

**2-POINT AND MULTIPOINT PRIVATE LINE CIRCUIT
MAINTENANCE PROCEDURES
DIGITAL DATA SYSTEM**

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1. GENERAL

1.01 This section provides the procedures to be followed by the Digital Data System (DDS) hub office in conjunction with a centralized test center (CTC) or a serving bureau (SVB) hub office when a customer reports trouble on a DDS circuit.

1.02 This section is reissued to add the maintenance procedures for the multipoint private line circuit. The maintenance procedures for the multipoint private line circuit were previously covered in Section 314-901-301. Other additions include information on dataport using D3, D4, and SLC* 96 Subscriber Loop Carrier channel systems and the KS-21899 test system which is called the Automated Bit Access Test System (ABATS). All references to the term "serving test center (STC)" have been removed, as the STC does not apply to DDS. Since this

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is a general revision, no revision arrows have been used to denote significant changes.

1.03 The definitions and responsibilities of hub (and CTC) and SVB hub offices are found in Section 660-230-100. Other offices in the digital serving area (DSA) are also covered.

2. OBJECTIVES

2.01 The DDS overall service objective is to provide circuit availability 99.96 percent of the time for channels terminated in data service units (DSUs) or channel service units (CSUs). In order to meet this objective, the following maintenance goals have been established.

(a) Isolation of a trouble to one of the following areas within 15 minutes after the receipt of a customer trouble report:

- DSU
- 4-Wire local cable pairs, including 56-kb/s repeaters and the CSU
- Facilities between the hub office and the office channel unit (OCU)
- Inter-DSA facilities.

(b) Maximum outage intervals for the various DDS transmission facilities should not exceed the following:

- L4 or L5 cable terminated in an "L" mastergroup digital system (LMDS)—20 minutes
- TD/TH radio terminated in the 1A or 2A radio digital terminal (1A or 2ARDT)—20 minutes
- T1 line terminated in the T1 data multiplexer (T1DM) or T1 voice-data multiplexer (T1WB4/B5)—30 minutes
- Private line 4-wire local cable and OCU local channel (including DSU/CSU)—120 minutes.

2.02 The DDS performance objective is to provide a level of efficiency of 99.5 percent error-free

seconds (EFS) or greater. Procedures contained in this section verify the performance of a DDS circuit and are designed with the intention of meeting the objectives listed in paragraph 2.01 and minimizing the number of outage intervals that exceed 2 hours.

2.03 The performance objective for multipoint service, which is 99.5 percent EFS, applies to communication between the control station and each outlying station which is not an OFF-NET extension while all inactive outlying stations remain in the idle mode. The longer term duration tests discussed in paragraph 2.01 should be performed when checking a circuit to determine if performance objectives are being met.

2.04 In order to meet the above performance objective, the following maintenance goals have been established.

(a) *When the customer identifies the stations experiencing trouble*, isolate trouble to one of the following areas within 10 minutes, plus 5 minutes for each identified station, after the receipt of a customer trouble report:

- DSU
- Private line portion of an OFF-NET extension
- 4-wire local cable pairs including the CSU
- Hub-to-office OCU facilities
- Inter-DSA facilities.

(b) *When the customer does not identify the stations experiencing trouble*, identify faulty branches and return the working portion of the circuit to the customer within 10 minutes, plus 2 minutes for each station checked. Once the faulty branches have been identified, isolation of a trouble to one of the areas previously mentioned should not exceed 5 minutes per branch.

Note: After identifying the faulty branches, the portion of the circuit which is operating properly should be returned to the customer within 30 minutes after receiving the trouble report.

2.05 Maintenance responsibility for the various DDS facilities is assigned to a number of

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maintenance centers which may be administered by either an associated operating company or Long Lines maintenance organization. These centers are the SVB hub or CTC/hub office, T-carrier restoration control center (TRCC), T-carrier administration center (TCAC), and the regional operations control center (ROCC). For a description of the TRCC, TCAC, and ROCC responsibilities and functions, refer to Section 314-900-300.

2.06 In addition to the offices and responsibilities referenced in paragraph 2.05, the maintenance responsibility for a multipoint circuit is allocated to the control offices (SVB hub or CTC/hub) which serve the control station and the hubs which serve the outlying stations. The responsibility for each hub is assigned as follows:

(a) **Control Office (SVB Hub or CTC/Hub)**

- Accepts trouble reports from the customer or hubs serving the outlying stations and obtains release of the circuit, or specific segments in trouble, for test purposes
- Notifies the customer when new or malfunctioning circuits, or portions of circuits, are installed or repaired, respectively, and verified to be operating properly
- Coordinates preservice installation and testing for new circuits and added segments or stations
- Coordinates trouble isolation activities for the entire multipoint circuit
- Keeps records on the overall multipoint circuit and collects data on outage times during trouble isolation for customer rebate.

(b) **Hub Office Serving Outlying Stations**

- Performs tests during installation and trouble isolation on midlinks and end links served by the hub
- Isolates troubles on specified branches and tests multipoint junction units (MJUs) located in the hub at the request of the control office or customer
- Reports to the control office the results and conclusion of tests performed during trouble

isolation, including outages in excess of 30 minutes.

2.07 Test access is provided in the DDS through the use of manual testing arrangements (950-type testboard, jack and connector panels, and CP test points) or ABATS. For a more detailed description of the DDS test access arrangements, refer to Section 314-900-300.

2.08 The protection switching and automatic monitoring that are provided in the DDS for the T1 lines, 1ARDS, and multiplexing equipment are described in Section 314-900-300. The DDS network status, control code signaling, and alarm indications are also described in Section 314-900-300.

3. MULTIPPOINT CIRCUITS

3.01 A multipoint circuit is composed of a control station connected to any number of outlying stations via MJUs and 2-point circuit segments as shown in Fig. 1. When the outlying station is an OFF-NET extension, connection to the DDS portion of the circuit can be to an MJU or, if the data rate is 2.4 or 4.8 kb/s, an analog bridge.

3.02 A multipoint circuit can accept customer data at any of the four DDS speeds (2.4, 4.8, 9.6, and 56 kb/s); however, all stations served by a single multipoint circuit must operate at the same rate.

3.03 The MJUs in a multipoint circuit are located in hub offices and operate in the full-duplex mode at the DS-0 (64 kb/s) level to provide the following features:

- (a) Splits the channel signal (at port 0) from the control station into identical branch signals for transmission to outlying stations
- (b) Combines branch signals (at ports 1 and 2 for a 2-branch MJU and at ports 1 through 4 for a 4-branch MJU) from the outlying stations and allows the signals from a station in the data mode to be transmitted over the channel to the control station
- (c) Permits selection of any one particular branch from a hub location for testing purposes during trouble isolation on the multipoint circuit.

3.04 Each MJU can serve up to four outlying stations; if more than four stations are to be

served, MJUs must be cascaded. MJUs are cascaded by connecting any one of the four branches (ports 1 through 4) of one MJU to the channel input (port 0) of a downstream MJU. MJUs are cascaded within a hub office whenever more than four stations on the same multipoint circuit are served from that hub office. Whenever additional stations on the circuit must be served by a downstream hub office, the MJUs must be cascaded between hub offices.

3.05 Each MJU in a hub office contains test circuitry and is assigned a hub identification (HUB ID) code to allow testing from a multipoint signaling unit (MSU) located in the SVB hub or CTC/hub office.

3.06 The MSU should be used during trouble isolation in an attempt to establish a 2-point test connection to an outlying station, using the point of failure as an aid in trouble isolation. Once a 2-point test connection has been established, the trouble on the channel can be isolated using the 2-point test procedures.

4. RECORDS

4.01 Each SVB hub or CTC/hub office should maintain an up-to-date circuit layout record (CLR) card file at some location readily accessible to the testing personnel. The file should contain a card for every DDS circuit having testing access at the hub office and should be updated immediately upon change in circuit arrangement.

4.02 The SVB hub or CTC/hub office must also have access to information not recorded on the CLR. This information may be obtained from other files located in the hub office building, such as the following:

- Customer line cards
- Circuit detail cards (office wiring)
- Equipment location records
- Facility order layout record (FOLR)
- Trouble history file.

4.03 Each hub office in a multipoint circuit, including the control office, should maintain a DDS SVB multipoint record card (Form E-6562, Fig. 2)

which contains the addresses of all stations downstream from the control office, the location of MJUs in the office, the MJU branch numbers necessary to access any downstream station plus the HUB ID code of each MJU, and the telephone number of all other hubs in the circuit which contain an MJU.

4.04 Each hub which contains MJUs that connect directly to the station(s) over an end link(s) should have a card for each individual station to record the equipment makeup on the local loop and at the station, along with the results of installation tests which are to be used as benchmarks.

4.05 In some cases, multipoint circuit segments will be routed through a hub office without having testing access, since the circuit has no MJUs located in that office nor any stations served from that office. When a circuit is routed in this manner, the hub office may keep records on this portion of the circuit on a facility basis instead of recording it under a circuit number.

4.06 Isolation of troubles which lie between the hub office and near-end OCU require a knowledge of the facility arrangement for this part of the circuit. Once the facility records are consulted, the correct flowchart (Fig. 5 through 17 or 20 through 23) figure number should be recorded on the CLR to eliminate future circuit arrangement research.

4.07 In some cases, inter-DSA trouble isolation procedures will require the control hub to obtain facility layout details from files located in other hub offices.

5. MAINTENANCE AIDS

5.01 This part lists the Bell System Practice (BSP) sections and test equipment which may be required for performing these maintenance procedures.

