43A1 VOICE-FREQUENCY CARRIER TELEGRAPH (VFCT) SYSTEM

(J70112-)

MAINTENANCE PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section describes the procedures for performing routine maintenance and isolating troubles in the 43A1 VFCT systems. The test procedures referenced in the following text and figures may be found in Section 312-700-500.

This section is written with the assumption that the reader has a general knowledge of the 43A1 VFCT system. This information may be found in Section 312-700-100.

1.02 This section is reissued to:

(a) Delete obsolete information.

(b) Include information pertaining to the 262-type electronic switch and 4143-type network that replace the 429A electron tubes.

(c) Include information pertaining to the KS-type hybrid integrated networks (HINs) that replace the 407A and 408A electron tubes.

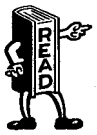
(d) Include information previously given in Sections 312-700-301, 312-700-302, 312-700-303, and 312-702-501. With the publication of this practice, the sections listed above are canceled.

(e) Change the format of this section to conform to the standard BSP format specification.

Since this is a general revision, arrows normally used to indicate changes have been omitted.

1.03 ***Routine maintenance.*** These routine tests are intended to check the conditions of the electron tubes, electronic switches (262-type) and networks (4143-type), and KS-type HINs on an "in-service" basis.

1.04 Installation (circuit order) tests refer to the tests that are to be performed following the completion of circuit order work that initially places a channel or system in service or rearranges a system already in service.



When circuit order work that is done subsequent to the initial installation testing involves changes that will affect the initial adjustment and previously recorded test results, only the tests for the adjustments affected need be performed.

The installation tests are indicated in the CO column of Table A and are to be performed in the order given.

1.05 ***Maintenance activities*** refer to the troubleshooting tests and procedures that are to be performed in order to isolate a faulty unit in a 43A1 VFCT system. The tests to be performed for troubleshooting procedures are indicated in the MA column of Table A.

1.06 There are four types of MA tests:

(a) ***MA/LINE:*** Tests indicated in this column are to be done in the order given when the trouble is identified as being on the line (VF) side of the channel.

(b) ***MA/LOOP:*** Tests indicated in this column are to be done in the order given when the trouble is identified as being on the loop (dc) side of the channel.

Note: The MA/LINE and MA/LOOP tests may be done on an in-service basis without interruption of customer service. Therefore, it is not necessary to patch the channel to a spare channel or obtain a circuit release prior to performing these tests.

(c) ***MA/TD:*** Tests indicated in this column are to be done in the order given after a channel has been turned down or patched to a spare channel following the unsuccessful performance of an MA/LINE or MA/LOOP test.

(d) ***MA/TR:*** Tests indicated in this column are to be done in the order given following the replacement of any electron tube, electronic switch (262-type) or network (4143-type), or KS-type HIN.

2. MAINTENANCE AIDS

2.01 The following BSPs and schematic drawings (SDs) contain information that may be helpful in troubleshooting the 43A1 VFCT system.

SECTION	TITLE
100-635-101	Electron (Vacuum) Tube Test Set—KS-15560-L1 and -L2 Hickok Tube Testers—Description and Application
100-635-501	Western Electric Electron Tube Test Data—KS-15560-L1 and -L2 Tube Testers
312-405-300	96A1 Electronic Loop Repeater—Summary of Tests
312-700-500	43A1 Voice-Frequency Carrier Telegraph (VFCT) System—Test Procedures

NUMBER	TITLE
SD-70552-01	43A1 Carrier Telegraph Channel Terminal
SD-70553-01	Carrier Telegraph Line Connection Circuit
SD-70572-01	Test and Miscellaneous Jack Circuits (With Loop Pads)
SD-70573-01	DC Loops in Testboard Offices (Application Schematic)
SD-70544-01	Carrier Failure Alarm Circuit
SD-70515-01	Interconnection Circuits
SD-95692-01	Application Schematic
SD-70358-01	Line and Miscellaneous Jack Circuits.

2.02 The amount and type of test equipment required at a given office will vary with the number of channel terminals installed. The maintenance activities and tests given in this section

TABLE A

SUMMARY OF 43A1 VFCT CHANNEL TESTS

TEST OR ADJUSTMENT	REFERENCES		PERFORM TEST FOR					TEST BETWEEN TEST POINTS	REQUIREMENTS	REMARKS
				MA						
	BSP	TEST	CO	LINE	LOOP	TD	TR			
*Electron tube test	100-635-101 and 100-635-501	— —	AR	AR	AR	AR	AR	— —	As given on roll chart of tube tester or in 100-635-501	Use KS-15560-L1 or -L2 tube tester and/or tube test data in 100-635-501.
*Electron tube, electronic switch, 4143-type network, and HIN test	103-824-502	—	AR	AR	AR	AR	AR	—	Per 103-824-502	Use 165C telegraph test set.
*Electron tube, electronic switch, 4143-type network, and HIN replacement	—	—	AR	AR	AR	AR	—	—	—	Replacement tubes, switches, networks, and HINs should be tested prior to placing in service. Make all tests indicated by X in TR column after replacement.
Filament voltage test: In offices using −24 plant	312-700-500	C	X	X	X	X	X	FA-FB at filament panel	23 to 25 Vdc with HINs	Adjust using FIL ADJ on panel.
Filament voltage test: In offices using −48 plant to supply channel terminals in pairs	312-700-500	C	X	X	X	X	X	FA-FB and FB-FC at filament panel	21 to 25 Vdc with tubes	Adjust using FIL ADJ on panel.
*Sending level test	312-700-500	P/O E or F	X	—	—	X	X	—	See toll circuit layout record card	Adjust with SEND LEV control on chan term.
Loop current: 20-mA service	312-700-500	P/O H, I, J, or K	X	—	X	X	X	—	19 to 21 mA	Loop voltage (LP-C) must be 78 to 82 Vdc.
Loop current: 62.5-mA service	312-700-500	P/O H, I, J, or K	X	—	X	X	X	—	60 to 65 mA	Loop voltage (LP-C) must be 78 to 82 Vdc.
Loop current: Back-to-back	312-700-500	P/O H, I, J, or K	X	—	X	X	X	—	62.5 mA	Loop voltage (LP-C) must be 80 Vdc.
Receive gain — for terminals equipped with carrier failure alarm or terminals arranged for any use of dc amplifier V2(a)	312-700-500	N	X	—	—	X	X	—	Correct operation of RS relay	Adjust using REC GAIN of chan term. This sets up the carrier failure alarm level.
Receive reference voltage	312-700-500	P/O N	—	X	—	X	—	SC to G	+60 ±10 Vdc (marking cond.) −30 ±5 Vdc (spacing cond.)	Adjust using REC GAIN control on chan term. Check tube or HIN in V3 and replace 454-type receive network.
*Overall lineup test	312-700-500	O	X	—	—	X	X	—	Refer to BSP 312-700-500, Table L, distortion requirements	All channels.
*Hub operation test	312-700-500	L	X	—	—	X	X	—	Position TTY runs closed, IL lamp lighted	TTY SET plug inserted in LM jack and 367A plug inserted in T jack of chan term under test.
*453-type send network test	312-700-500	P	X	—	—	X	X	D-C on HDX chan term	D negative with respect to C	Use KS-16979-L1 type VOM, or equivalent.
*453-type send network test	312-700-500	P	X	—	—	X	X	SA-G on HDX or FDX chan term	High frequency ±1 Hz, low frequency ±3 Hz	Use Hewlett-Packard 5211A frequency counter, or equivalent.

Legend:

* — These tests require a release of the channel prior to their performance.

