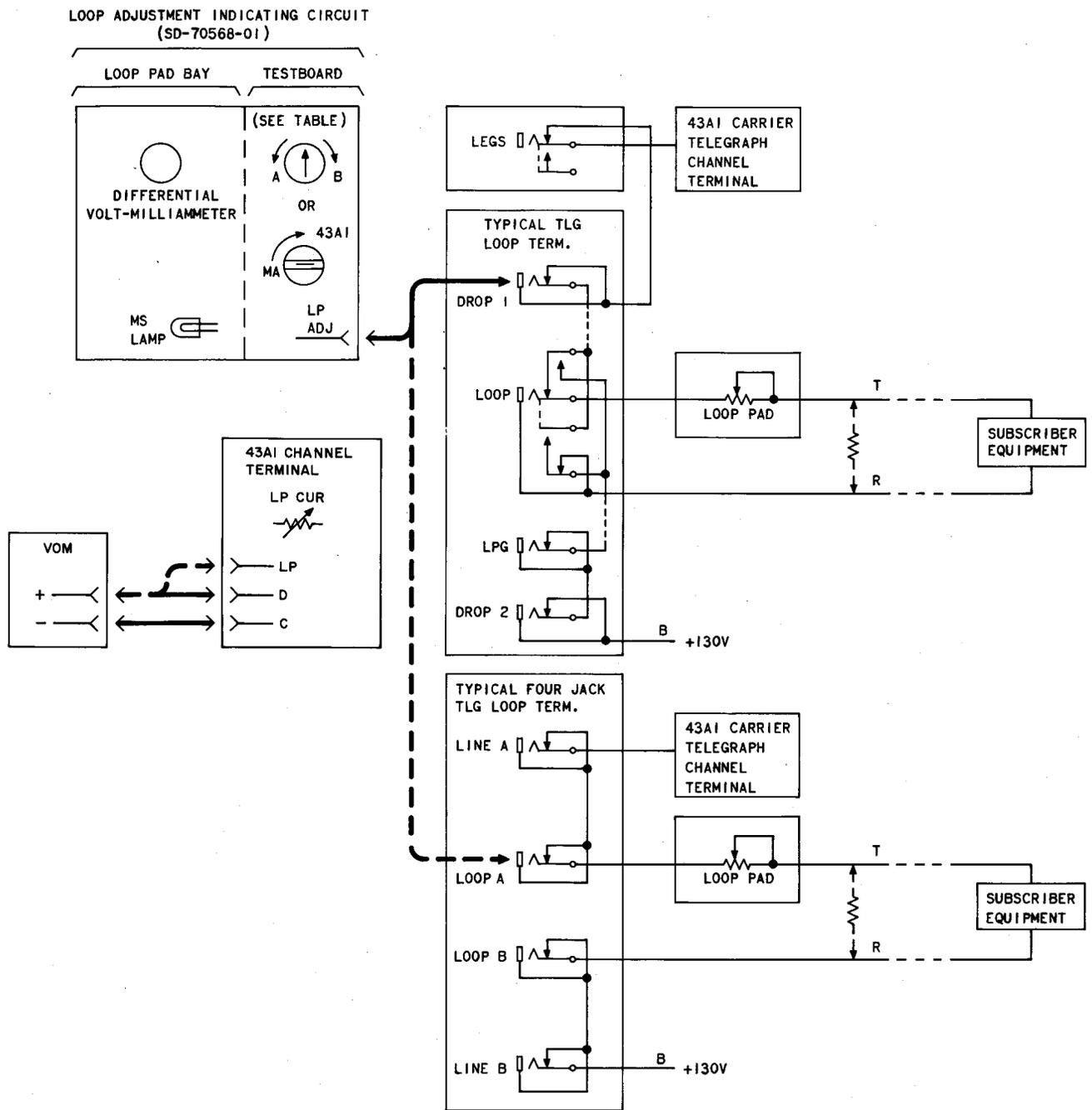
- 1a If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D before proceeding with this test. If not, establish a marking condition in accordance with Test D or local procedures.
- 2a Ensure that the loop side is properly terminated.

**Caution:** Correct loop current is obtained only with the loop terminated into the terminal equipment at the customer location. If adjustment is made with the loop terminated by any other means, the loop current must be readjusted with the customer terminal equipment connected before the channel can be put in service.

#### HDX Loop or FDX Receive Loop

- 3 At the testboard—  
Patch the differential meter to the DROP 1 or LOOP A jack of the TLT (see Fig. 6) in accordance with local procedures.

**Requirement:** MS lamp at the loop pad bay extinguished.



**Fig. 6—Test J Connections**

## STEP

## PROCEDURE

**Caution:** If the MS lamp is lighted, disconnect the patch as excessive loop current is indicated. Correct the condition causing the excessive loop current flow and repeat Step 3.

- 4 At the differential meter control unit—  
Operate the A/B or 43A1/MA switch as follows and record the differential meter indication:

- $\pm 130$  volt loop—Operate A/B switch to B.
- $+130$  volt loop—Operate 43A1/MA switch to 43A1.

**Requirement:** Differential meter indicates zero.

(If this requirement is not met, alternately adjust the LOOP PAD control and channel terminal LP CUR control for the proper indication.)



**When V5 and V6 are equipped with the 262-type switch and 4143-type network, the LP CUR control is to be set fully CCW and all references to the adjustment of the LP CUR control are to be ignored.**

- 5 Operate the A/B or 43A1/MA switch as follows and record the differential meter indication:

- $\pm 130$  volt loop—Operate A/B switch to the center (unoperated)
- $+130$  volt loop—Operate 43A1/MA switch to MA.

**Requirement:** Differential meter indicates 60 to 65 mA for 62.5-mA loop or 17.5 to 22.5 mA for 20-mA loop.

(If this requirement is not met, repeat Step 4.)

- 6 At the channel terminal under test—  
Condition the VOM to measure 80 Vdc, connect the positive (+) VOM lead to pin jack LP, and the negative (–) VOM lead to pin jack C (See Fig. 6).

- 7 Record VOM indication.

**Requirement:** VOM indicates 75 to 85 volts.

(If this requirement is not met, repeat Steps 4, 5, and 6.)

#### FDX Send Loop

- 8 Operate the differential meter A/B or 43A1/MA switch as follows:

- $\pm 130$  volt loop—A/B switch to the center (unoperated)
- $+130$  volt loop—43A1/MA switch to MA.

STEP	PROCEDURE
9	Patch the differential meter to the TLT DROP 1 or LOOP A jack (see Fig. 6) in accordance with local procedures.  <b>Requirement:</b> At the loop pad bay, the MS lamp extinguished.  <b>Caution:</b> <i>If the MS lamp is lighted, disconnect the patch as excessive loop current is indicated. Correct the condition causing the excessive loop current and repeat Step 9.</i>
10	Record the differential meter indication.  <b>Requirement:</b> 62.5-mA loop—60 to 65 mA 20-mA loop—17.5 to 22.5 mA.  (If this requirement is not met, adjust the LOOP PAD control for the proper indication.)
11	<b>End of test:</b> Disconnect all test equipment and report the circuit ready for service or continue installation testing.

#### K. Loop Current Test Using Nondifferential Meter

- 1a If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D before proceeding with this test. If not, establish a marking condition in accordance with Test D or local procedures.
- 2a Ensure that the loop side is properly terminated.