SECTION	TITLE
107-600-100	Digital Data System—KS-20909 Data Test Set (Digital Transmitter)—Description and Operation
107-601-100	Digital Data System—KS-20908 Data Test Set (Receiver)—Description and Operation
314-410-310	Digital Data System—Local Loop—Maintenance Procedures

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SECTION	TITLE
314-900-300	Digital Data System—Overall Maintenance
314-901-500	2-Point and Multipoint Private Line Circuits—Test Procedures—Digital Data System
314-917-100	Digital Data System—Multipoint Junction Units and Auxiliary Circuits—Description
314-917-300	Digital Data System—Multipoint Junction Units and Auxiliary Circuits—Maintenance and Troubleshooting Procedures
314-917-500	Digital Data System—Multipoint Junction Units and Auxiliary Circuits—Test Procedures
660-230-100	Administrative Procedures—Digital Data System
666-600-100	Digital Data System—950A Testboard (J70176A and B)—Description and Operation
666-600-101	Switched Digital Data System—950B Testboard (J70176C)—Description and Operation.

Test Equipment

- 950-type testboard and associated test equipment (KS-20908 data test set digital receiver and KS-20909 data test set digital transmitter)
- KS-21899 ABATS
- Control code generator
- MSU.

6. 2-POINT CIRCUIT MAINTENANCE ACTIVITIES

6.01 This part describes the procedures to be followed by the SVB hub or CTC/hub office when a trouble report is received. It is presented in five parts (6A, 6B, 6C, 6D, and 6E) as follows:

- 6A—General information required for the performance of Parts 6B, 6C, 6D, and 6E

- 6B—Initial trouble report analysis
- 6C—Hub-to-station trouble isolation
- 6D—Inter-DSA trouble isolation
- 6E—Hub-to-Off-Net extension station.

A. General

6.02 In most cases, customer-reported trouble will be caused by a faulty DSU/CSU, 4-wire local cable pairs, or OCU. The trouble analysis (Fig. 3) and isolation flowcharts (Fig. 4 through 29) are to be used for an organized trouble investigation, with a minimum amount of time spent in identifying the faulty equipment. The tests referred to in the following text and flowcharts are given in Section 314-901-500.

Note: The flowcharts (Fig. 3 through 29) are for use by testing personnel at the SVB hub or CTC/hub office. However, some of the procedures given are to be performed by a telephone company (TELCO) employee at the intermediate or end office under direction of the SVB hub or CTC/hub office personnel.

6.03 The following list is provided as an aid to identifying the various circuit packs (CPs) mentioned in the text and flowcharts:

- OCU CP—HL1, 2, 3, 4, 141, or 142
- D/T CP—HL7 or HL89 of OCU shelf
- 5-channel integral subrate multiplexer (ISMX) CP—HL8 of OCU shelf
- 10-channel ISMX CP—HL88 of OCU shelf
- T1DM port CP—HL18
- T1DM common CP—HL11 through HL17
- Subrate data multiplexer (SRDM) port CP—HL36
- SRDM common CP—HL37
- T1WB4/B5 common CP—HL70
- T1WB4/B5 port CP—HL73
- Digital data group terminal (DDGT) analog transmitter CP—HL85.



Prior to removing any CP, refer to the appropriate section, listed in paragraph 6.04, for the proper procedures.

Caution: Removal of any CP may cause an interruption of service to customers other than those affected by the original failure.

6.04 The following sections are related to troubleshooting of the various units in the DDS:

SECTION	UNIT
314-910-300	OCU and ISMX
314-911-300	Cabling to or from SRDM
314-911-502	Cabling to or from SRDM
314-912-500	Cabling to or From T1DM
314-910-300	Cabling to or from OCU
314-915-501	Cabling to or from T1WB4
314-915-510	Cabling to or from T1WB5
314-912-300	T1DM
314-912-500	T1DM
314-911-300	SRDM
314-911-502	SRDM
595-200-300	DSU
595-100-300	CSU
314-410-310	Local Loop
314-915-300	T1WB4
314-915-501	T1WB4
314-914-310	T1WB5
314-915-510	T1WB5
314-918-510	DDGT
314-919-300	Subrate off-net extension arrangement

6.05 The following principles apply to the trouble isolation procedures in paragraphs 6.08 through 6.30. In all cases, a circuit that has been reported in trouble should be monitored with either the KS-20908 data test set (DTS) (digital receiver) at the 950-type testboard or ABATS. This indicates whether or not the customer has stopped transmitting data. In addition, the type signal monitored will give a clue as to the direction of transmission that is faulty, such as:

- No signal (NS), multiplexer channel out of sync (MCOS), or unassigned multiplexer channel (UMC) indicates that a failure has occurred between the test access and the OCU and that the direction of failure is incoming. In this case, testing personnel uses the OCU loopback **control code** for signal tracing purposes to locate the trouble.
- Idle code (IC), abnormal station condition (ASC), all "1s" data (A1), or all zeros (A0) data indicates the point of failure is not located on the incoming portion of the circuit from the OCU.

If the number of circuits experiencing trouble is known, it is an important aid in fault location.

B. Customer Trouble Report Analysis (Fig. 3)

6.06 When a customer trouble report is received, interrogate the customer in accordance with the procedures outlined in Fig. 3. This will minimize the dispatch of a TELCO employee to the station in cases where faulty customer-provided equipment (CPE), an unplugged DSU/CSU, or absence of power at the customer outlet is the cause of trouble.

6.07 In cases where the trouble is isolated to the loop and the loop contains 56-kb/s regenerative repeaters, trouble isolation should continue using Fig. 27. If trouble isolation is being directed toward a station which is served by a DDGT or is a subrate off-net extension, Fig. 28 or 29, respectively, should be used to locate the trouble.

C. Hub-to-Station Trouble Isolation (Fig. 4 Through 19 and Fig. 22 through 27)

Preliminary Hub Trouble Isolation Procedures (Fig. 4)

6.08 The flowchart given in Fig. 4 is used to isolate the trouble to either the near-end (NE) DSA,

far-end (FE) DSA, DDS network, or no TELCO trouble. When a trouble is isolated in accordance with Fig. 4, trouble isolation should continue as follows.

- **UMC or MCOS code from NE**—According to Fig. 5 and paragraph 6.14.
 - **NE OCU loopback test failure**—Continue NE trouble isolation in accordance with Fig. 5.
 - **FE OCU Loopback test failure when another SVB hub or CTC/hub office is associated with the FE**—Refer to FE SVB hub or CTC/hub office to commence trouble isolation with Fig. 5.
 - **FE OCU loopback test failure when another SVB hub or CTC/hub office is not associated with FE**—Continue FE trouble isolation with Fig. 5.
 - **Looped circuit indication**—Continue trouble isolation per paragraph 6.11.
- 6.09** If the FE local channel meets the DSU/CHAN loopback requirements when the test is performed by the FE SVB hub or CTC/hub office, continue trouble isolation according to Part 6D and Fig. 20.
- 6.10** If the local channel fails one or more of the loopback tests (Tests A, B, and/or C), dispatch a TELCO employee as follows.
- (a) Station equipped with DSU:
- (1) Fails DSU loopback only—dispatch to station to replace DSU per Section 595-200-300.
 - (2) Failure of DSU and CHAN loopback to station and satisfactory OCU loopback test—dispatch to OCU location to perform 1-employee test per Section 314-410-310. If trouble is not found, dispatch to station to replace DSU per Section 595-200-300. If trouble persists, perform 2-employee tests per Section 314-410-510.
- (b) Station equipped with CSU:
- (1) Failure of CHAN loopback to station and satisfactory OCU loopback—replace OCU CP and, if trouble still exists, dispatch to OCU

location to perform 1-employee tests of local 4-wire cable pairs per Section 314-410-310. If trouble is not cleared, dispatch to station to replace CSU per Section 595-100-300. If trouble persists, perform 2-employee tests per Section 314-410-510.

Looped Condition Circuit Analysis (Fig. 26)

6.11 There are points within a DDS DSA where circuits could be looped either toward the testing access point, at the hub, or toward the station location. The possible loop points, beginning at the hub's testing access point and progressing toward the station, are as follows:

- (1) DSX-0A cross-connection (via a looping plug)

Note: The loop points (2) through (6) will cause multiple channel troubles.

- (2) SRDM common CP, HL37, in hub or end office (via a loopback switch located behind the faceplate of HL37)
- (3) DSX-0B cross-connection (via a looping plug)
- (4) T1DM common CP, HL10 (via a looping switch on the faceplate of HL10)
- (5) T1 line at DSX-1 cross-connection, high-frequency cross-connection, or any span terminating office (via jumper cables)
- (6) Multiplexer jack and connector panel (M-JCP) at intermediate or end office (via jumper cable)
- (7) Submultiplexer jack and connector panel (SM-JCP) in end office (via jumper cable).

6.12 If analysis of the circuit trouble indicates that a looped condition exists, refer to Fig. 26 for procedures to aid in locating the trouble area.

Note: When a T1WB4/B5 is used in the circuit instead of a T1DM, check for patch cords in the jacks located on the faceplate of CP HL78.

6.13 When a looped condition is suspected in the long-haul portion of a circuit, check the DSX-1 cross-connection for a looping plug and the 1ARDT for a patch cord causing a looped condition. If a

looped condition is isolated to the long-haul portion of the circuit but the loop cannot be found, refer to Section 314-903-300.

Hub-to-OCU Circuit Analysis (Fig. 5)

6.14 When the procedure given in Fig. 3 or 4 indicates the trouble is between the hub and OCU, the facility arrangement for this part of the circuit should be identified, then analyzed per Fig. 5 to determine which of the flowcharts should be used to complete the trouble isolation procedure. The facility arrangement should be shown on the CLR.



The local forces should enter the figure number on the CLR, thereby alleviating the need of performing the analysis given in Fig. 5.

Intermittent Trouble Isolation Procedures (Fig. 6)

6.15 After performing all necessary trouble isolation procedures in this section following a trouble report and trouble cannot be found on the circuit, Fig. 6 should be used as an aid in isolating the trouble when the trouble is intermittent. The procedure to be followed in Fig. 6 depends upon the number of times trouble has been reported on the same circuit within a 30-day period. Loopback tests are used in an attempt to isolate troubles on the first three trouble reports with each successive test being longer in duration. If the trouble is reported a fourth time, the trouble should be reported to the responsible supervisor who has the option of requesting that a long-term end-to-end test be performed or referring the trouble to data technical support (DATEC).