CO — Circuit order test to be performed in the order given following the initial installation of a channel or system.

mA — Maintenance activity test to be performed when trying to isolate a faulty unit to be performed as follows:

TR — After tube, electronic switch, network, or HIN replacement.
TD — After turning down a channel or system to perform maintenance activities.
AR — Perform as required following the failure of a channel terminal to meet any test requirements.

require the following test equipment or equipment capable of measuring the following:

(a) Current and dc voltage—KS-16979-L1 volt-ohm-milliammeter (VOM), or equivalent

(b) AC voltage—403-type voltmeter, or equivalent

(c) Power in dBm—Stelma KS-19935-type telegraph carrier test set (TCTS)

(d) Distortion and bias in data signals at speeds up to 150 baud—911-type distortion measuring set (DMS), or equivalent

Note: In addition, a 911-type test sentence generator (TSG), or equivalent, is required to send data signals at speeds up to 150 baud.

(e) Frequencies between 300 and 3200 Hz—72A frequency meter, or equivalent.

Note: In addition, a 21A transmission measuring set (TMS), or equivalent, is required to send frequencies between 300 and 3200 Hz.

2.03 When these maintenance procedures are to be performed on a channel terminal located at the customer premises, the following test equipment may be required in addition to the usual tools and instruments:

- KS-16979-L1 VOM, or equivalent
- 911-type data test set (DTS), or equivalent
- 509-type high-impedance receiver, or equivalent.

Note: It is assumed that sending level tests and adjustments to channel terminals located on customer premises will be done using the appropriate test in Section 312-700-500.

2.04 There are no special tools required for the performance of these procedures.

3. MAINTENANCE ACTIVITIES

3.01 This part describes the procedure to be followed when trying to isolate a trouble in a 43A1 VFCT system.

A. General Maintenance Considerations

Channel Terminations

3.02 The type of termination and jack arrangement for the 43A1 channel terminal varies with the type of telegraph board at a particular office. The most common arrangement is the high-voltage hub termination with the number 2 or 9B serviceboard.

Note: Some long lines hub offices will be equipped with the data observing test center (DOTC).

The usual arrangement for smaller offices is the seven and eight jack telegraph loop termination (TLT) circuits with the number 9 testboard. Typical TLT arrangements are shown on SD-70572-01 and SD-70573-01.

The procedures in this section assume that the channel terminal under test is accessible from a testboard (eg, LEG MULT jacks of the No. 2 serviceboard).

3.03 Full-duplex (FDX) loops are developed on hubbed channels by use of 96A-type electronic repeaters, or equivalent. The send and receive loops of the hub channel terminal are connected through 96A-type repeaters to the hub send and receive potentiometers. The repeaters convert the loop signals to hub signals and vice-versa. In the case of neutral channel terminals, loop current pads are provided. In addition, it is also necessary to provide loop pads in the loop terminations. Half-duplex (HDX) circuits require one loop pad per channel circuit, while FDX circuits require two loop pads per channel circuit.

Power Supply

3.04 The filament, plate, and telegraph battery voltages for the channel terminal are provided through proper fusing by the regulated office battery supplies. Filament voltage is supplied to the channel terminal by the common 24- or 48-volt plant filament battery. Refer to the office wiring list and SD-70552-01 (in offices equipped with filament potentiometers) or SD-70626-01 (in offices equipped with strapping bus at the top of the bays) for the specific office application of the filament supply.

3.05 In offices where the filament voltage is adjustable, the voltage should be checked in accordance with Test C of Section 312-700-500 whenever:

(1) Channel terminals are removed or added to the bay

(2) Any tubes are replaced by 262-type switches, 4143-type networks, and/or KS-type HINs.

3.06 The channel terminals require a plate potential of +130 volts on all tubes except V5 and (neutral channel terminals only) V6. In neutral channel terminals, the plate voltage for V5 and V6 is supplied by the telegraph battery and is determined by the dc loop option (20- or 62.5-mA operation) of the particular channel terminals. However, in all cases, the plate-to-cathode potential is the same, due to adjustment of the loop resistance and screen voltage. In hub channel terminals, plate voltage for tube V5 is supplied by the hub potentiometer (HUB POT).

Note: The plate and filament fuses associated with a channel terminal which is not immediately placed in service may be removed after the initial tests and adjustments are complete.

Maintenance Reduction Procedures

3.07 The operation of the 43A1 VFCT system may be improved with a reduction of required maintenance activities as follows.

(1) In all offices except those where filament voltage is provided by the 48-volt plant and supplied to the channel terminals in pairs, certain tubes may be removed from the channel terminals when only one-way service is required.

(a) For ***receive only*** channel terminals, V1 and V8 may be removed.

(b) For ***send only*** channel terminals, V3 through V8 may be removed.

(2) The 429A tubes may be replaced by the 262-type switch and 4143-type network.

(3) The 407A and 408A tubes should be replaced by the KS-type HINs.

Note: In all offices where filament voltage is provided by the 48V plant, all 407A and 408A tubes can be replaced by KS-type HINs after change has been made to the mounting unit. Refer to SD-70552-01 for information on changes required to the mounting unit.

B. Troubleshooting

General

3.08 A summary of tests for the 43A1 VFCT system is given in Table A. The REQUIREMENTS column is provided to allow personnel who are familiar with the tests to bypass the step-by-step procedures given in Section 312-700-500.

Note: When the following tests call for substituting a HIN or tube during the trouble clearing procedure, a filament voltage test is also made. When a HIN is substituted for another HIN, the filament voltage test may be omitted due to the negligible current drain of the HIN.

3.09 Faults in the 43A1 VFCT system are normally identified by (1) fuse alarms, (2) customer reports, (3) carrier failure alarms (if A1 level variation detector or equivalent is provided with hub channels), or (4) by signal degradation detected by the DQM (if provided). Once the trouble has been identified, the following flowcharts and paragraphs are to be used to organize the trouble investigation and minimize the amount of time spent locating the faulty unit:

(a) Fuse alarms—Fig. 1 and 3.11

(b) Customer-reported troubles—Fig. 2 and 3.12 ***or*** Fig. 3 and 3.13

(c) Carrier failure alarms—Fig. 4 and 3.14.

3.10 In Fig. 1, 2, 3, and 4, the expression "chan term" refers to the channel terminal plug-in chassis complete with tubes, electronic switch and network, and/or HINs. It is assumed that the 453- and 454-type networks will be removed from a faulty channel terminal and placed in the replacement channel terminal.