**Caution:** *Correct loop current is obtained only with the loop terminated into the terminal equipment at the customer location. If adjustment is made with the loop terminated by any other means, the loop current must be readjusted with the customer terminal equipment connected before the channel can be put in service.*

#### HDX Loop, FDX Receive Loop, or FDX Send Loop

- 3 At the testboard or loop pad bay miscellaneous jack field—  
Patch the nondifferential meter LP ADJ jack to the TLT DROP 1 (or LOOP A) jack (See Fig. 7) in accordance with local procedures.

**Requirement:** MS lamp at loop pad bay extinguished.

**Caution:** *If MS lamp is lighted, disconnect the patch as excessive loop current is indicated. Correct the condition causing the excessive loop current flow and repeat Step 3.*

- 4 Operate the nondifferential meter VOLTS/MA key to MA and record meter indication.

**Requirement:** 20-mA loop—19 to 21 mA  
62.5-mA loop—60 to 65 mA.

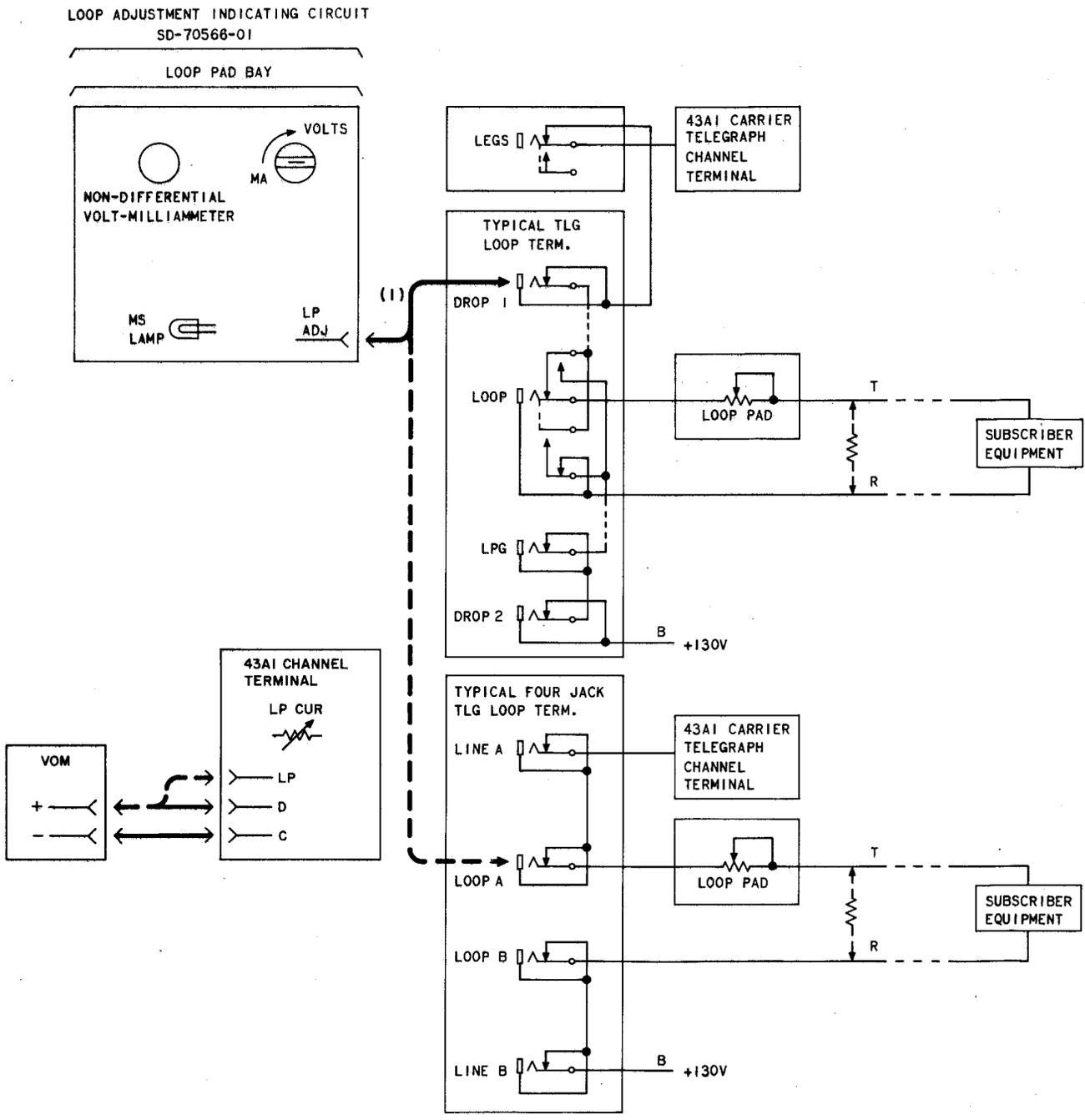


Fig. 7—Test K Connections

## STEP

## PROCEDURE

(If this requirement is not met, adjust the LOOP PAD control and channel terminal LP CUR control until the nondifferential meter indication does not vary when the VOLTS/MA key is operated alternately between VOLTS or MA.)



**When V5 and V6 are equipped with the 262-type switch and 4143-type network, the LP CUR control is to be set fully CCW and all references to the adjustment of the LP CUR control are to be ignored.**

**HDX Loop and FDX Receive Loop**

- 5 At the channel terminal under test—  
Connect the positive (+) VOM lead to pin jack LP and the negative (–) VOM lead to pin jack C and record the VOM indication (See Fig. 5).

**Requirement:** VOM indicates 75 to 85 volts.

(If this requirement is not met, repeat Step 4.)

- 6 **End of test:** Disconnect all test equipment and report the channel ready for service or continue installation testing.

**L. Hub Operational Test**

- 1a If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D. If not, establish a marking condition in accordance with Test D or local procedures.

- 2 At the No. 2 or 9B serviceboard—  
Insert a 367A (release) plug into the T (test) jack of the channel terminal being tested (patch a of Fig. 8).

- 3 Operate the IL I key.

**Requirement:** IL (idle) lamp lighted.

- 4 Insert the SET plug of the teletypewriter cord circuit into the LM (legs multiple) jack of the serviceboard for the channel terminal being tested (patch c of Fig. 8).

**Requirement:** Position teletypewriter runs closed.



**If the requirement for either Step 3 or 4 is not met, verify that the channel terminal is arranged for hub operation in accordance with Section 312-700-200.**

- 5 **End of test:** Disconnect the RELEASE and SET plugs and report the channel ready for service or continue installation testing.