DDS Network Trouble Isolation Procedures (Fig. 7 Through 19 and 22 Through 27)

6.16 When the idle code, all "1s" data, or all "0s" data is received from the station, the loopback test (OCU, CHAN, and DSU) should have already been performed in accordance with Fig. 4.

6.17 If a local office is manned, call the responsible maintenance personnel at that office and request performance of the required action. When the local office *is not* manned, dispatch the appropriate responsible central office TELCO employee to the office to perform the required action.

D. Inter-DSA Trouble Isolation (Fig. 20 and 21)

6.18 This part contains the procedures to be followed when both hubs find no trouble in the

hub-to-station portions of the circuit. The trouble is assumed to be in the long-haul portion of the network (inter-DSA). The following text is provided as support for Fig. 20.



The type of circuit troubles covered in this procedure can only result from the double failure of protected equipment, the failure of intraoffice cabling, or unintentional removal of cross-connect jumpers, and thus represent a very small segment of total expected troubles.

6.19 The trouble isolation routine given in Fig. 20 uses the signal monitored from the network as an aid in trouble isolation and then proceeds "upstream" in logical steps *until* the fault is located.

6.20 If the SVB hub or CTC/hub office monitors MCOS from the network, the fault will involve a DS1 (or higher) level (1.544 Mb/s) signal channel. Except in cases where a T1WB4/B5 port CP is removed from the shelf or is making poor contact at the connector, an office alarm will be activated at some point in the long-haul portion of the network and restoral or repair activities *should* be under way. For this type of failure, the objective is to restore service *within* 20 minutes. Should the outage persist and the long-haul trouble condition is not identified, Fig. 21 (flowchart) can be used to locate the faulty DS1 facility. Section 314-903-300 describes the procedure for detailed fault isolation within the DS1 facility.

6.21 If the SVB hub or CTC/hub office monitors the UMC signal from the network, the failure *may not* be alarmed and the hub must locate the trouble. If the UMC signal is monitored on a channel that operates at 56 kb/s, the failure involves a DS0 level (64-kb/s) signal and may be located in any "express hub" office (Fig. 30) having T1DM multiplexers.

6.22 If the UMC signal is monitored on a subrate channel, determine whether the trouble is confined to this single subrate channel or affects the complete DS0 channel on which it is multiplexed.

6.23 This is determined by observing the alphanumeric light-emitting diode (LED) display on the appropriate SRDM. If the letter "O" is lighted, an incoming signal is being received; however, subrate

framing has been lost (ie, the failure involves the entire DS0 channel and UMC is present on all associated subrate channels). This failure could be located at any hub office where the DS0 channel is multiplexed (ie, T1DM locations), but no further upstream than the next SRDM. If none of the alphanumeric displays on the SRDM are lighted, an incoming signal is being received with the proper framing. This indicates a single subrate channel failure; and the trouble must be upstream, possibly at the next hub office where the channel undergoes subrate multiplexing or beyond. By monitoring the UMC signal at each upstream office in turn, the trouble can be successfully traced to the faulty location.

6.24 Since channels going through the express hub office do not have testing access in that office, signal monitoring is performed at the multiplexer port nearest the hub coordinating the tests (ie, downstream multiplexer). This allows a single test to isolate the trouble to that office or indicates that the fault is further upstream.

6.25 Isolation of a trouble within a hub office depends on whether a DS0 level or subrate channel trouble is being traced and if the office is a hub or express hub office for the faulty channel.

6.26 Intraoffice ("This Office") Trouble Isolation: Office cabling and cross-connect arrangements for both hub and express hub offices are shown in Fig. 30. The following guidelines will aid in locating an intraoffice fault when the results of Fig. 20 indicate such.

- (1) When NO SIGNAL is indicated in Fig. 20, it is assumed to have been monitored at the input port of the downstream multiplexer or at the testing access.
- (2) When checking for the TEST CODE, monitor at the output port of the upstream multiplexer. If the TEST CODE is not present, check the multiplexer alphanumeric LED display which may indicate trouble at this multiplexer.
- (3) Replace quad cross-connect jumper on DSX-0A for subrate trouble or DSX-0B for DS0 level trouble.
- (4) Faults in intraoffice cabling can be traced by using ABATS or the KS-20908 DTS receiver and a locally assembled loopback plug (Fig. 31) at

the DSX-0 (A or B) cross-connection. The output port of the multiplexer is monitored to identify the signal present, the circuit is looped back at the cross-connect, and then the input port of the complementary multiplexer is monitored for the same signal present at the multiplexer.

E. Hub-to-Off-Net Extension Station Trouble Isolation (Fig. 28 and 29)

6.27 When the station experiencing trouble is an off-net extension served by a DDGT or a subrate off-net extension, Fig. 28 and 29, respectively, should be used as aids in isolating troubles on the circuit.

6.28 Location of trouble on a circuit containing an off-net extension station served by a DDGT involves monitoring for the presence of a signal via ABATS or the 950-type testboard and the DDGT in the hub office to determine the direction of transmission that is faulty. If the fault cannot be found by monitoring in the hub office, loopback tests must be performed to the DDGT in the hub and serving offices and to the DSU or CSU at the station.

6.29 When isolating troubles on a circuit containing a subrate off-net extension station, loopback tests should first be performed over the DDS portion of the circuit toward both ends of the circuit. This will avoid involvement of the customer or personnel at a private line SVB when the trouble is not in the off-net portion of the circuit.

6.30 Isolation procedures to be used on the off-net portion of the circuit will depend upon whether or not the data set at the station location is Bell System equipment. If the data set at the station is Bell System owned, loopback tests can be performed to this data set, if necessary, to isolate troubles. When the data set at the station is customer provided, tests should be performed to the data set in the hub office only, and if no trouble is encountered, the responsible private line SVB should be instructed to continue trouble isolation on the remaining off-net portion of the circuit.

7. MULTIPOINT CIRCUIT MAINTENANCE ACTIVITIES

7.01 Access to every channel and branch of each MJU is provided at jack modules located in the 950-type testboard. To assist in selecting the correct jacks (NEAR or FAR) in a jack module when per-

forming tests, use the convention used to label the jacks that is shown in Fig. 32 and described as follows.

Note: The definition of "upstream" should be understood to mean toward the control station and "downstream" toward the outlying station(s).

- (a) For stations served directly by an MJU, "NEAR" is toward the station.
- (b) For inter-DSA facilities
 - At the "upstream" hub, "NEAR" is toward the control office.
 - At the "downstream" hub, "NEAR" is toward the outlying station(s).
- (c) For cascaded MJUs within the same office,
 - "NEAR" is toward the "upstream" MJU.
 - "FAR" is toward the "downstream" MJU.

7.02 This part describes the procedures to be followed by a hub when a trouble report is received on a multipoint circuit.

7.03 After receiving a trouble report, the customer should be questioned to find out which stations are experiencing trouble, in order to isolate the trouble to the smallest circuit segment containing all the stations experiencing trouble. If the customer cannot provide this information and is willing to re-

lease the circuit for testing, then the entire multipoint circuit must be checked to locate the stations experiencing trouble. After questioning the customer and analyzing the trouble, commence isolating the trouble using Fig. 33.

7.04 If the control office is not included in the isolated circuit segment containing the stations experiencing trouble, refer the trouble to the first hub downstream which is part of the circuit segment. The noncontrol hub receiving the trouble report should use Fig. 34 to isolate troubles in the segment.

7.05 The MSU, which is located in the 950-type testboard or ABATS, is used when a 2-point test connection between the MSU and a particular downstream station is desired. In order to establish a test connection to a station, the MSU is used to select a particular branch at each MJU between the MSU and the station one at a time until the connection is made. Verification of a test connection to a selected branch is accomplished by observing that the MSU displays the hub identification (HUB ID) code and branch number received from the selected MJU.

7.06 Once connection to the station has been established using the MSU, tests can be performed to the station using the KS-20908 DTS receiver and the KS-20909 DTS transmitter or ABATS. If any of these tests should fail, trouble isolation should continue, using Fig. 35 and 36, where applicable, from the hub serving the affected stations.