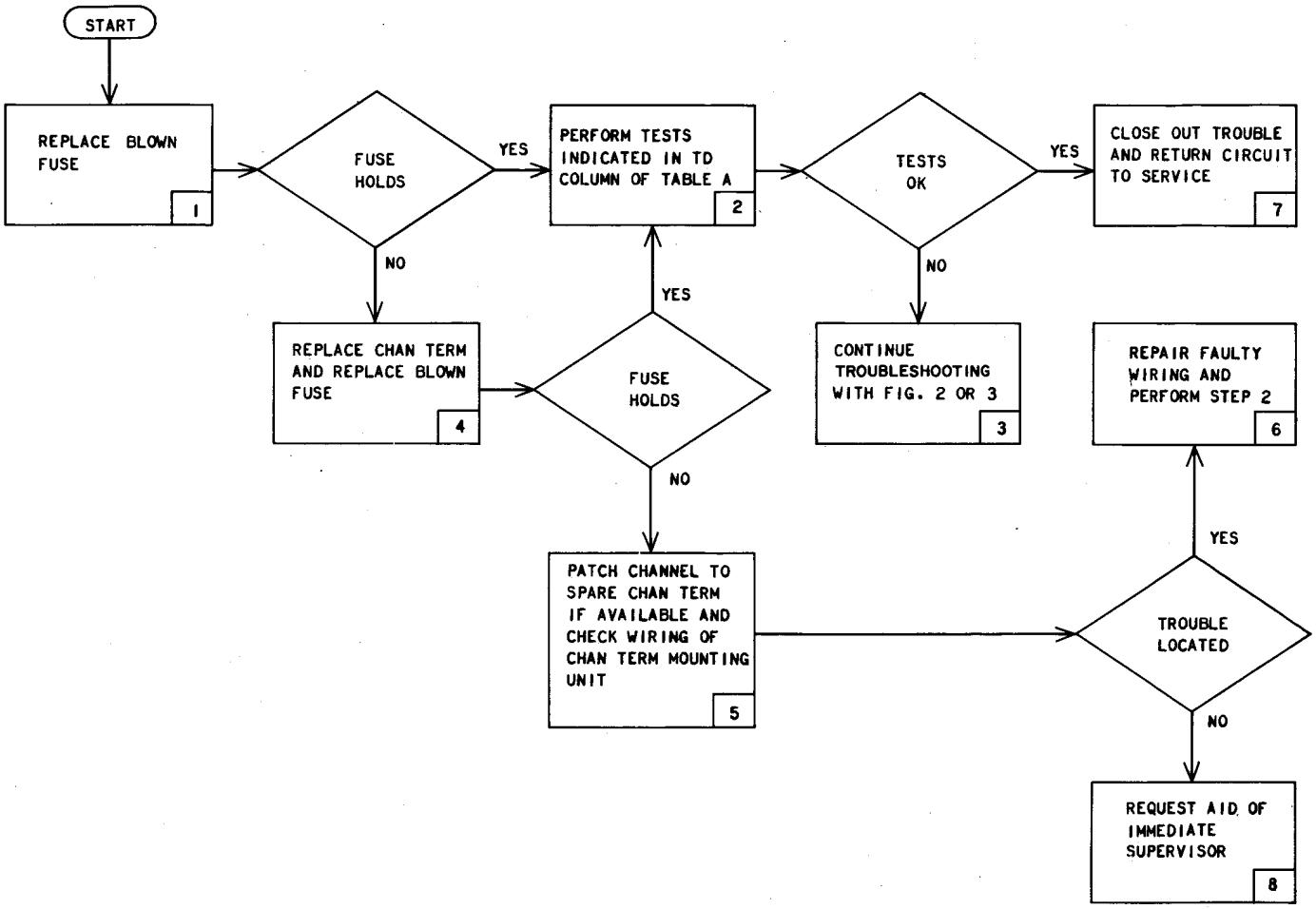


Fig. 1—Troubleshooting Flowchart for Fuse Alarms (3.12)

Caution: The terminals on the 453- and 454-type networks can be damaged if an attempt is made to place the 453-type network in the 454-type network position and vice versa. When replacing a HIN make sure all pins are properly aligned before attempting to insert it in the socket. Failure to observe this precaution will result in equipment damage (blown HIN).

The numbers in the corner of the blocks on Fig. 1, 2, 3, and 4 refer to the step number of the paragraph associated with that flowchart.

Fuse Alarms (Fig. 1)

3.11 When a fuse alarm is activated, commence troubleshooting with Fig. 1 and the following.

(1) Locate the blown fuse and replace it with one of the same type.

(2) If the replacement fuse holds, perform the tests indicated in the TD column of Table A. If the channel terminal meets the requirements of all tests, proceed to Step (7); if not, continue with Step (3).

(3) If the channel terminal fails to meet the requirements of any test, continue troubleshooting with 3.12 (Fig. 2) ***or*** 3.13 (Fig. 3).

(4) If the replacement fuse also blows, replace the channel terminal with one that is known to be operating properly and replace the blown fuse. If the fuse holds, perform Step (2).