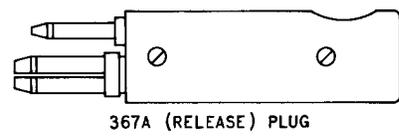
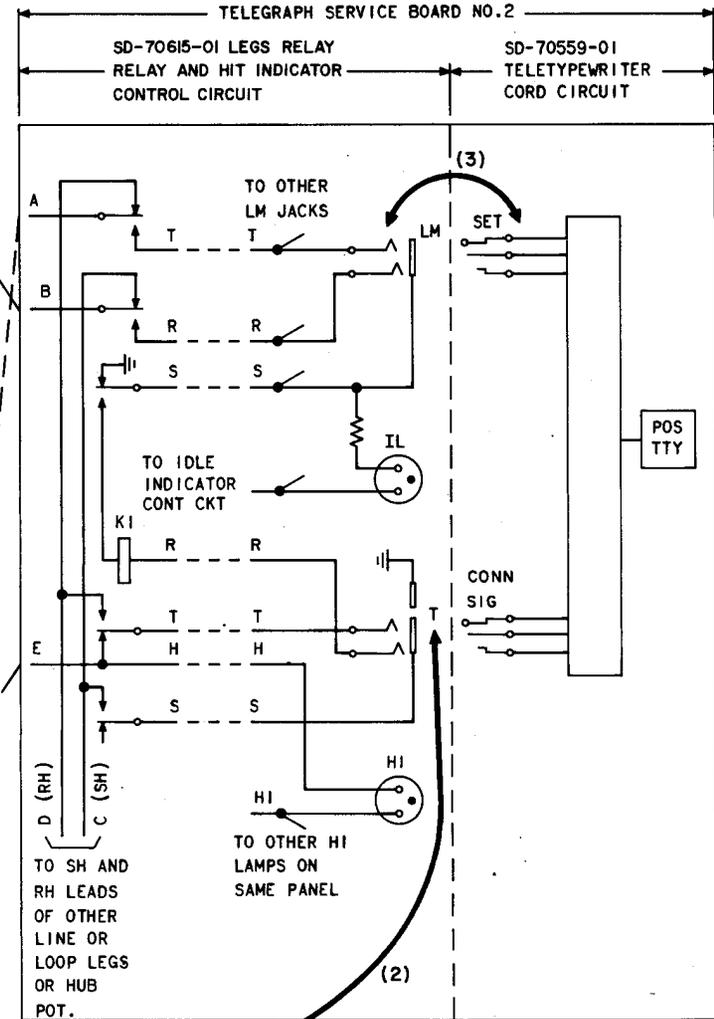
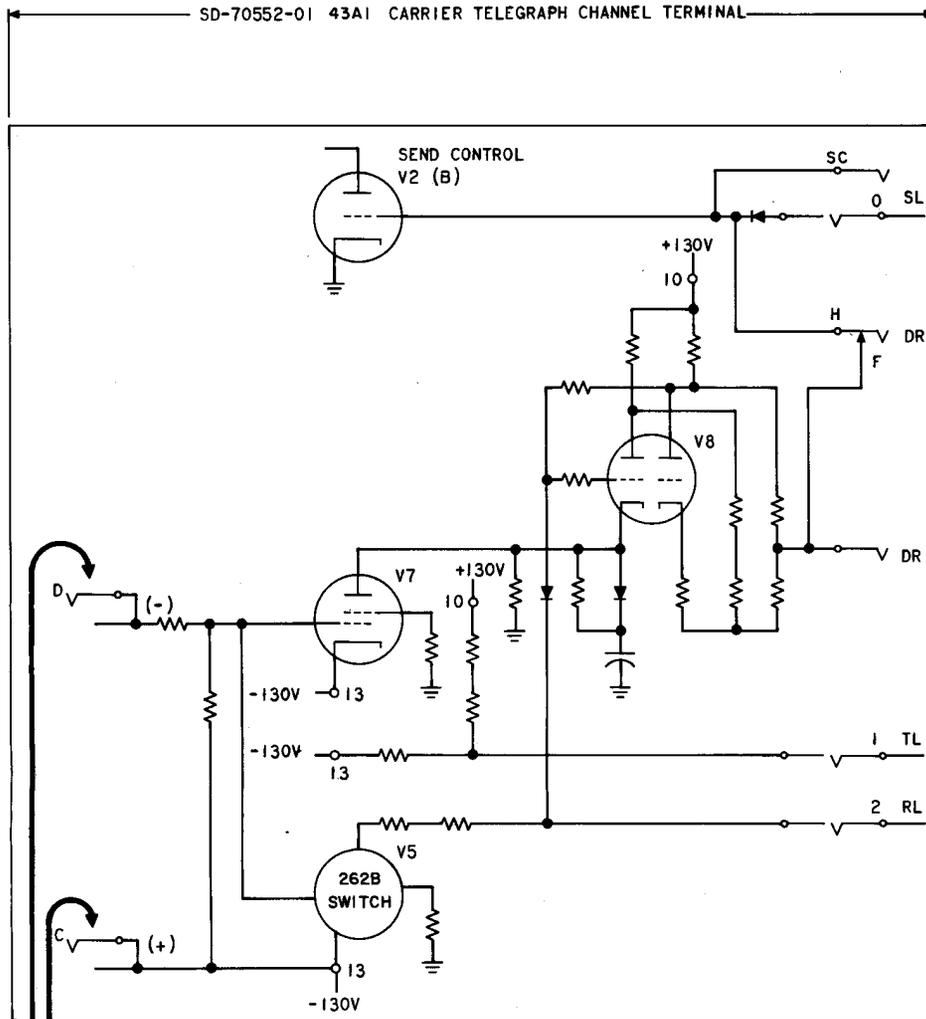


Fig. 8—Test L Connections

## STEP

## PROCEDURE

**M. Back-to-Back Operation Test**

*This test assumes that testing and patching jacks are provided in the carrier telegraph terminal bay; however, these jacks are optional and may not be provided. When local loops or interconnecting circuits are provided at the back-to-back location, the CUR and TST jacks (Fig. 9) are replaced by a TLT jack arrangement. In this case, use the TLT looping jacks when this test specifies the CUR or TST jacks.*

- 1a If testing an in-service channel terminal—  
Obtain a circuit release for the channel to be tested.
- 2 Ensure that the distant terminal is connected and in the marking condition by performing Test D. If not, establish a marking condition in accordance with Test D or local procedures.
- 3 At the channel terminal under test—  
Condition the VOM to measure 80 Vdc, connect the positive (+) VOM lead to pin jack LP, and the negative (–) VOM lead to pin jack C (see Fig. 9).
- 4 At the telegraph terminal bay—  
Patch the dc milliammeter to the CUR jack (see Fig. 9) of the channel terminal under test.

**Requirement:** Milliammeter indicates 62.5 mA; VOM indicates 80 volts.

(If this requirement is not met, alternately adjust the SC ADJ control and channel terminal LP CUR control for the proper indications.)



*When V5 and V6 are equipped with the 262-type switch and 4143-type network, the LP CUR control is to be set fully CCW and all references to the adjustment of the LP CUR control are to be ignored.*

- 5b If back-to-back channel terminal **has not** been tested—  
Disconnect all test equipment and perform this test (Test M) on the back-to-back channel terminal.
- 6c If the back-to-back channel terminal **has** been tested—  
**End of test:** Disconnect all test equipment and report channel ready for service or continue installation testing.

**N. Supervisory Circuit Test**

- 1a If testing an in-service channel terminal—  
Obtain a circuit release for the channel to be tested.
- 2 Set the attenuator for 0-dB loss.
- 3 Connect the attenuator between the tip and ring TGL jack and the tip and ring TGEQ jacks (see Fig. 10).