7.07 The tests requested in the trouble isolation flowcharts are contained in Section 314-901-500.

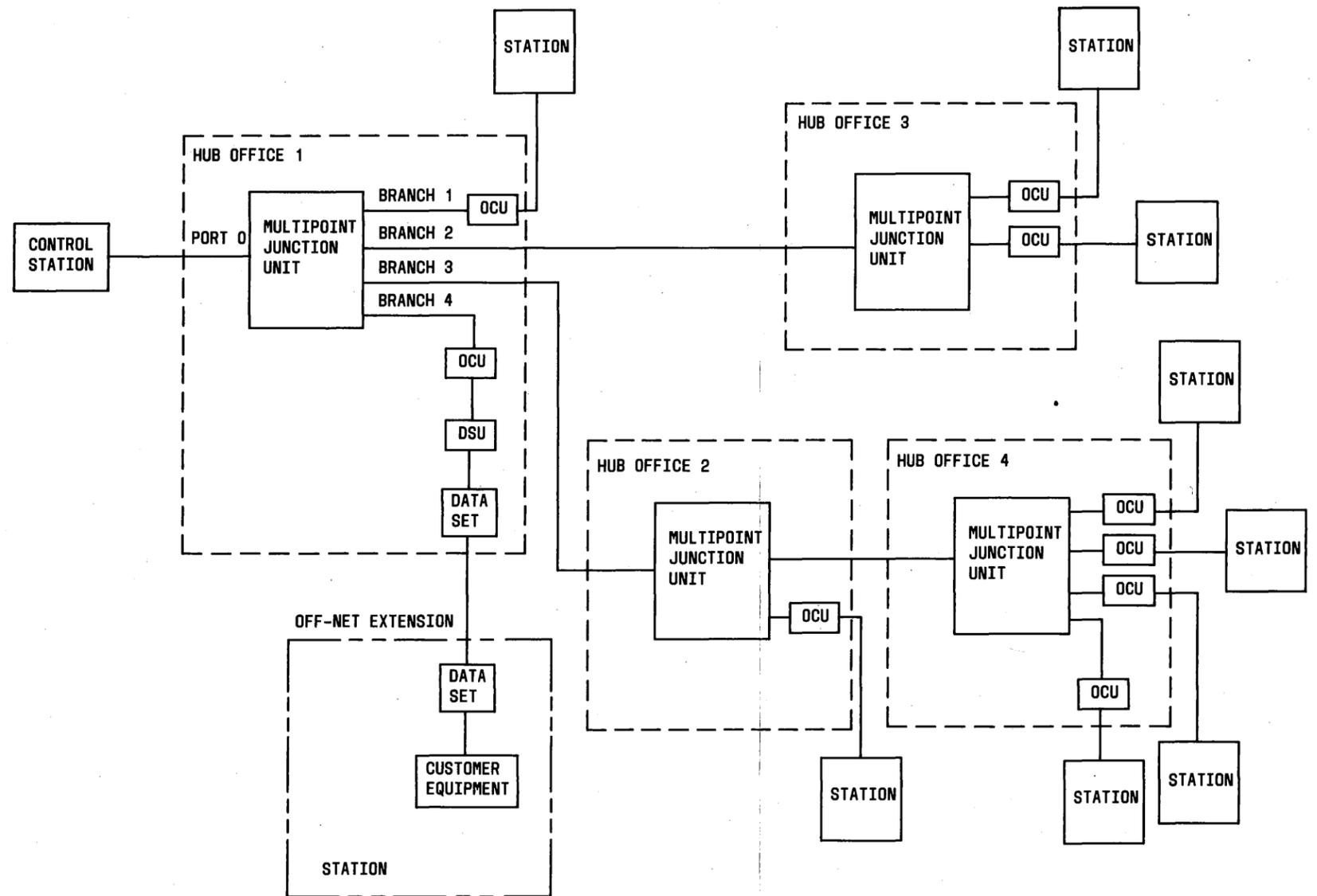
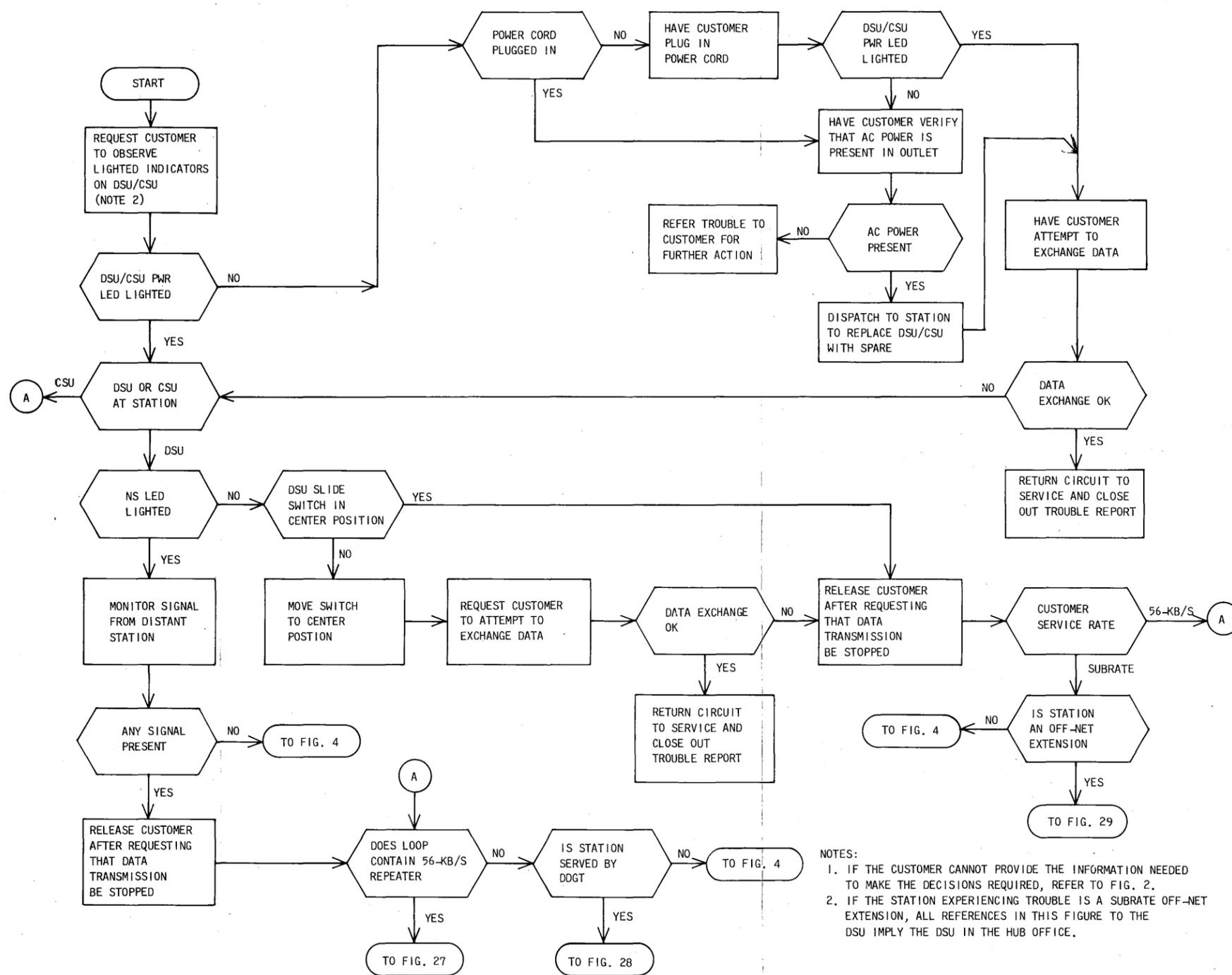
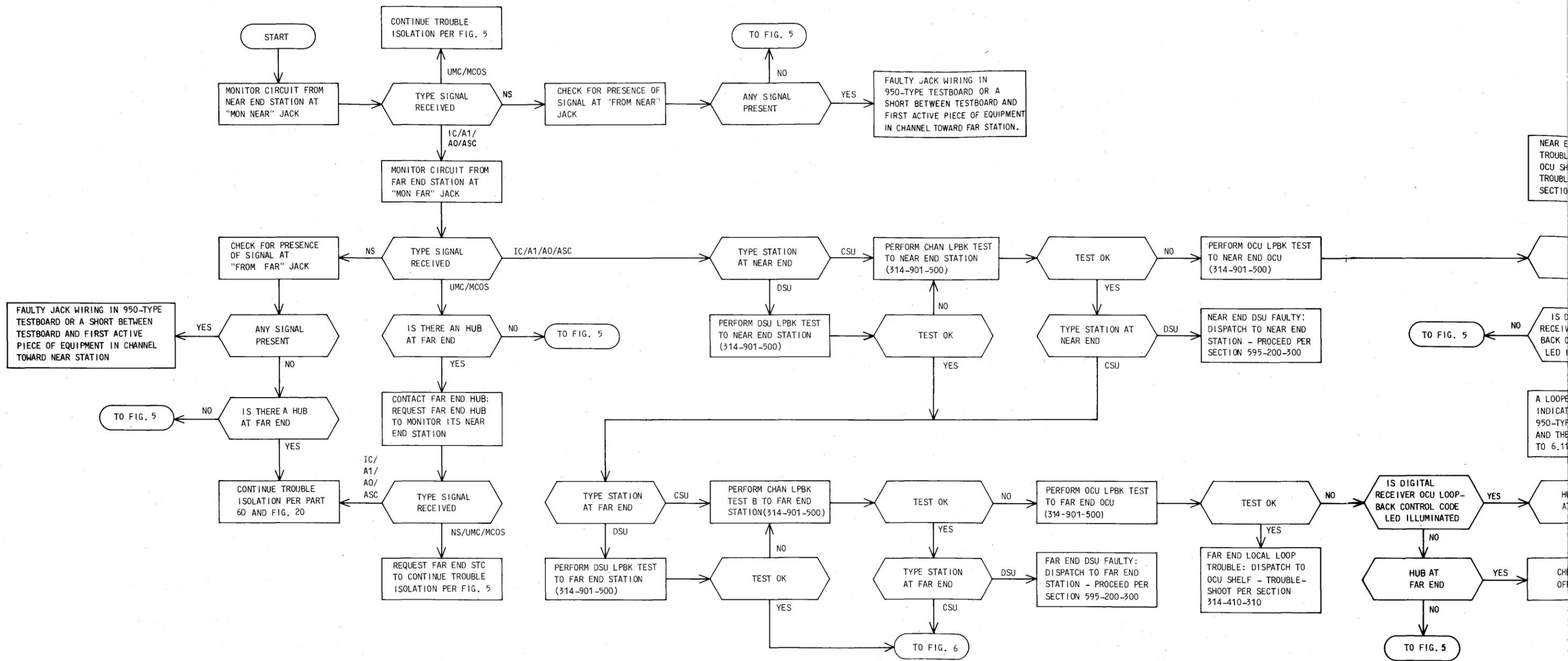