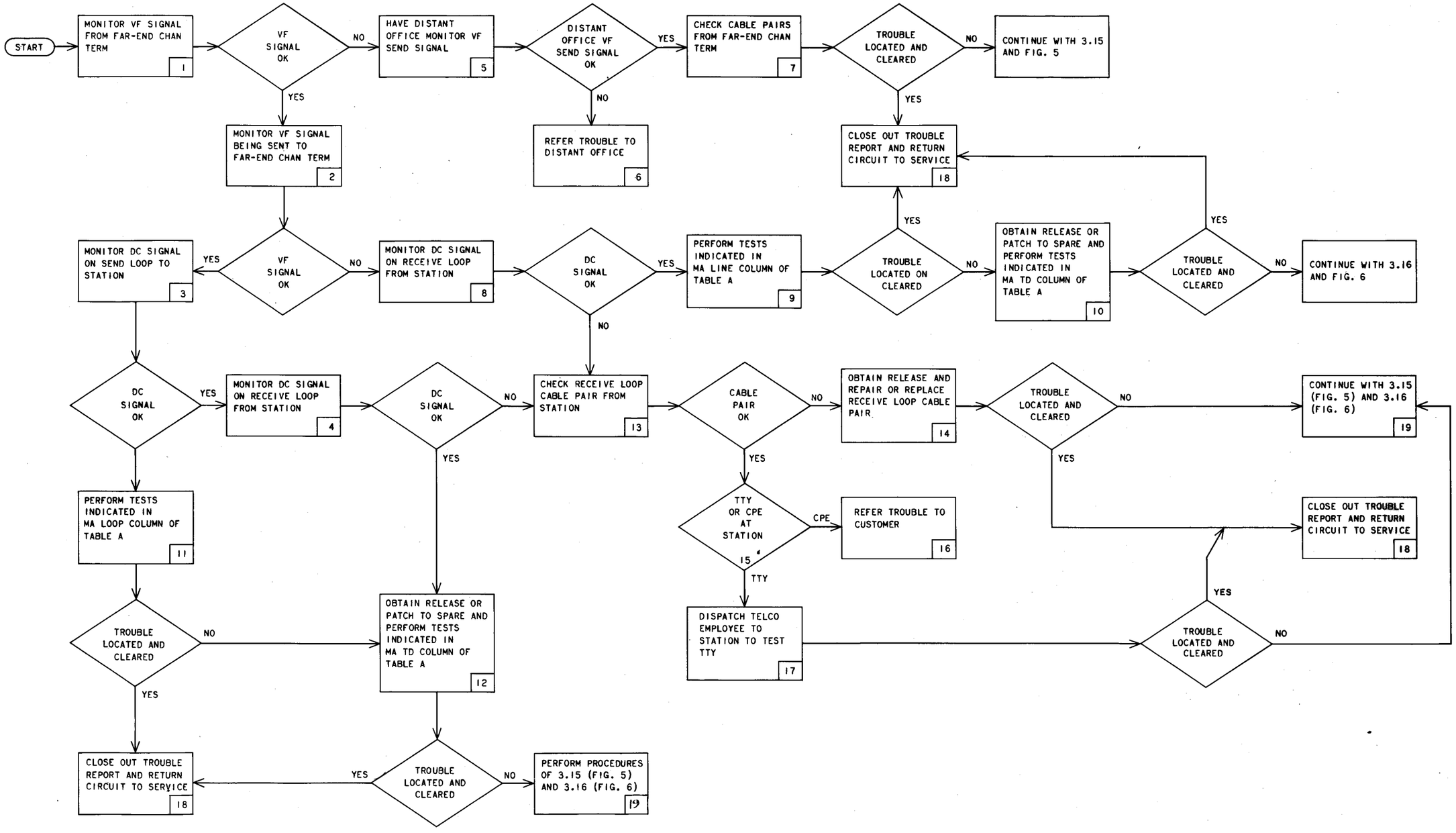


Fig. 2—Troubleshooting Flowchart for Channels Using DC Loops to the Station

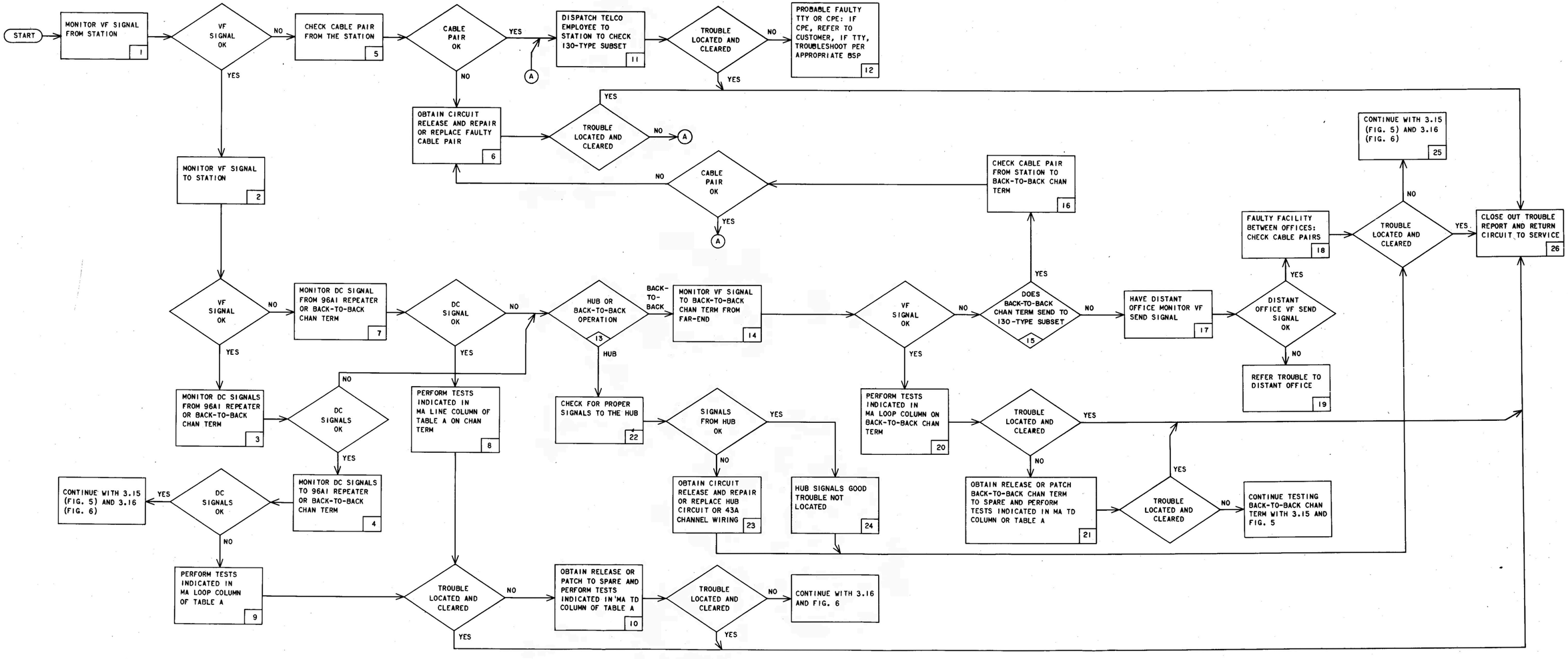


Fig. 3—Troubleshooting Flowchart for Channels Terminated at Customer Premises in a 130-Type Subscriber Set (3.13)

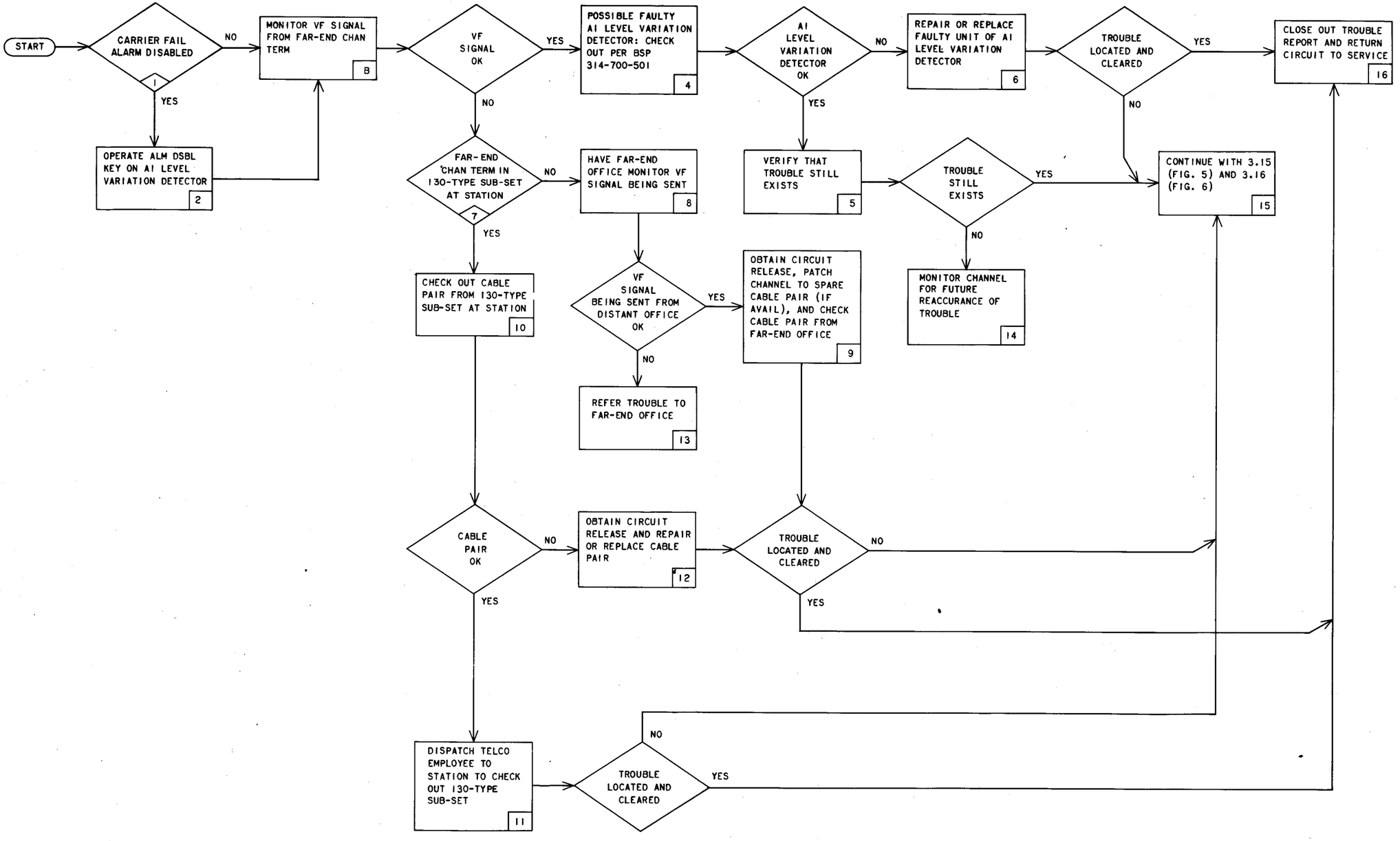


Fig. 4—Troubleshooting Flowchart for A1 Level Variation Detector Alarms (3.14)

(5) If, after replacing the channel terminal and fuse, the replacement fuse again blows, patch the channel to the spare channel terminal and check the wiring of the channel terminal mounting unit per SD-70552-01. If the trouble (wiring fault) is not located, proceed to Step (8).

(6) If the trouble is located, repair the wiring fault and perform Step (2).

(7) When the channel terminal has met the requirements of all tests in the TD column of Table A, close out the trouble report and return the channel to service in accordance with local policy.

(8) If the trouble (wiring fault) cannot be located, request the aid of the immediate supervisor.

Customer-Reported Troubles (Fig. 2 and 3)

3.12 ***DC Loops:*** When a customer reports a trouble on a channel using a dc loop to the customer, commence troubleshooting with Fig. 2 and the following.

(1) Using the Stelma KS-19935-type TCTS, monitor the VF signal being received from the distant-end office. If the received signal is good, continue with Step (2); if not, proceed to Step (5).

(2) Using the KS-19935-type TCTS, monitor the VF signal being sent to the far-end channel terminal. If the signal being sent is good, continue with Step (3); if not, proceed to Step (8).

(3) Using a test machine of the proper speed, monitor the dc signal being sent to the customer on the send loop. If the test machine runs closed, continue with Step (4); if not, proceed to Step (11).

(4) Using a test machine of the proper speed, monitor the dc signal being received from the customer on the receive loop. If the test machine runs closed, proceed to Step (12); if not, proceed to Step (13).