SD-70552-01  
43A1 CARRIER TELEGRAPH CHANNEL TERMINAL CIRCUIT

SD-70572-01  
TESTING AND MISCELLANEOUS JACK CIRCUITS

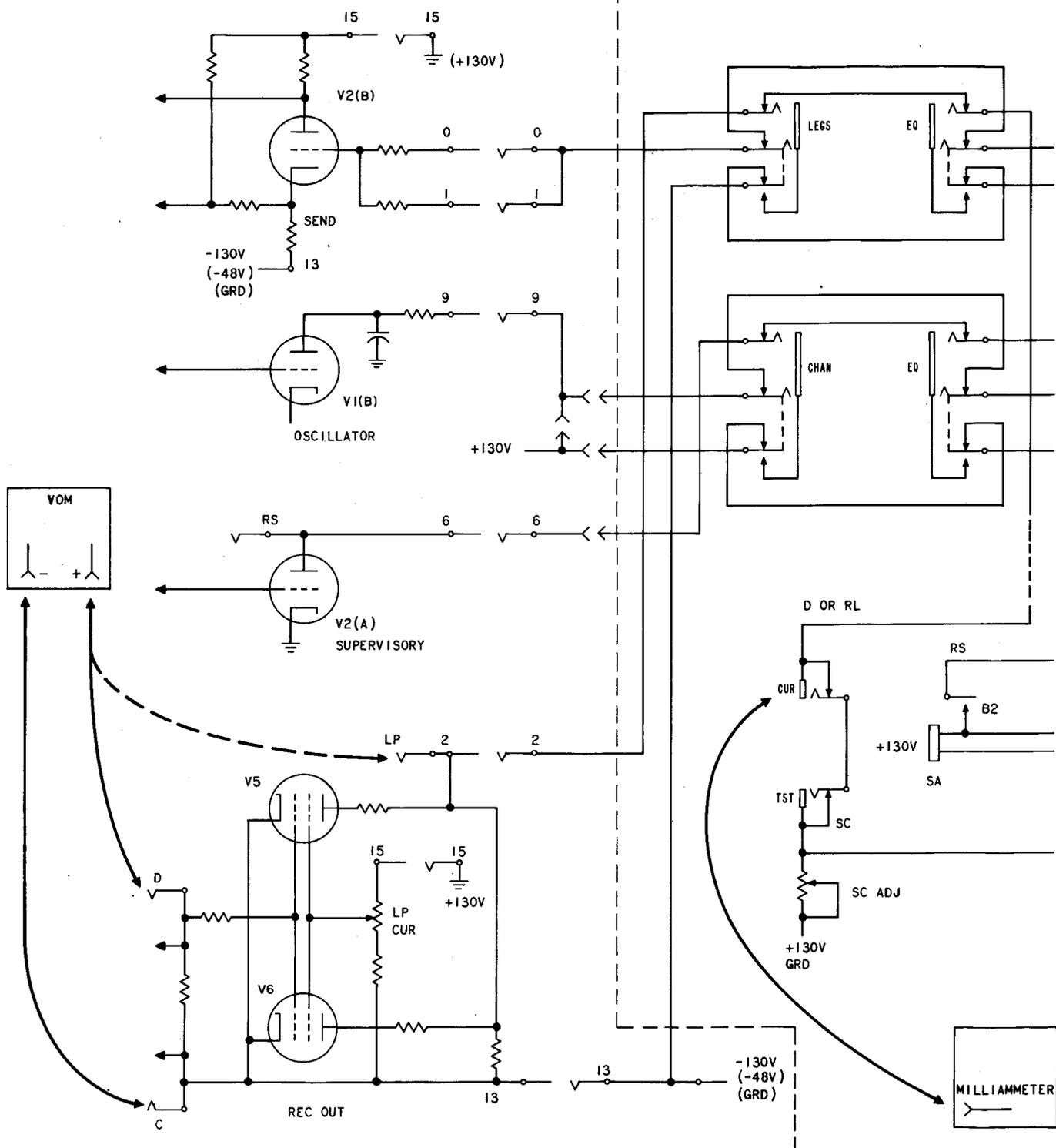


Fig. 9—Test M Connections

STEP

PROCEDURE

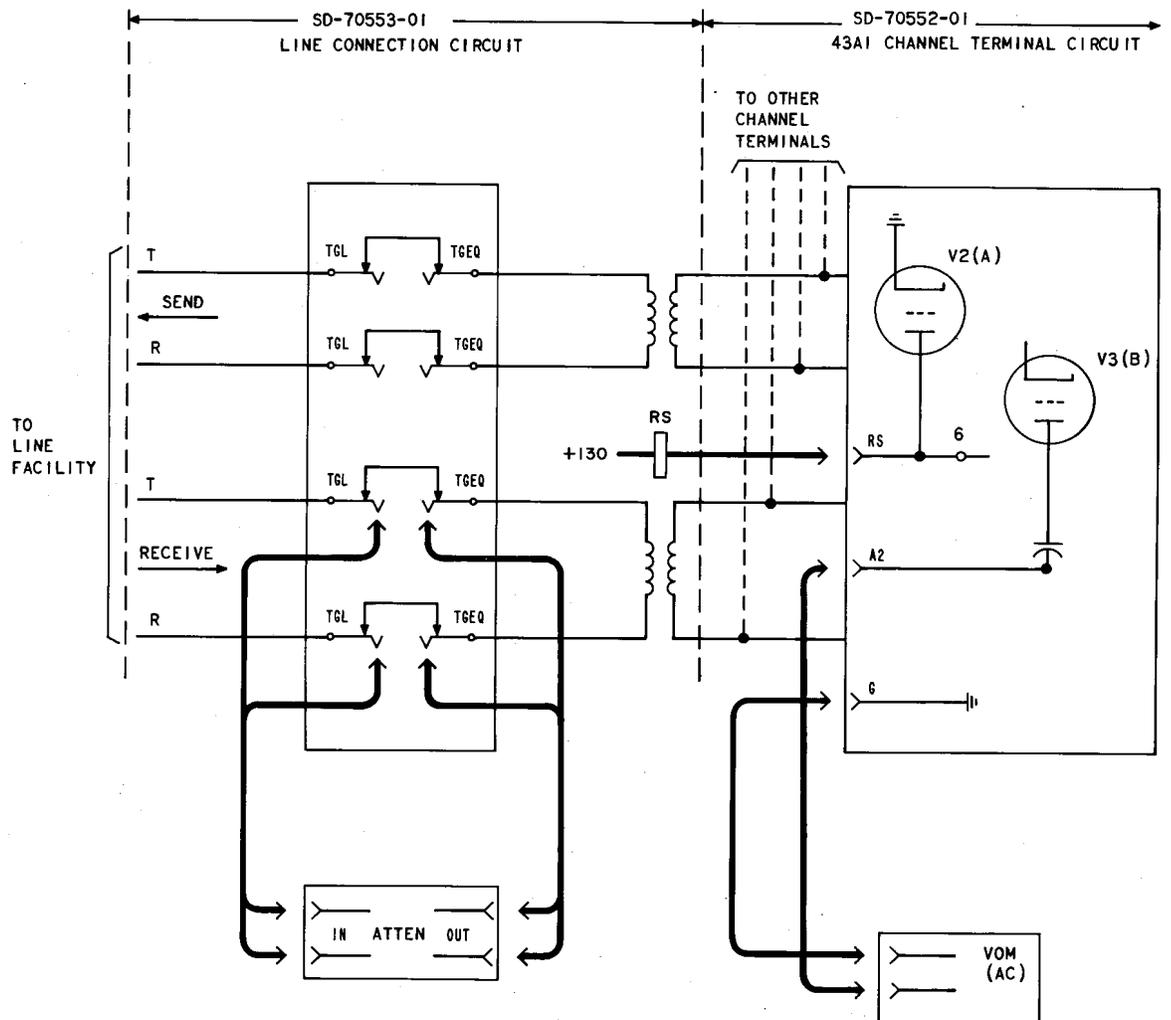


Fig. 10—Test N Connections—Supervisory Features

- 4b If performing an installation test on neutral channel terminal or hub channel terminals which connect to a supervisory relay, identify the supervisory relay associated with the channel under test.

**Requirement:** The RS relay is operated.

- 5b Set the attenuator for a 10-dB loss.