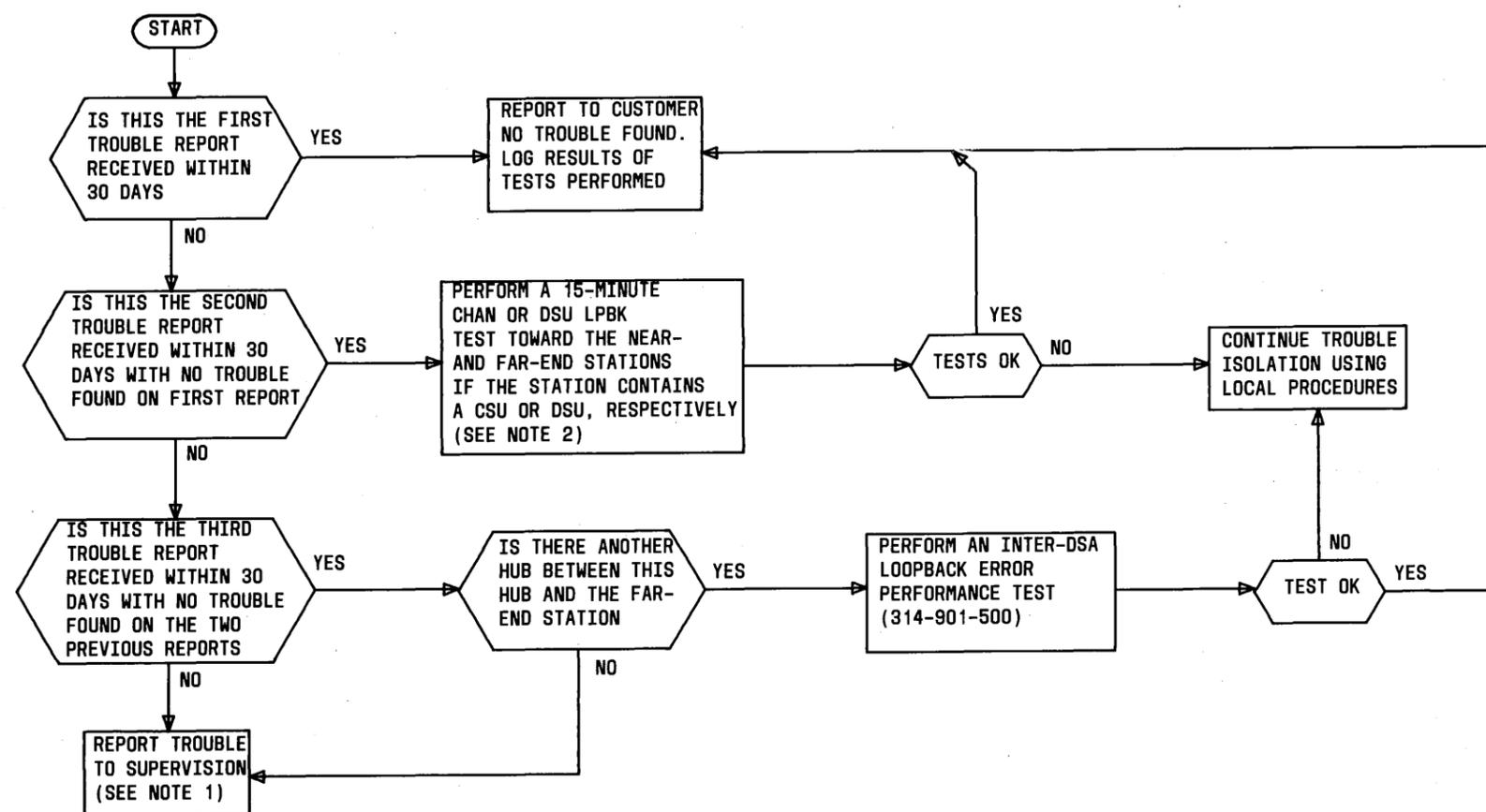
Fig. 1—Example of a Multipoint Circuit Arrangement



NOTES:
 1. IF THE CUSTOMER CANNOT PROVIDE THE INFORMATION NEEDED TO MAKE THE DECISIONS REQUIRED, REFER TO FIG. 2.
 2. IF THE STATION EXPERIENCING TROUBLE IS A SUBRATE OFF-NET EXTENSION, ALL REFERENCES IN THIS FIGURE TO THE DSU IMPLY THE DSU IN THE HUB OFFICE.

Fig. 3— Customer Trouble Report Analysis (Paragraph 6.06)

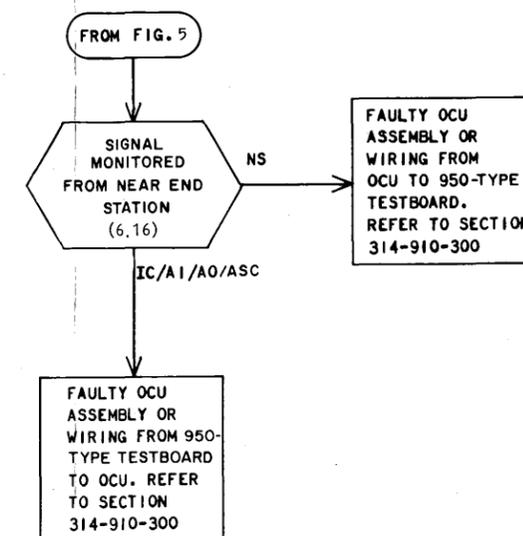




NOTES:

1. AT THIS POINT THE SUPERVISOR SHOULD MAKE THE DECISION TO EITHER PERFORM AN END-TO-END TEST OR REQUEST ASSISTANCE FROM DATEC.
2. THE MAXIMUM NUMBER OF ERRORS ALLOWED FOR THE 15-MINUTE LOOPBACK TEST IS 2, AND 6 WHEN TESTING TOWARD THE NEAR-END AND FAR-END STATIONS, RESPECTIVELY.

Fig. 6—Intermittent Trouble Isolation Procedures



LEGEND: NS -- NO SIGNAL
 IC -- IDLE CODE (X1111110)*
 AI -- ALL "1s" DATA (X1111111)*
 AO -- ALL "0s" DATA (X0000001)*
 ASC -- ABNORMAL STATION CONDITION (X0011110)*
 *X-- 1 FOR 56-KB/S
 0 FOR SUBRATE SERVICE

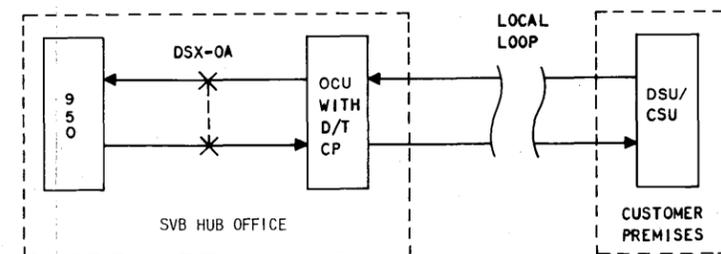
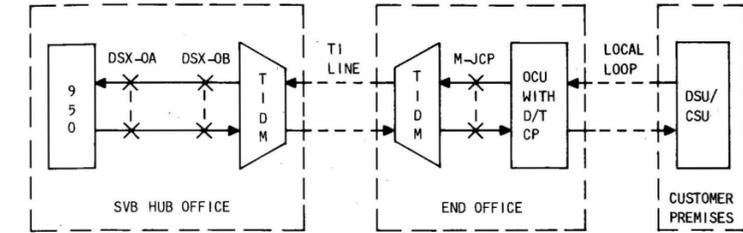
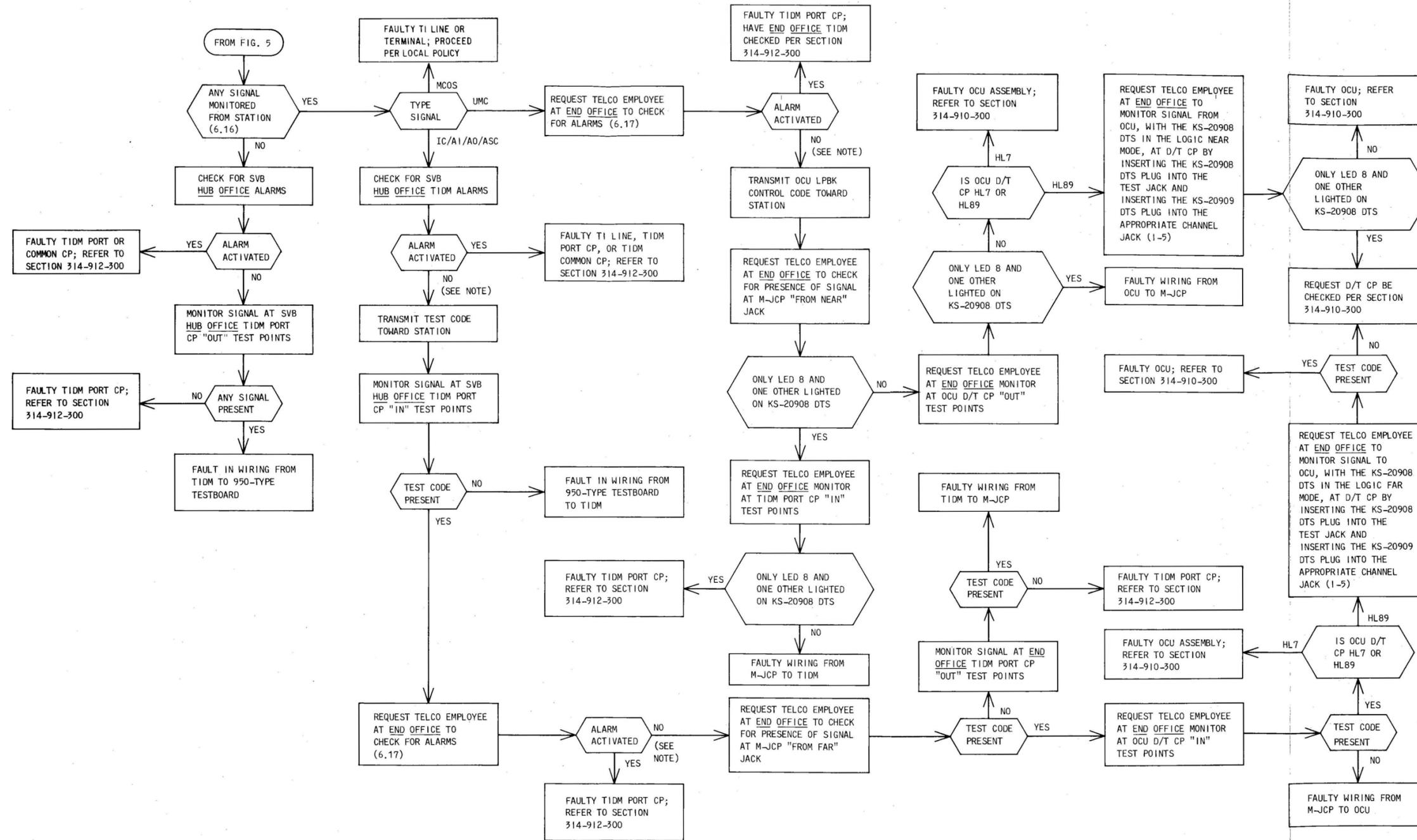