(5) Have the telephone company (telco) employee at the distant office monitor the VF signal being sent by the far-end channel terminal. If the signal is good, proceed to Step (7); if not, perform Step (6).

(6) Refer the trouble to the distant office for further trouble isolation.

(7) Check the cable pair from the far-end channel terminal. If the trouble can be located and cleared, perform Step (18); if not, continue troubleshooting with 3.15 (Fig. 5).

(8) Using a test machine of the proper speed, monitor the dc signal on the receive loop from the customer. If the machine runs closed, continue with Step (9); if not, proceed to Step (13).

(9) Perform the tests indicated in the MA/LINE column of Table A. If the trouble can be located and cleared, perform Step (18); if not continue with Step (10).

(10) If a spare channel is available on the system, patch the circuit to the spare and perform the tests indicated in the MA/TD column of Table A. If a spare is not available, obtain a circuit release and perform the MA/TD tests. If the trouble can be located and cleared, perform Step (18); if not, continue troubleshooting with 3.16 (Fig. 6).

(11) Perform the tests indicated in the MA/LOOP column of Table A. If the trouble can be located and cleared, perform Step (18); if not, continue with Step (12).

(12) Obtain a release or patch the channel to a spare circuit (if available) and perform the tests indicated in the MA/TD column of Table A. If the trouble can be located and cleared, perform Step (18); if not, continue with 3.15 (Fig. 5) and 3.16 (Fig. 6).

(13) Check the receive loop cable pair. If the cable pair checks good, proceed to Step (15); if not, continue with Step (14).

(14) Obtain a circuit release for the local loop and repair or replace the faulty cable pair. If the trouble can be located and cleared, perform Step (18); if not, perform Step (19).

(15) Determine if the station is equipped with a teletypewriter (TTY) or customer-provided

equipment (CPE). If CPE is provided, perform Step (16); if a TTY is provided, proceed to Step (17).

(16) The CPE is probably faulty. Refer the trouble to the customer for further action.

(17) Dispatch a telco employee to the customer premises to troubleshoot the TTY. If the trouble can be located and cleared, perform Step (18); if not, perform Step (19).

(18) When the trouble has been located and cleared, close out the trouble report and return the circuit to service in accordance with local policy.

(19) When the dc signal from the channel terminal is not good, or all signals to and from the channel terminal are found to be good and the trouble is not located and cleared by doing the tests indicated in the MA/LOOP and MA/TD columns of Table A, continue troubleshooting with 3.15 (Fig. 5) ***and*** 3.16 (Fig. 6).

3.13 ***VF Loops Terminated in a 130-Type Subset:*** When a customer reports a trouble on a channel that terminates at the customer location in a 130-type subscriber set (subset), commence troubleshooting with Fig. 3 and the following.

(1) Using the KS-19935-type TCTS, monitor the VF signal being received from the station. If the VF signal is good, continue with Step (2); if not, proceed to Step (5).

(2) Using the KS-19935-type TCTS, monitor the VF signal being sent to the station. If the VF signal being sent is good, continue with Step (3); if not, proceed to Step (7).

(3) Use the TTY cord circuit with associated position machine or other test machine of the correct speed to monitor the dc signal from the 96A1 repeater (hub arrangement) or back-to-back channel terminal. If the test machine runs closed, continue with Step (4); if not, proceed to Step (13).

(4) Use the TTY cord circuit with associated position machine or other test machine of the correct speed to monitor the dc signal from the 96A1 repeater (hub arrangement) or back-to-back channel terminal. If the test machine runs closed, continue troubleshooting with 3.15 (Fig. 5) ***and*** 3.16 (Fig. 6); if not, proceed to Step (9).

(5) Check the cable pair from the station. If the cable pair is found to be faulty, continue with Step (6); if not, proceed to Step (11).

(6) Obtain a circuit release and replace or repair the faulty cable pair. If the trouble can be located and cleared, proceed to Step (26); if not, perform Step (11).

(7) Use the TTY cord circuit with associated position machine or other test machine of the correct speed to monitor the dc signal from the 96A1 repeater (hub arrangement) or back-to-back channel terminal. If the test machine runs closed, continue with Step (8); if not, proceed to Step (13).

(8) Perform the tests and procedures indicated in the MA/LINE column of Table A. If the trouble is located and cleared, perform Step (26); if not, proceed to Step (10).

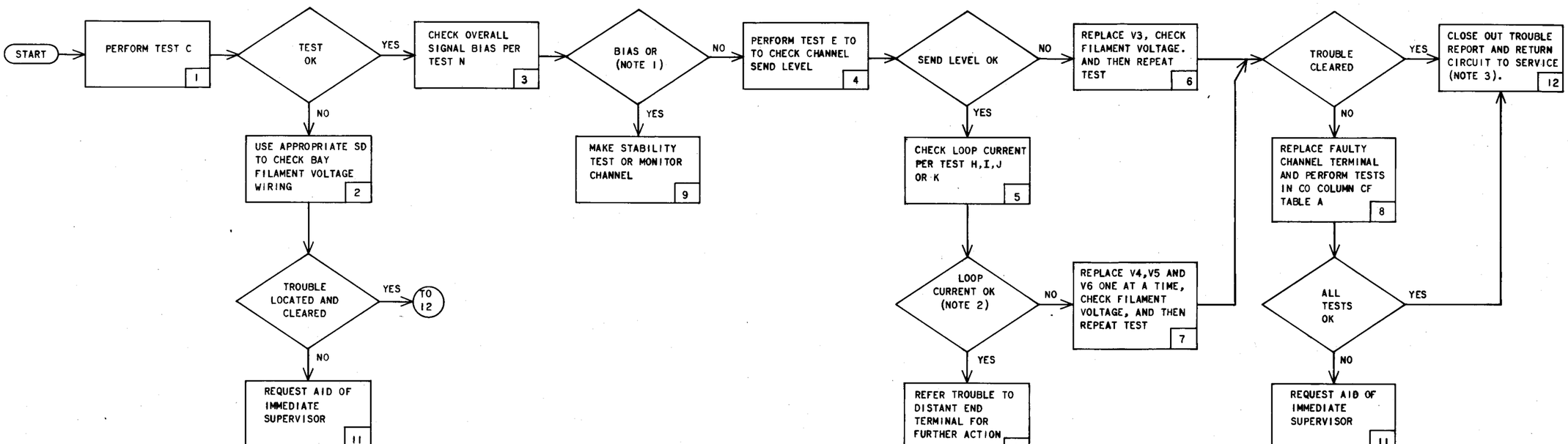
(9) Perform the tests and procedures indicated in the MA/LOOP column of Table A. If the trouble is located and cleared, perform Step (26); if not, continue with Step (10).

(10) Obtain a circuit release or patch the channel to a spare (if available) and perform the tests and procedures indicated in the MA/TD column of Table A. If the trouble is located and cleared, perform Step (26); if not, continue with 3.16 (Fig. 6).

(11) Dispatch a telco employee to the station to check out the 130-type subset. If the trouble is located and cleared, perform Step (26); if not, perform Step (12).

(12) If the trouble cannot be located and cleared (130-type subset is good), trouble is probably a faulty station TTY or CPE. If the station is a CPE, refer the trouble to the customer for further action. If the station is a TTY, troubleshoot the TTY in accordance with the appropriate BSP.