**Requirement:** The RS relay is released.

STEP

PROCEDURE

(If this requirement is not met, adjust the channel terminal REC GAIN control for the proper indication. If the REC GAIN cannot be properly adjusted, V3 is probably faulty. In this case, replace V3 and repeat Steps 4b and 5b to determine if V3 was the cause of the trouble. If the requirements are still not met, refer to the section entitled 165C1 Telegraph Test Set Method of Operation for Maintenance Center Tests of 43A1 Channel Terminals (103-824-502) for additional testing).

- 6c If performing an installation test on a hub channel terminal—  
 At the channel terminal under test—  
 Condition the VOM to measure 60 Vdc, connect the positive (+) VOM lead to pin jack SC, and the negative (-) VOM lead to pin jack G (see Fig. 11).

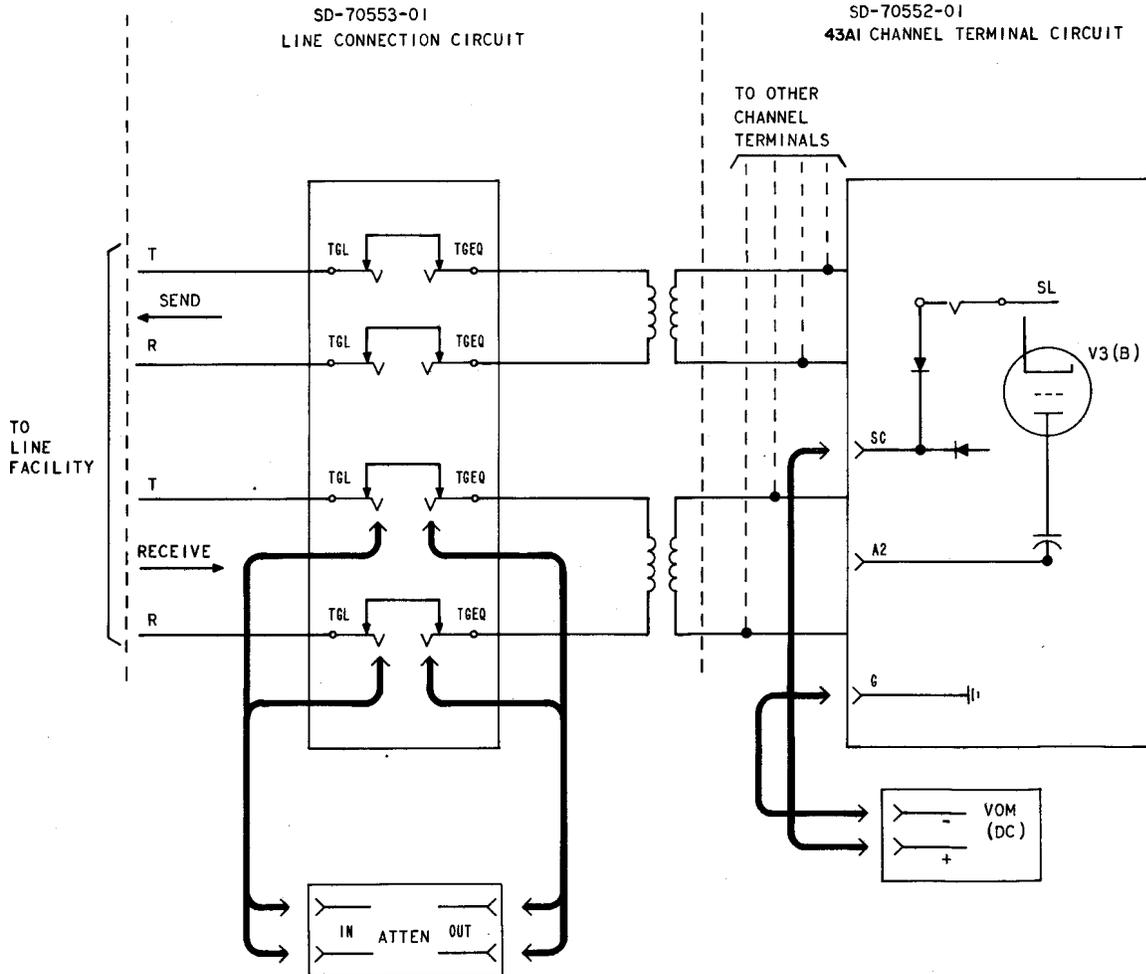


Fig. 11—Test N Connections—Space Hold Feature

STEP	PROCEDURE
	<b>Requirement:</b> VOM indicates $+60 \pm 10$ Vdc (marking condition).
7c	Disconnect the VOM.
8c	Set the attenuator for a 10-dB loss.
9c	Connect the positive (+) VOM lead to pin jack G and the negative (-) VOM lead to pin jack SC.
	<b>Requirement:</b> VOM indicates $-30 \pm 5$ Vdc (spacing condition).
	(If this requirement is not met, adjust the channel terminal REC GAIN control for the proper indication. If the REC GAIN cannot be properly adjusted, V3 is probably faulty. In this case, replace V3 and repeat Steps 7c and 8c to determine if V3 was the cause of the trouble. If the requirements are still not met, refer to the section entitled 165C1 Telegraph Test Set Method of Operation for Maintenance Center Tests of 43A1 Channel Terminals (103-824-502) for additional testing).
10	<b>End of test:</b> Disconnect all test equipment and return the channel to service.

#### O. Overall Lineup Test

- 1a If testing an in-service channel terminal—  
Obtain a circuit release for the channel to be tested.
- 2b If performing an installation test—  
Ensure that the distant terminal is connected and in the marking condition by performing Test D. If not, establish a marking condition in accordance with Test D or local procedures.

#### Single Carrier Section (Fig. 12)

- 3 At the distant terminal—  
Condition the 911-type TSG to transmit 100-word-per-minute (WPM)/5-level (SW) or 150-WPM/8-level (DW) data signals.
- 4c If distant terminal is equipped with a neutral channel terminal—  
Connect the 911-type TSG output to the LPG jack [patch (2) of Fig. 12] associated with the channel terminal under test.  
  
**Note:** When testing FDX channels, use the SEND LPG jack.
- 5d If distant terminal is equipped with a hub channel terminal—  
Connect the 911-type TSG output to the LM jack [patch (1) of Fig. 13] associated with the channel under test.
- 6d Insert a 367A (release) plug into the T jack [patch (2) of Fig. 13] associated with the channel under test.