Fig. 7—Local Loop Trouble Isolation Procedures

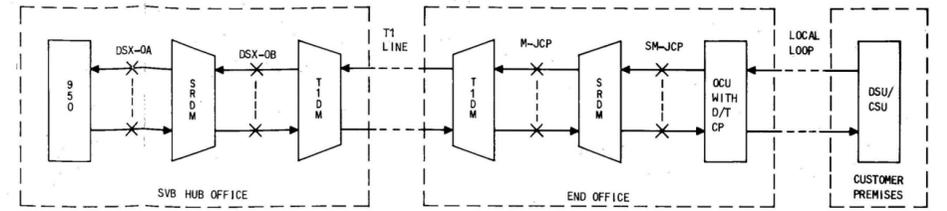
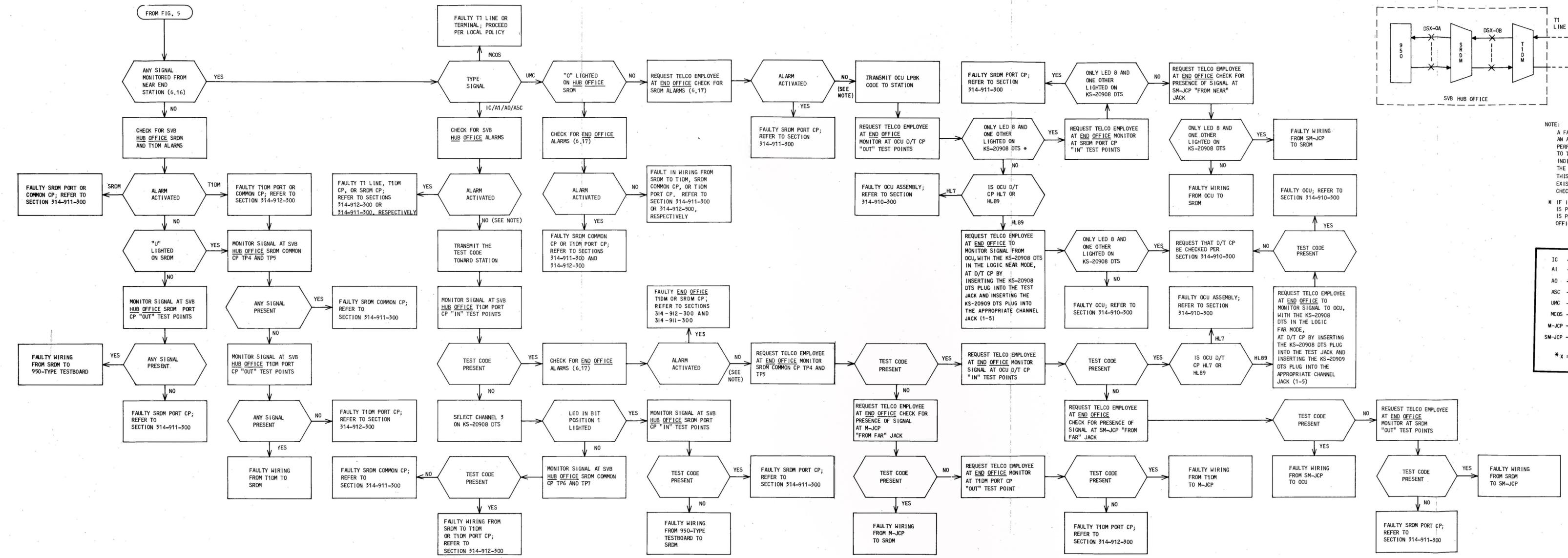
Fig. 6 and 7



LEGEND:
 IC - IDLE CODE (X1111110) *
 AI - ALL "1"'S DATA (X1111111) *
 AO - ALL "0"'S DATA (X0000001) *
 ASC - ABNORMAL STATION CONDITION (X001110) *
 UMC - UNASSIGNED MULTIPLEXER CHANNEL (00011000) *
 MCOS - MULTIPLEXER CHANNEL OUT OF SYNC (00011010) *
 * X = 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

NOTE:
 A FAULT IN A T1DM WILL NOT ACTIVATE AN ALARM AT THE OFFICE IF A T1DM PERFORMANCE MONITOR IS NOT CONNECTED TO THE T1DM AND THE TROUBLE REPORTED INDICATES INTERMITTENT ERRORS. IF THE TROUBLE CANNOT BE FOUND USING THIS FIGURE AND THESE TWO CONDITIONS EXIST, REQUEST THAT THE T1DM BE CHECKED PER SECTION 314-912-300.

Fig. 8—Hub-to-End Office—T1DM, 56-kb/s or Nonsubmultiplexed Subrate Channel Trouble Isolation Procedures



NOTE:
 A FAULT IN A T1DM WILL NOT ACTIVATE AN ALARM AT THE OFFICE IF A T1DM PERFORMANCE MONITOR IS NOT CONNECTED TO THE T1DM AND THE TROUBLE REPORTED INDICATES INTERMITTENT ERRORS. IF THE TROUBLE CANNOT BE FOUND USING THIS FIGURE AND THESE TWO CONDITIONS EXIST, REQUEST THAT THE T1DM BE CHECKED PER SECTION 314-912-300.
 * IF IDLE CODE IS PRESENT, THE FAULT IS PROBABLY IN BOTH DIRECTIONS AND IS PROBABLY WIRING BETWEEN END OFFICE SROM AND OCU ASSEMBLY.

- IC - IDLE CODE (X1111111)*
 - AI - ALL "Is" DATA (X1111111)*
 - AO - ALL "Os" DATA (X0000001)*
 - ASC - ABNORMAL STATION CONDITION (X0011110)*
 - UMC - UNASSIGNED MULTIPLEXER CHANNEL (0001000)
 - MCOS - MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 - M-JCP - MULTIPLEXER JACK AND CONNECTOR PANEL
 - SM-JCP - SUBMULTIPLEXER JACK AND CONNECTOR PANEL
- * X = 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

Fig. 9—Hub-to-End Office—T1DM, SROM Submultiplexed Substrate Channel Trouble Isolation Procedures

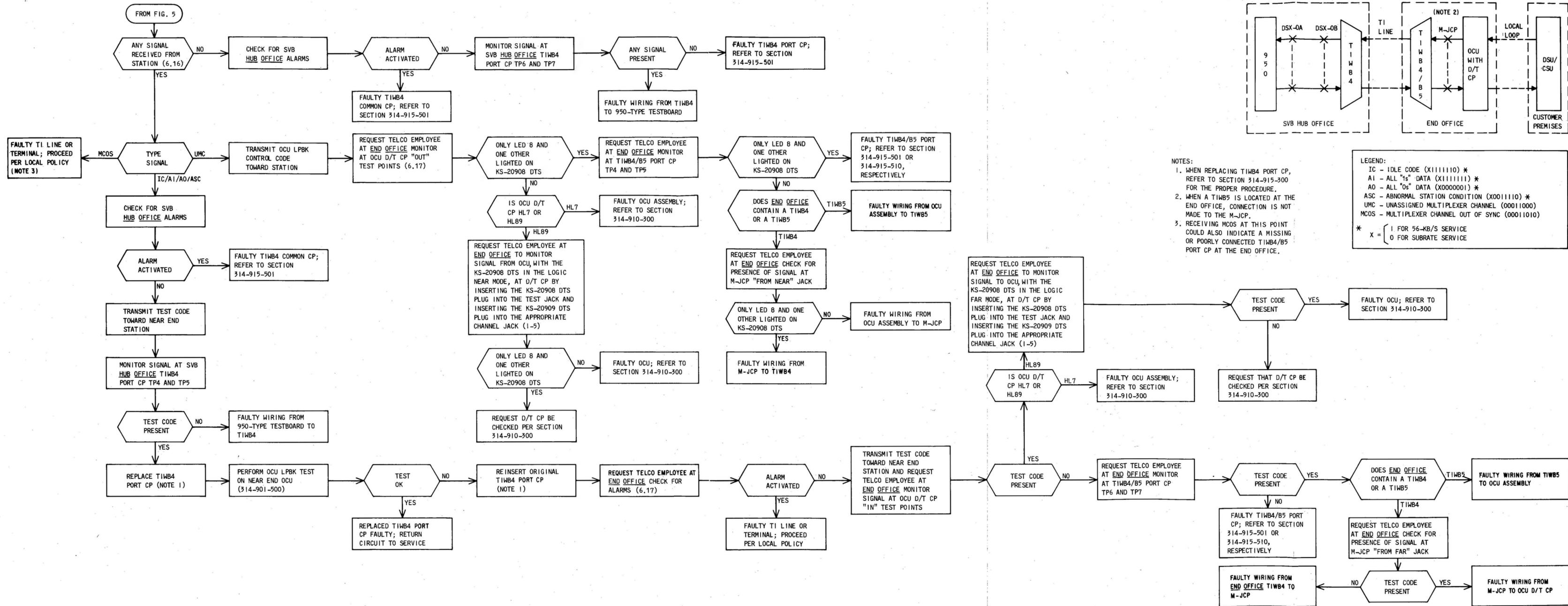
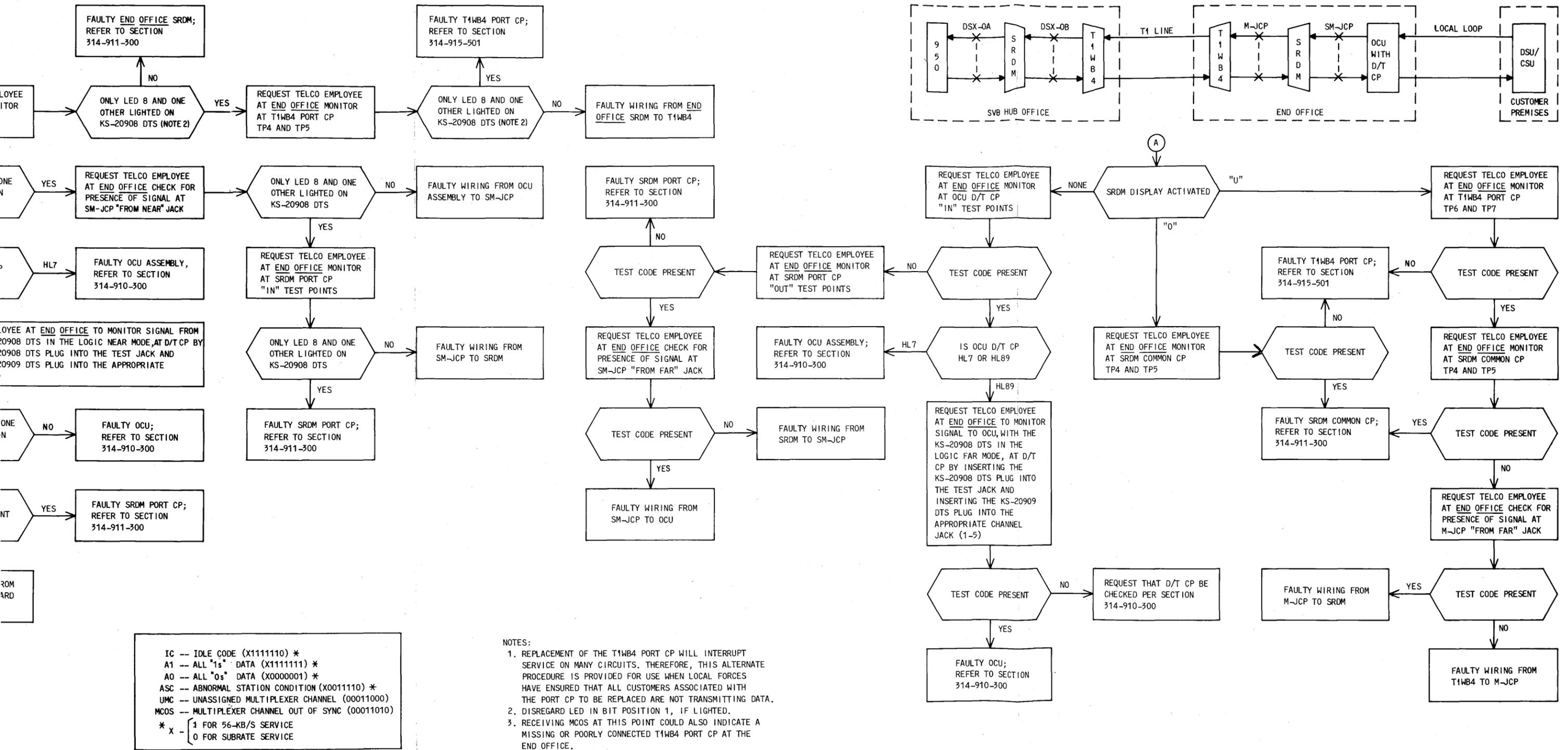