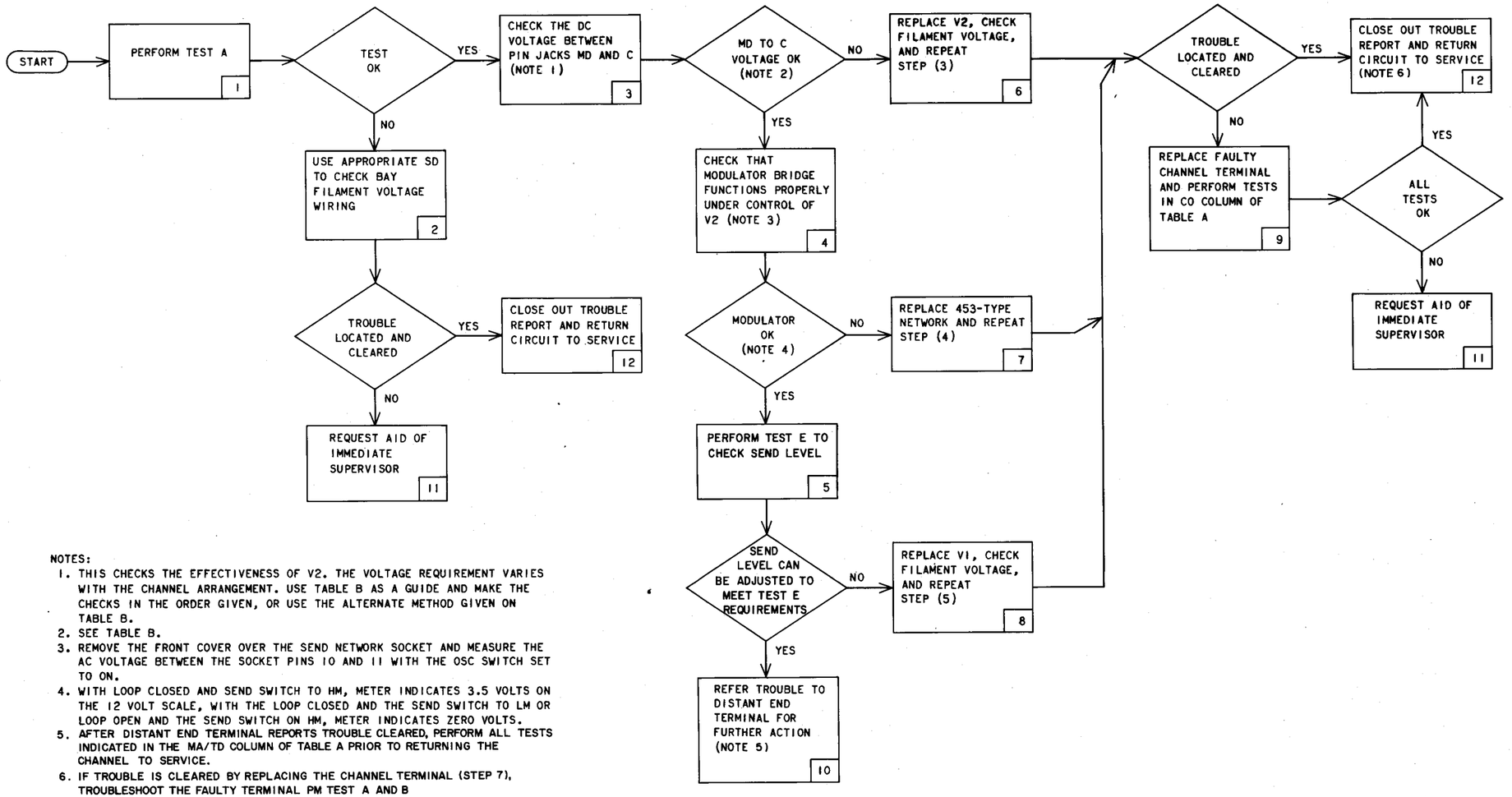
(13) Determine whether channel terminal is used in a hub arrangement or neutral channel terminal back-to-back arrangement. If in the



NOTES:

1. IF THE BIAS CANNOT BE MADE TO MEET THE TEST REQUIREMENTS WITH TMC REC BIAS CONTROL. CONSIDER THE BIAS NOT OK.
2. LOOP CURRENT SHALL BE 60-65 MA OR 19-21 MA.
3. IF THE TROUBLE IS CLEARED BY REPLACING THE CHANNEL TERMINAL. TROUBLESHOOT THE FAULTY CHANNEL TERMINAL PER TEST A AND/OR B

Fig. 5—Bay Test Procedures for Receiving Terminals (3.15)



NOTES:

1. THIS CHECKS THE EFFECTIVENESS OF V2. THE VOLTAGE REQUIREMENT VARIES WITH THE CHANNEL ARRANGEMENT. USE TABLE B AS A GUIDE AND MAKE THE CHECKS IN THE ORDER GIVEN, OR USE THE ALTERNATE METHOD GIVEN ON TABLE B.
2. SEE TABLE B.
3. REMOVE THE FRONT COVER OVER THE SEND NETWORK SOCKET AND MEASURE THE AC VOLTAGE BETWEEN THE SOCKET PINS 10 AND 11 WITH THE OSC SWITCH SET TO ON.
4. WITH LOOP CLOSED AND SEND SWITCH TO HM, METER INDICATES 3.5 VOLTS ON THE 12 VOLT SCALE, WITH THE LOOP CLOSED AND THE SEND SWITCH TO LM OR LOOP OPEN AND THE SEND SWITCH ON HM, METER INDICATES ZERO VOLTS.
5. AFTER DISTANT END TERMINAL REPORTS TROUBLE CLEARED, PERFORM ALL TESTS INDICATED IN THE MA/TD COLUMN OF TABLE A PRIOR TO RETURNING THE CHANNEL TO SERVICE.
6. IF TROUBLE IS CLEARED BY REPLACING THE CHANNEL TERMINAL (STEP 7), TROUBLESHOOT THE FAULTY TERMINAL PM TEST A AND B

Fig. 6—Bay Test Procedures for Sending Terminals (3.16)

back-to-back arrangement, continue with Step (14); if in the hub arrangement, proceed to Step (22).

(14) Using the KS-19935-type TCTS, monitor the VF signal being received by the back-to-back channel terminal. If the VF signal is good, proceed to Step (20); if not, continue with Step (15).

(15) Determine whether back-to-back channel terminal sends to a 130-type subset. If so, continue with Step (16); if not, proceed to Step (17).

(16) Check the cable pair to the 130-type subset at the station. If the cable pair is found to be good, perform Step (11); if not, perform Step (6).

(17) Have the distant office monitor the VF signal being sent to the back-to-back channel terminal. If the distant-office VF send signal is good, continue with Step (18); if not, perform Step (19).

(18) When the VF signal from the distant office is good and the VF signal received at the back-to-back channel terminal is not good, it indicates a faulty facility between the offices. In this case, obtain a circuit release or patch the channel to a spare (if available), and check the cable pairs. If the trouble is located and cleared, perform Step (26); if not, perform Step (25).

(19) When the VF signal being sent by the distant office is not good, the trouble is to be referred to the distant office for further action.

(20) Perform the tests and procedures indicated in the MA/LOOP column of Table A on the back-to-back channel terminal. If the trouble is located and cleared, perform Step (26); if not, continue with Step (21).

(21) Obtain a circuit release or patch the back-to-back channel to a spare (if available) and perform the tests and procedures indicated in the MA/TD column of Table A. If the trouble is located and cleared, perform Step (26); if not, continue with 3.15 (Fig. 5).

(22) Check that the proper signals are being delivered to the hub. If the hub circuit is not sending the proper signals, continue with Step (23); to Step (24).

(23) The trouble condition is probably located in the hub circuit or 43A1 channel unit wiring. Obtain a circuit release and take the necessary steps to repair or replace the circuit. If the trouble is cleared, perform Step (26); if not, perform Step (25).

(24) The hub circuit is providing a good signal but trouble has not been located, perform Step (25).

(25) When all the procedures have been performed and the trouble has not been located and cleared, continue troubleshooting with 3.15 (Fig. 5) ***and*** 3.16 (Fig. 6).

(26) When a trouble has been located and cleared, close out the trouble report and return the circuit to service in accordance with local policy.

A1 Level Variation Detector Carrier Failure Alarms (Fig. 4)

The A1 level variation detector is only used on 4-wire systems. An activated carrier failure alarm indicates that the level of the VF signal from the far-end channel terminal has deviated more than plus or minus 8 dB from the set reference level for a period of four or more seconds.

3.14 When the A1 level variation detector carrier failure alarm has been activated, commence troubleshooting with Fig. 4 and the following.