STEP

PROCEDURE

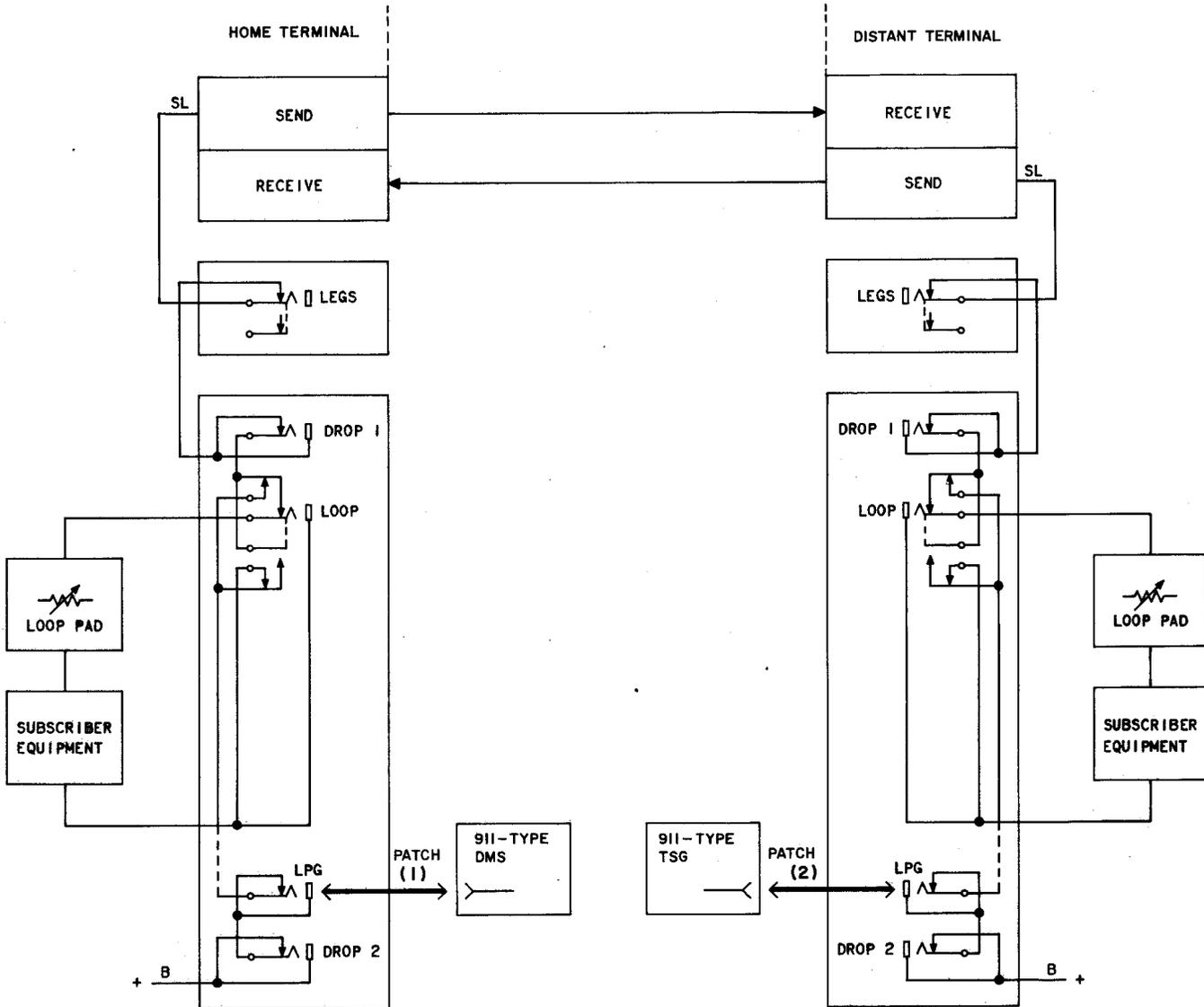


Fig. 12—Test O Connections—Typical Single Carrier Section—Neutral HDX Channel

- 7e If distant terminal is arranged for back-to-back operation (Fig. 14)—  
Connect the 911-type TSG output to the CUR jack [patch (2) of Fig. 14] associated with the channel terminal opposite the one under test.

**Note:** If local loops or interconnecting circuits are provided at the back-to-back location, use the appropriate TLT LPG jack that replaces the CUR jack.

## STEP

## PROCEDURE

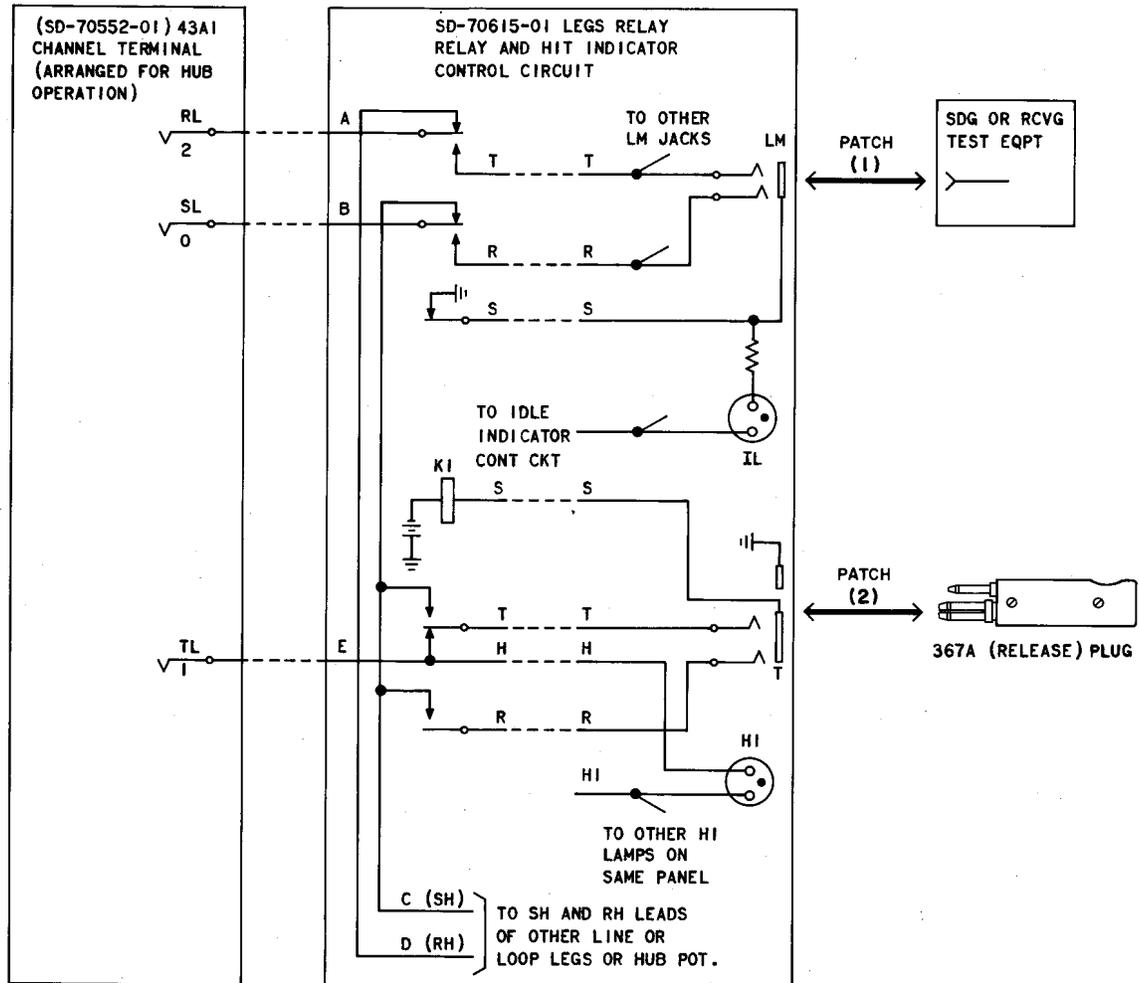


Fig. 13—Test O Connections—Hub Channel Terminal

- 8 At home terminal—  
Condition the 911-type DMS to measure the data signal distortion.
- 9f If home terminal is equipped with a neutral channel terminal—  
Connect the 911-type DMS input to the LPG jack [patch (1) of Fig. 12] associated with the channel terminal under test.
- Note:** When testing FDX channels, use the RECEIVE LPG jack.
- 10g If home terminal is equipped with hub channel terminal—  
Connect the 911-type DMS input to the LM jack [patch (1) of Fig. 13] associated with the channel terminal under test.