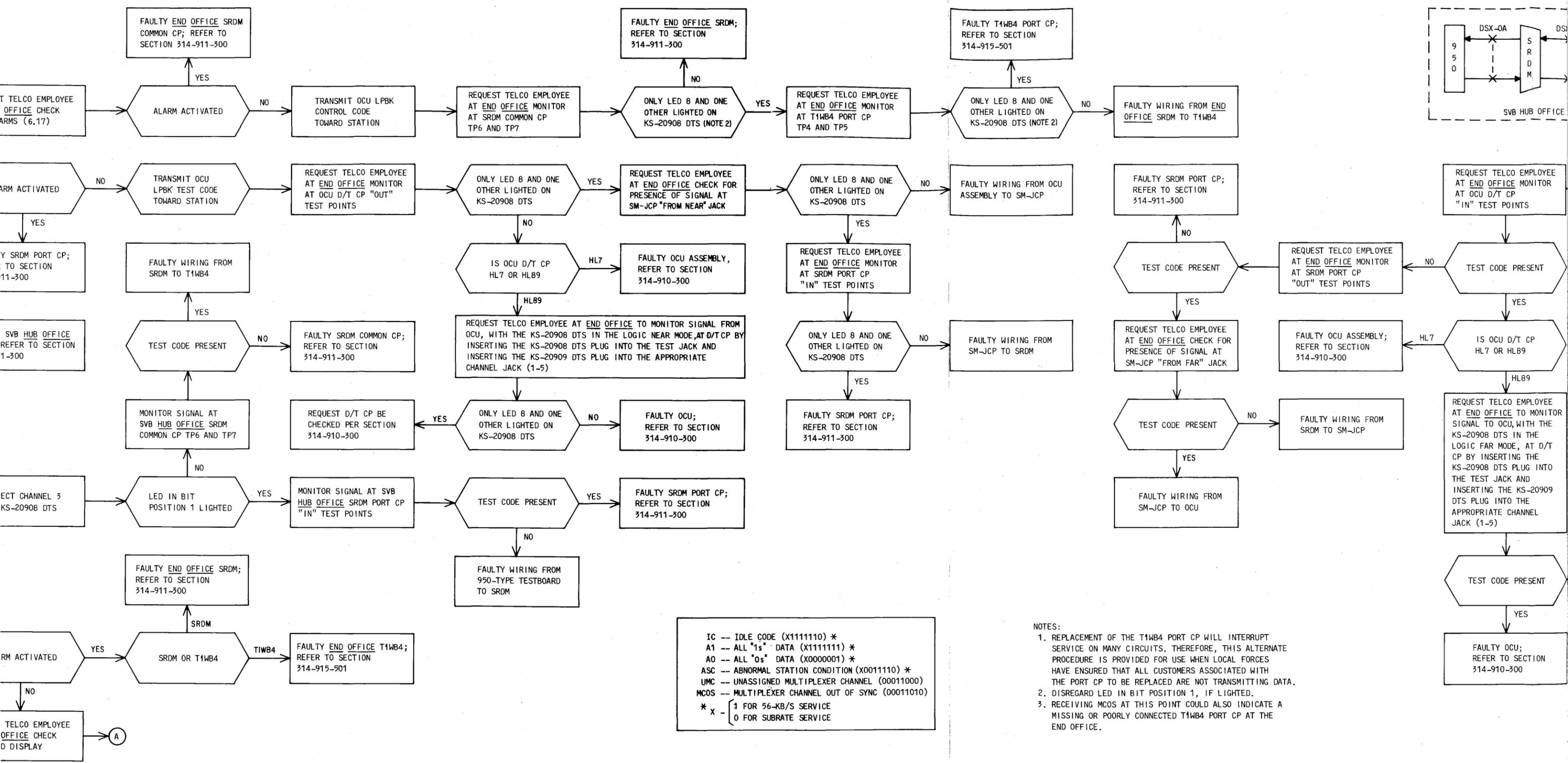
Fig. 11—Hub-to-End Office—TIW4/B5, 56-kb/s or Nonsubmultiplexed Subrate Channel Trouble Isolation Procedures



IC -- IDLE CODE (X1111110) *
 A1 -- ALL "1s" DATA (X1111111) *
 A0 -- ALL "0s" DATA (X0000001) *
 ASC -- ABNORMAL STATION CONDITION (X0011110) *
 UMC -- UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS -- MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 * X - 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

- NOTES:
1. REPLACEMENT OF THE T1WB4 PORT CP WILL INTERRUPT SERVICE ON MANY CIRCUITS. THEREFORE, THIS ALTERNATE PROCEDURE IS PROVIDED FOR USE WHEN LOCAL FORCES HAVE ENSURED THAT ALL CUSTOMERS ASSOCIATED WITH THE PORT CP TO BE REPLACED ARE NOT TRANSMITTING DATA.
 2. DISREGARD LED IN BIT POSITION 1, IF LIGHTED.
 3. RECEIVING MCOS AT THIS POINT COULD ALSO INDICATE A MISSING OR POORLY CONNECTED T1WB4 PORT CP AT THE END OFFICE.

Fig. 12—Hub-to-End Office—T1WB4, SRDM Submultiplexed Subrate Channel Trouble Isolation Procedures