(1) Determine whether the carrier failure alarm is to be disabled while performing this procedure. If so, continue with Step (2); if not, proceed to Step (3).

(2) Operate the ALM DSBL key on the A1 level variation detector associated with the faulty channel.

(3) Using the KS-19935-type TCTS, monitor the VF signal being received from the far-end channel terminal. If the VF signal is good,

continue with Step (4); if not, proceed to Step (7).

(4) A good VF signal from the far-end channel terminal indicates a possible faulty A1 level variation detector. In this case, check out the A1 level variation detector in accordance with Section 314-709-501. If the A1 level variation detector is found to be good, continue with Step (5); if not, proceed to Step (6).

(5) Verify that the carrier failure still exists. If so, perform Step (15); if not, perform Step (14).

(6) Repair or replace the faulty unit of the A1 level variation detector. If the trouble is located and cleared, perform Step (16); if not perform Step (15).

(7) Determine from the circuit layout record card (CLRC) whether the far-end channel terminal is in a 130-type subset at the customer premises. If so, proceed to Step (10); if not, continue with Step (8).

(8) Contact the far-end office and have the VF signal being sent from the channel terminal at that office monitored with the KS-19935-type TCTS. If the VF signal being sent by the far-end channel terminal is good, continue with Step (9); if not perform Step (13).

(9) Obtain a circuit release, patch the channel to a spare cable pair (if available), and check the cable pair from the far-end office. If the trouble is located and cleared, perform Step (16); if not, perform Step (15).

(10) Check out the cable pair from the 130-type subset at the station. If the cable pair checks good, continue with Step (11); if not, proceed to Step (12).

(11) Dispatch a telco employee to the station to check out the 130-type subset. If the trouble is located and cleared, perform Step (16); if not, perform Step (15).

(12) Obtain a circuit release and repair or replace the faulty cable pair. If the trouble is located and cleared, perform Step 16; if not, perform Step (15).

(13) Refer the trouble to the far-end office for further action.

(14) Keep the trouble report open and monitor the channel for a length of time reasonably long enough to ensure that the trouble was only due to a momentary failure and not an intermittent condition.

(15) When all the procedures have been performed and the trouble cannot be located and cleared, continue troubleshooting with 3.15 (Fig. 5) ***and*** 3.16 (Fig. 6).

(16) When a trouble has been located and cleared, close out the trouble report and return the circuit to service in accordance with local policy.

Bay Test Procedures for Receiving Terminals (Fig. 5)

3.15 When the procedures of 3.12 (Fig. 2), 3.13 (Fig. 3), or 3.14 (Fig. 4) do not locate the fault and it appears to be a receiving terminal trouble, continue troubleshooting with Fig. 5 and the following. The abbreviated tests (A) and (B) may be used to aid in locating the trouble condition and avoid additional detail testing outlined in the following procedure.

(1) Check the filament voltage by performing Test C. If the filament voltage is correct, proceed to Step (3); if not, continue with Step (2).

(2) Use the appropriate SD and check the bay filament voltage wiring. If the trouble is located and cleared, proceed to Step (12); if not, proceed to Step (11).

(3) Check overall signal bias of received signal per Test N.

Note: If the bias cannot be made to meet the test requirements with the channel terminal REC BIAS control, consider the bias ***not*** OK. If the test requirements are met, proceed to Step (9); if not, continue with Step (4).

(4) Perform Test E to check the channel send level. If the send level is correct, proceed to Step (5). When the send level cannot be adjusted to the correct value, proceed to Step (6).

(5) Check the loop current per Test H, I, J, or K. If the loop current meets the requirements of Test H, I, J, or K, proceed to Step (10); if not, proceed to Step (7).

Note: The loop current should be 60 to 65 mA or 19 to 21 mA.

(6) Replace the tube or HIN in V3, check the filament voltage and repeat test. If the trouble is cleared, proceed to Step (12); if not, proceed to Step (8).

(7) Replace tube or HIN in V4, the tube, 262-type switch, or 4143-type network in V5 and V6 one at a time; check the filament voltage and repeat the test. If the trouble is cleared, proceed to Step (12); if not, continue with Step (8).

(8) Replace the faulty channel terminal with one that is known to be operating properly and perform all tests indicated in the CO column of Table A on the replacement channel terminal. If the requirements for all tests are met, proceed to Step (12); if not, proceed to Step (11).

(9) Using a 911-type test set, make stability tests with the help of the distant-end terminal attendant in accordance with Section 103-810-100, or monitor the channel for a length of time long enough to ensure the trouble is not of a recurring nature.

Note: If trouble is not indicated within a reasonable time, consider the overall channel OK and return the circuit to service. If the trouble reappears, test the channel starting with Step (3).

(10) Refer trouble to distant-end terminal for further action.

Note: After distant-end terminal reports trouble cleared, perform all tests indicated in the MA/TD column of Table A prior to returning the channel to service.

(11) Request the aid of the immediate supervisor.

(12) Close out the trouble report and turn the circuit up for service in accordance with local procedures.

Note: If the trouble was cleared by replacing the channel terminal [Step (8)], troubleshoot the channel terminal on the 165C1 TTS per Test A and/or B.

Bay Test Procedures for Sending Terminals (Fig. 6)

3.16 When the procedures of 3.12 (Fig. 2), 3.13 (Fig. 3), 3.14 (Fig. 4), or 3.15 (Fig. 5) do not locate the fault and it appears to be a sending terminal trouble, continue troubleshooting with Fig. 6 and the following.

(1) Check the filament voltage by performing Test C. If the filament voltage is correct, proceed to Step (3); if not, continue with Step (2).

(2) Use the appropriate SD and check the bay filament voltage wiring. If the trouble is located and cleared, proceed to Step (12); if not, proceed to Step (11).

(3) Using Table B as a guide, check the dc voltage between the channel terminal pin jacks MD and C. Perform the checks in the order given or as directed in the alternate method on Table B.

If the MD-to-C voltage is OK, continue with Step (4); if not, proceed to Step (6).

Note: This checks the effectiveness of V2. The voltage requirement varies with the channel arrangement (see Table B).

(4) Check that the modulator bridge functions properly under control of the tube or HIN in V2 by removing the front cover over the ***send network socket*** and measuring the ac voltage between pins 10 and 11 of the socket. If the modulator checks OK, continue with Step (5); if not, proceed to Step (7).

Note: With VOM set to the 12-Vac scale, the loop closed, and the SEND switch in the HM position, meter indicates 3.5 volts. With the loop closed and the SEND switch set to LM or the loop open and the SEND switch set to HM, meter indicates zero volts.

(5) Perform Test E to check the send level. If the send level can be adjusted to meet the

requirements given in Table E, proceed to Step (10); if not, go to Step (8).

(6) Replace the tube or HIN in V2, check the filament voltage per Test C and then repeat Step (3). If the trouble is cleared, proceed to Step (12); if not, proceed to Step (9).

(7) Replace the 453-type send network and repeat Step (4). If the trouble is cleared, proceed to Step (12); if not, proceed to Step (9).

(8) Replace the tube or HIN in V1, check the filament voltage per Test C, and then repeat Step (5). If the trouble is cleared, proceed to Step (12); if not, continue with Step (9).

(9) Replace the faulty channel terminal with one that is known to be operating properly and perform all the tests indicated in the CO column of Table A on the replacement channel terminal. If the requirements of all tests are met, proceed to Step (12); if not, proceed to Step (11).

(10) Refer trouble to distant-end terminal for further action.

Note: After distant-end terminal reports trouble cleared, perform all tests indicated in the MA/TD column of Table A prior to returning the channel to service.

(11) Request the aid of the immediate supervisor.

(12) Close out the trouble report and return the channel to service in accordance with local procedures.

Note: If the trouble is cleared by replacing the channel terminal [Step (9)], troubleshoot the faulty channel terminal per Test A and/or B.

Note: Terminal 3 of the SEND switch is the inside center terminal.