STEP	PROCEDURE
11g	Insert the 367A (release) plug into the T jack [patch (2) of Fig. 13] associated with the channel terminal under test.
12h	If terminal is arranged for back-to-back operation— Connect the 911-type DMS input to the TST jack [patch (3) of Fig. 14].
	<b>Note:</b> If local loops or interconnecting circuits are provided at the back-to-back location, use the appropriate TLT LPG jack that replaces the TST jack.
13	At both locations— Momentarily operate the RESET switch on 911-type DMS and TSG.
14	At home terminal— Measure the distortion of the received signal.

**Requirement:** See Table L.

(If this requirement is not met, adjust the channel terminal REC BIAS control for less than 5-percent distortion for SW and 10-percent distortion for DW channels).

**Note:** If the REC BIAS control is at the end of its range in either direction and the requirement has not been met, trouble is indicated. In this case, troubleshoot in accordance with Section 312-700-300 to clear the trouble and then repeat this test.



*If the line facilities are derived from C or H carrier telephone channels, check that the transmitting and receiving oscillator frequencies are within limits. For incorrect frequencies of up to about 10 Hz, each 1-Hz difference causes about 1.5-percent distortion in the telegraph signal. Type N, O, and ON carrier telephone channels have transmitted carrier; therefore, there is no difference between transmitting and receiving channel oscillator frequencies.*

#### Tandem Carrier Section (Fig. 14)

- 15 At distant terminal—  
Condition the 911-type TSG to transmit 100-WPM/5-level (SW) or 150-WPM/8-level (DW) data signals.
- 16i If distant terminal is equipped with a neutral channel terminal—  
Connect the 911-type TSG output to the LPG jack [patch (4) of Fig. 14] associated with the channel terminal under test.
- Note:** When testing FDX channels, use the SEND LPG jack.
- 17j If distant terminal is equipped with a hub channel terminal—  
Connect the 911-type TSG output to the LM jack [patch (1) of Fig. 13] associated with the channel under test.

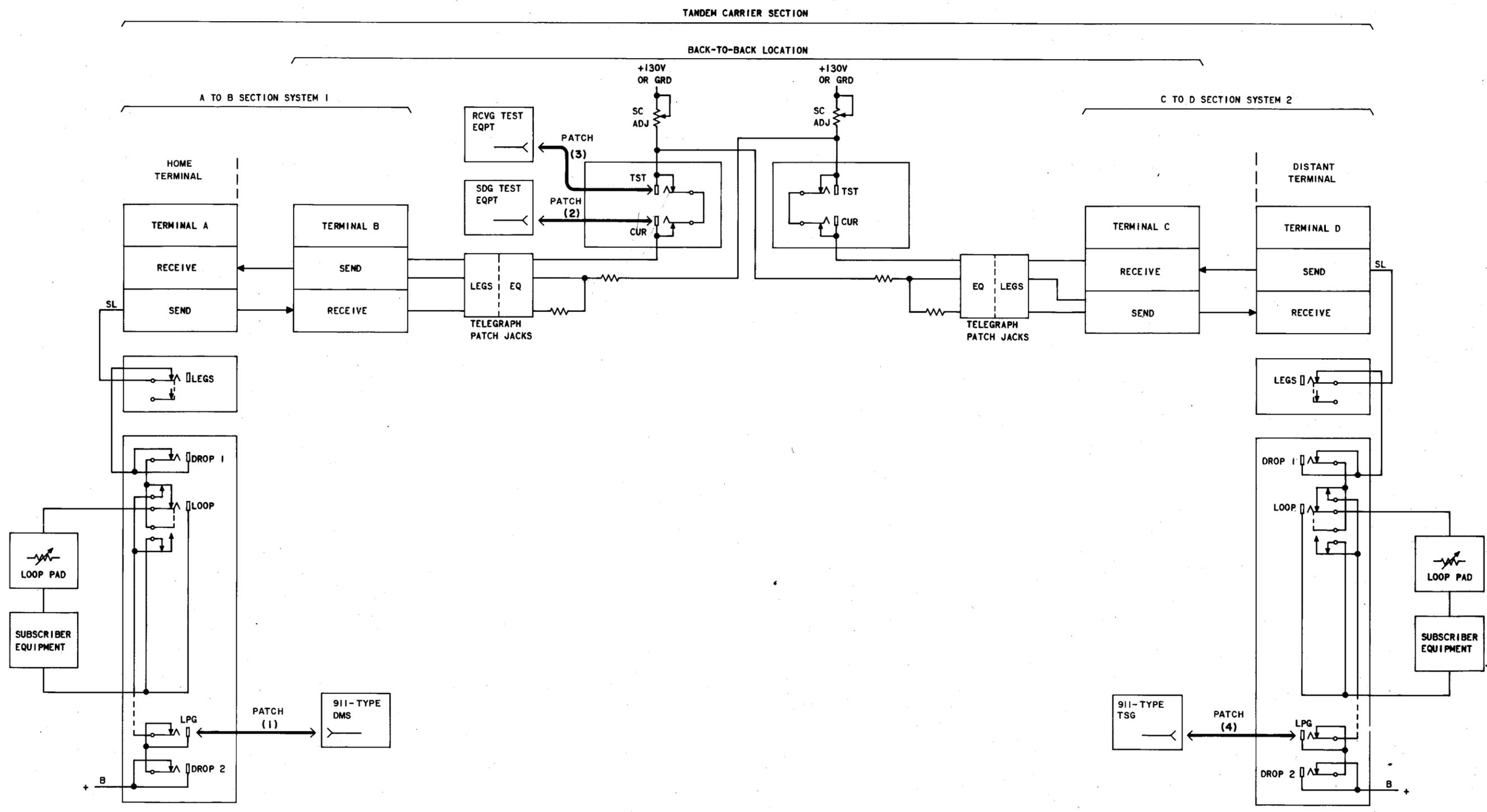


Fig. 14—Test O Connections—Typical Tandem Carrier Section—Neutral HDX Operation

STEP	PROCEDURE
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TABLE L

## TEST O – DISTORTION REQUIREMENTS

TYPE OF CHANNEL TERMINAL	MAXIMUM SIGNAL SPEED (BAUD RATE)	OPTION PROVIDED	TOTAL DISTORTION (INCLUDING BIAS)	
			SINGLE SECT.	TANDEM SECT.
SW	57	XP	0±5%	0±10%
SW	75	XQ	0±5%	0±10%
DW	150	—	0±10%	0±20%

- 18j Insert a 367A (release) plug into the T jack [patch (2) of Fig. 13] associated with the channel under test.
- 19 At home terminal—  
Condition the 911-type DMS to measure the data signal distortion.
- 20k If home terminal is equipped with a neutral channel terminal—  
Connect the 911-type DMS input to the LPG jack [patch (1) of Fig. 12] associated with the channel under test.
- Note:** When testing FDX channels, use the RECEIVE LPG jack.
- 21 At both locations—  
Momentarily operate the RESET switch on 911-type DMS and TSG.
- 22 At home terminal—  
Measure the distortion of the received signal.

**Requirement:** See Table L.

(If this requirement is not met, adjust the channel terminal REC BIAS control for less than 5-percent distortion for SW channels and 10-percent distortion for DW channels).

**Note:** If the REC BIAS control is at the end of its range in either direction and the requirement has not been met, trouble is indicated. In this case, troubleshoot in accordance with Section 312-700-300 to clear the trouble and then repeat this test.