4. MAINTENANCE PROCEDURES

4.01 This part describes the procedures for installing replacement units in the 43A1 VFCT system when a faulty unit has been identified. It also contains the precautions that should be observed when installing a replacement unit.

Channel Terminal

4.02 When a replacement channel terminal is to be installed, proceed as follows.

(1) Ensure that the proper tubes, 262-type switch, 4143-type network, and/or HINs are installed in the replacement channel terminal (see Tables C, D, and E).

(2) Remove the faulty channel terminal from the mounting unit.

(3) Remove the 453-type send network and 454-type receive network from the faulty channel terminal.

(4) Insert the 453-type send network into the proper socket on the replacement channel terminal (see Fig. 7).

Caution: Network terminals may be damaged if an attempt is made to install the send network in the receive network position.

(5) Insert the 454-type receive network into the proper socket of the replacement channel terminal (see Fig. 7).

Caution: Network terminals may be damaged if an attempt is made to install the receive network in the send network position.

(6) Plug the replacement channel terminal into the mounting unit position from which the faulty channel terminal was removed in Step (2).

Caution: If – 48 volt office battery is used to supply filament voltage to two channel terminals, take the proper precautions to ensure that the actuator arm of the Micro Switch* adjacent to connector J1 on the mounting unit will not be broken off while installing the channel terminal.

(7) Perform all the tests indicated in the CO column of Table A.

*Product of Honeywell Co., Minneapolis, Minnesota

TABLE B

MD-TO-C VOLTAGE CHECK

STEP	SEND LOOP	SEND SW	PIN JACK C POTENTIAL	TEST REQ
1	Open	LM	GRD, −48V, or −130V	Note indication
2	Open	HM	GRD, −48V, or −130V	At least 12 volts below Step 1
3	Closed	HM	GRD or −130V	At least 16 volts below Step 1
			−48V	At least 9 volts below Step 1

ALTERNATE METHOD

If desired, V2 may be checked by measuring the dc voltage across the bridge. This check may be made from the front of the panel by running a strap from terminal 3 of the SEND switch to terminal 9 of the send network socket and then measuring the dc voltage between pin jack MD and terminal 9 of the send network socket under two conditions:

Note: Terminal 3 of the SEND switch is the inside center terminal.

Step 2 of Table B — Requirement: Not over 1 volt.
Step 3 of Table B — Requirement: At least 12 volts.

453- and 454-Type Networks

4.03 When a send or receive network suspected of being faulty is to be replaced, proceed as follows.

(1) Remove the channel terminal containing the suspected faulty network(s) from the mounting unit.

(2) Remove the suspected faulty network(s) from the channel terminal.

(3) Verify that the proper code network has been selected as a replacement (see Table F).

(4) Install the replacement network(s) into the appropriate socket on the channel terminal (see Fig. 7).

Caution: Network terminals may be damaged if an attempt is made to install the send network into the receive network position and vice versa.

(5) Reinstall the channel terminal into the mounting unit position from which it was removed in Step (1).

Caution: If −48 volt office battery is used to supply filament voltage to two channel terminals, take the proper precautions to ensure that the actuator arm of the Micro Switch adjacent to connector J1 of the mounting unit is not broken off while installing the channel terminal.

(6) Perform all the tests indicated in the MA/TD column of Table A.

TABLE C

CHANNEL TERMINAL TUBES

TYPE	DESIGNATION		FUNCTION
Tubes Used in Both Neutral and Hub Channel Terminals			
407A	V1	V1a V1b	Send amplifier Oscillator
407A	V2	V2a V2b	Supervisory amplifier Send control
407A	V3	V3a V3b	1st amplifier-limiter 2nd amplifier-limiter
408	V4		3rd amplifier-limiter
429A (Note 1)	V5		Receive output
Tube Used in Neutral Channel Terminals, 62.5-mA Loops Only			
429A (Note 1)	V6		Receive output
Tubes Used in Hub Channel Terminals Only			
429A (Note 1)	V7		Directional control dc amplifier
407A	V8	V8a V8b	Directional control flip-flop

Notes:

1. May be replaced by 262-type switch and 4143-type network.
2. See Tables D and E for information on substitution of HINs.
3. In hub channel terminals, tube V6 is omitted and tubes V7 and V8 are added. Tube V7 is mounted in the position occupied by tube V6 in neutral channel terminals, and tube V8 is mounted in a socket that is not provided in neutral channel terminals.

TABLE D

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

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

TABLE E

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

Tubes, 262-Type Switches, 4143-Type Networks, and HINs

4.04 When a faulty tube, 262-type switch, 4143-type network, and/or HIN is to be replaced, refer to Tables C, D, and E, respectively, to determine the code of the proper device; remove the faulty device from the channel terminal and plug in the replacement device; and then perform all the tests indicated in the MA/TR column of Table A.

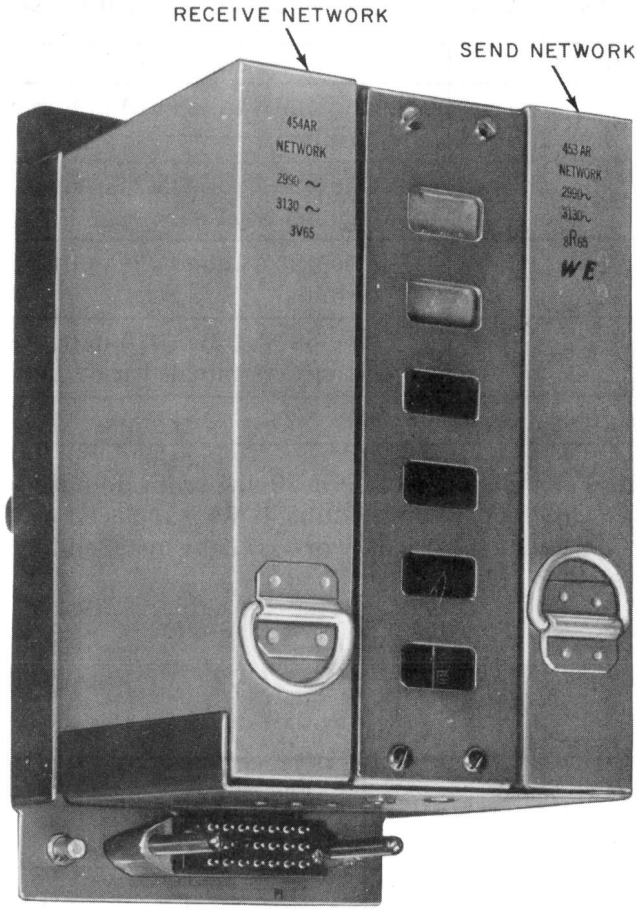


Fig. 7—Send and Receive Network Installation

TABLE F

SEND AND RECEIVE NETWORKS

NETWORKS		CHANNEL FREQUENCIES (HZ)				CHANNEL NUMBERS
SEND	RECEIVE	MIDBAND	HIGH	LOW	SHIFT	
SW Voiceband Channels						
453AE	454AE	425	460	390	70	1
453A	454A	595	630	560		2
453B	454B	765	800	730		3
453C	454C	935	970	900		4
453D	454D	1105	1140	1070		5
453E	454E	1275	1310	1240		6
453F	454F	1445	1480	1410		7
453AA	454AA	1615	1650	1580		8
453G	454G	1785	1820	1750		9
453H	454H	1955	1990	1920		10
453J	454J	2125	2160	2090		11
453K	454K	2295	2330	2260		12
453L	454L	2465	2500	2430		13
453M	454M	2635	2670	2600		14
453AB	454AB	2805	2840	2770		15
453AC	454AC	2975	3010	2940		16
453AD	454AD	3145	3180	3110	70	17
DW Voiceband Channels						
453AK	454AK	1360	1430	1290	140	51
453AL	454AL	1700	1770	1630		52
453AM	454AM	2040	2110	1970		53
453AN	454AN	2380	2450	2310		54
453AP	454AP	2720	2790	2650		55
453AR	454AR	3060	3130	2990	140	56