**If the line facilities are derived from C or H carrier telephone channels, check that the transmitting and receiving oscillator frequencies are within limits. For incorrect frequencies of up to about 10 Hz, each 1-Hz difference causes about 1.5-percent distortion in the telegraph signal. Type N, O, and ON carrier telephone channels have transmitted carrier; therefore, there**

STEP	PROCEDURE
	<i>is no difference between transmitting and receiving channel oscillator frequencies.</i>
	(If this requirement still cannot be met, perform Steps 3 through 14 on each single carrier section of the system.)
23l	If testing a single carrier section— Perform Steps 3 through 14 for the other direction of transmission, this time making the distant terminal the home terminal and vice versa.
24m	If testing a tandem carrier section— Perform Steps 15 through 22 for the other direction of transmission, this time making the distant terminal the home terminal and vice versa.
25	<b>End of test:</b> Disconnect all test equipment and report channel ready for service or continue installation testing.

**P. 453-Type Send Network Test**

- 1a If testing the send network of an in-service channel terminal—  
Obtain a circuit release for the channel terminal to be tested.
- 2 Connect the frequency counter to a 117-volt, 60-Hz power source, set the POWER switch to ON, and allow a sufficient warm-up time.
- 3 At the channel terminal being used for test—  
Set the SEND switch to HM.
- 4b If performing an installation test—  
Ensure that distant terminal is connected and in the marking condition by performing Test D. If not, establish a marking condition in accordance with Test D or local procedures.
- 5 Connect frequency counter to pin jacks SA and G (Fig. 15).
- 6 Record the frequency counter indication on the TCLR card as the ***channel terminal high-frequency reference.***

**Requirement:** See Table M.

(If this requirement is not met, adjust the OSC control (Fig. 2) on network under test for correct frequency.)

**Note:** If testing a SW network and the frequency cannot be made to meet the requirements with the OSC switch, remove the network, adjust the strap in accordance with Fig. 2, and repeat this test. If testing a DW network and the frequency cannot be made to meet the requirement with the OSC control, replace the faulty network and repeat this step.

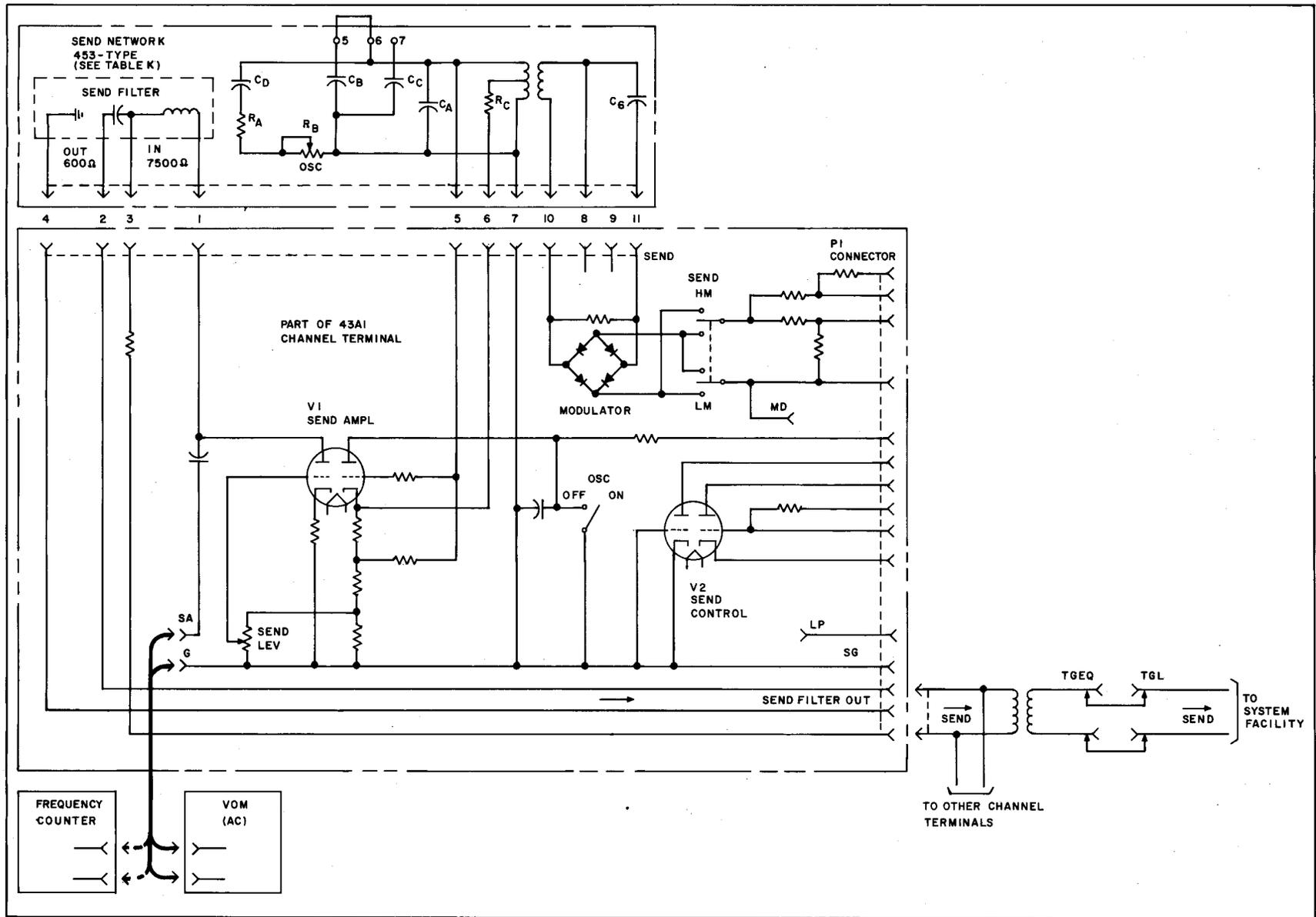


Fig. 15—Test P Connections—43A1 Channel Terminal and Send Network

TABLE M

## SEND NETWORK FREQUENCY REQUIREMENTS

CHANNEL NUMBER	NETWORK CODE (453-)	NETWORK TYPE	CHANNEL FREQUENCY (HZ)	
			HIGH	LOW
1	AE	SW	460±1	390±3
2	A		630±1	560±3
3	B		800±1	730±3
4	C		970±1	900±3
5	D		1140±1	1070±3
6	E		1310±1	1240±3
7	F		1480±1	1410±3
8	AA		1650±1	1580±3
9	G		1820±1	1750±3
10	H		1990±1	1920±3
11	J		2160±1	2090±3
12	K		2330±1	2260±3
13	L		2500±1	2430±3
14	M		2670±1	2600±3
15	AB		2840±1	2770±3
16	AC		3010±1	2940±3
17	AD		3180±1	3110±3
51	AK	DW 24	1430±1	1290±3
52	AL		1770±1	1630±3
53	AM		2110±1	1970±3
54	AN		2450±2	2310±3
55	AP		2790±1	2650±3
56	AR		3130±1	2990±3

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STEP	PROCEDURE
7	At channel terminal being used for test— Set the SEND switch to LM.
8	Record the frequency counter indication on the TCLR card as the <i>channel terminal low-frequency reference</i> .  <i>Requirement:</i> See Table M.  (If this requirement is not met, replace the network and repeat Steps 3, 6, 7, and 8.)
9	<i>End of test:</i> Disconnect all test equipment and return the channel to service.

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