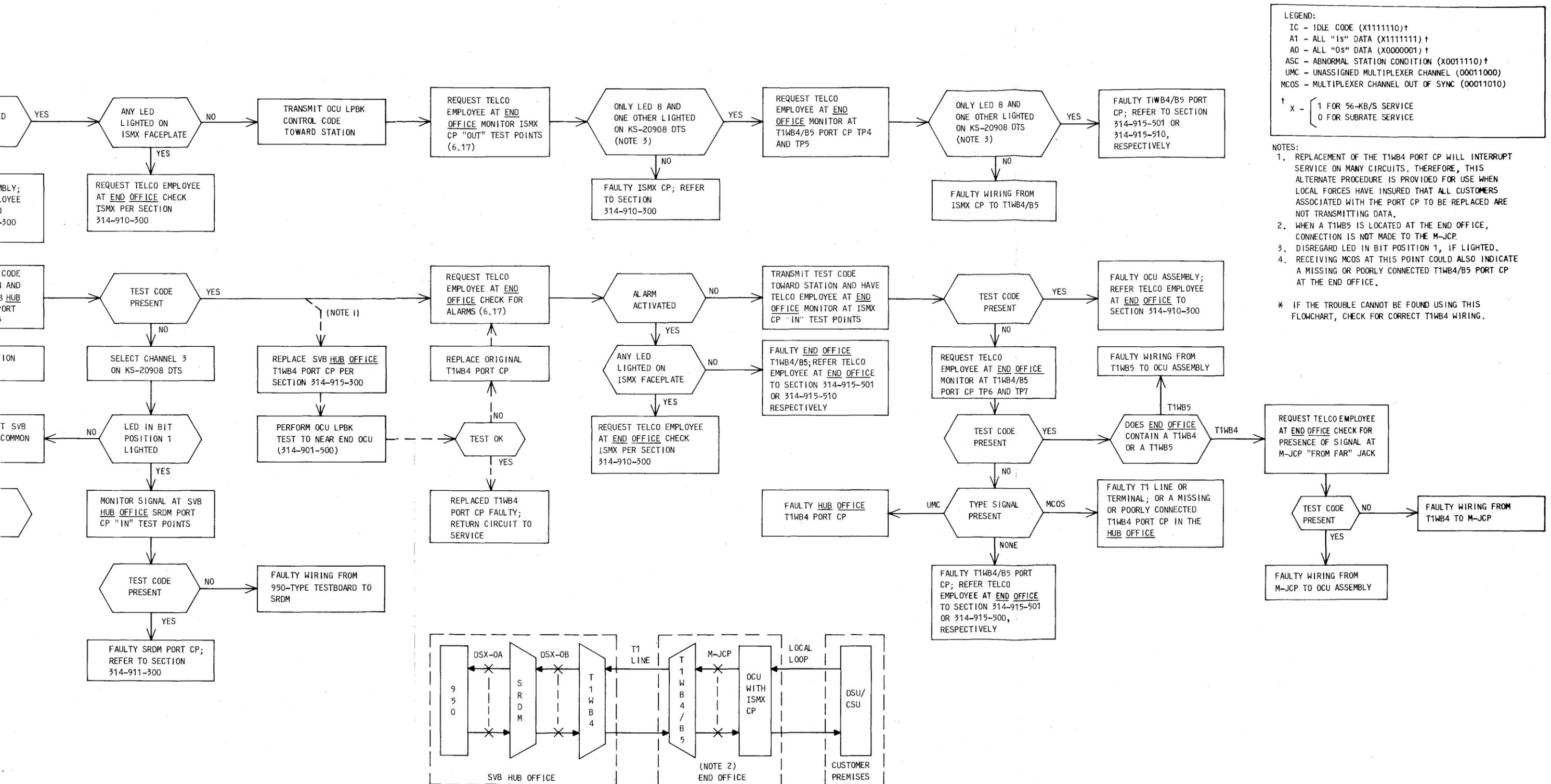


IC -- IDLE CODE (X1111110) *
 A1 -- ALL "1s" DATA (X1111111) *
 A0 -- ALL "0s" DATA (X0000001) *
 ASC -- ABNORMAL STATION CONDITION (X0011110) *
 UMC -- UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS -- MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 * X - 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

- NOTES:
1. REPLACEMENT OF THE T1WB4 PORT CP WILL INTERRUPT SERVICE ON MANY CIRCUITS. THEREFORE, THIS ALTERNATE PROCEDURE IS PROVIDED FOR USE WHEN LOCAL FORCES HAVE ENSURED THAT ALL CUSTOMERS ASSOCIATED WITH THE PORT CP TO BE REPLACED ARE NOT TRANSMITTING DATA.
 2. DISREGARD LED IN BIT POSITION 1, IF LIGHTED.
 3. RECEIVING MCOS AT THIS POINT COULD ALSO INDICATE A MISSING OR POORLY CONNECTED T1WB4 PORT CP AT THE END OFFICE.



IC -- IDLE CODE (X1111110)
 A1 -- ALL "1s" DATA (X111111)
 AO -- ALL "0s" DATA (X000000)
 ASC -- ABNORMAL STATION COND
 UMC -- UNASSIGNED MULTIPLEXER
 MCOS -- MULTIPLEXER CHANNEL O
 * X - 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE



LEGEND:
 IC - IDLE CODE (X1111110)†
 A1 - ALL "1s" DATA (X1111111)†
 A0 - ALL "0s" DATA (X0000001)†
 ASC - ABNORMAL STATION CONDITION (X0011110)†
 UMC - UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS - MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 † X - 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

- NOTES:
 1. REPLACEMENT OF THE T1WB4 PORT CP WILL INTERRUPT SERVICE ON MANY CIRCUITS. THEREFORE, THIS ALTERNATE PROCEDURE IS PROVIDED FOR USE WHEN LOCAL FORCES HAVE INSURED THAT ALL CUSTOMERS ASSOCIATED WITH THE PORT CP TO BE REPLACED ARE NOT TRANSMITTING DATA.
 2. WHEN A T1WB5 IS LOCATED AT THE END OFFICE, CONNECTION IS NOT MADE TO THE M-JCP.
 3. DISREGARD LED IN BIT POSITION 1, IF LIGHTED.
 4. RECEIVING MCOS AT THIS POINT COULD ALSO INDICATE A MISSING OR POORLY CONNECTED T1WB4/B5 PORT CP AT THE END OFFICE.
 * IF THE TROUBLE CANNOT BE FOUND USING THIS FLOWCHART, CHECK FOR CORRECT T1WB4 WIRING.

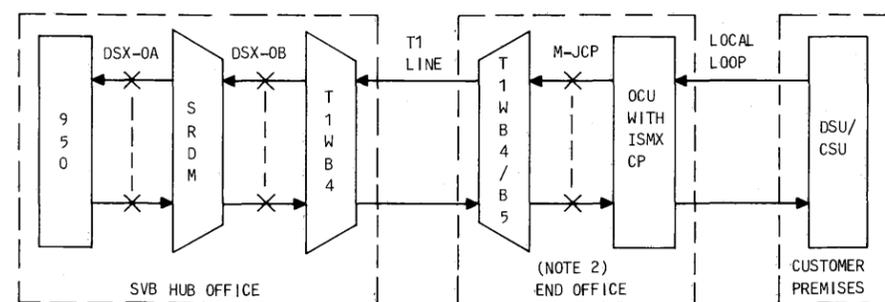
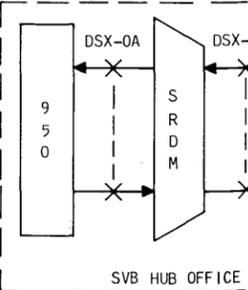
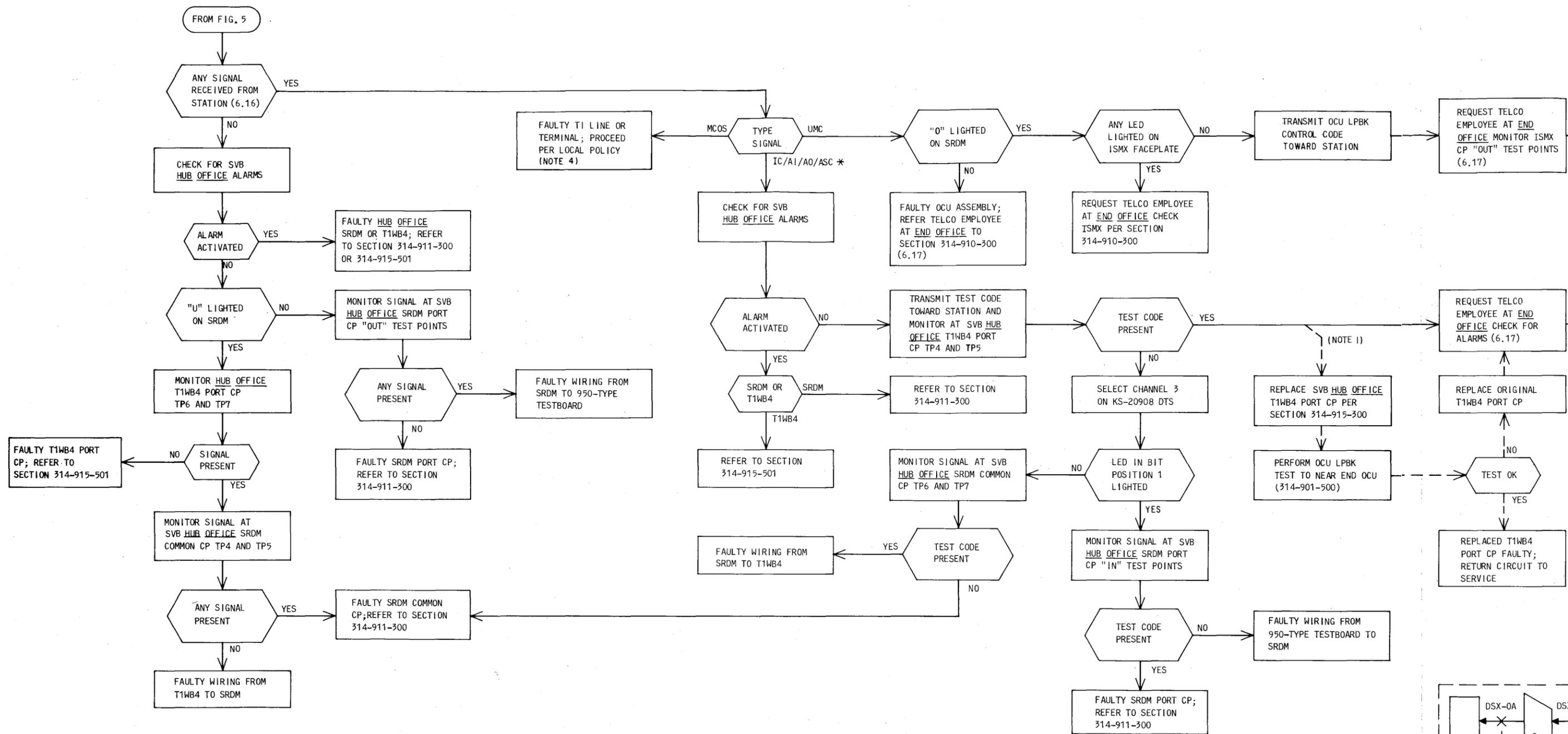


Fig. 13—Hub-to-End Office—T1WB4/B5, ISMX Submultiplexed Subrate Channel Trouble Isolation Procedures



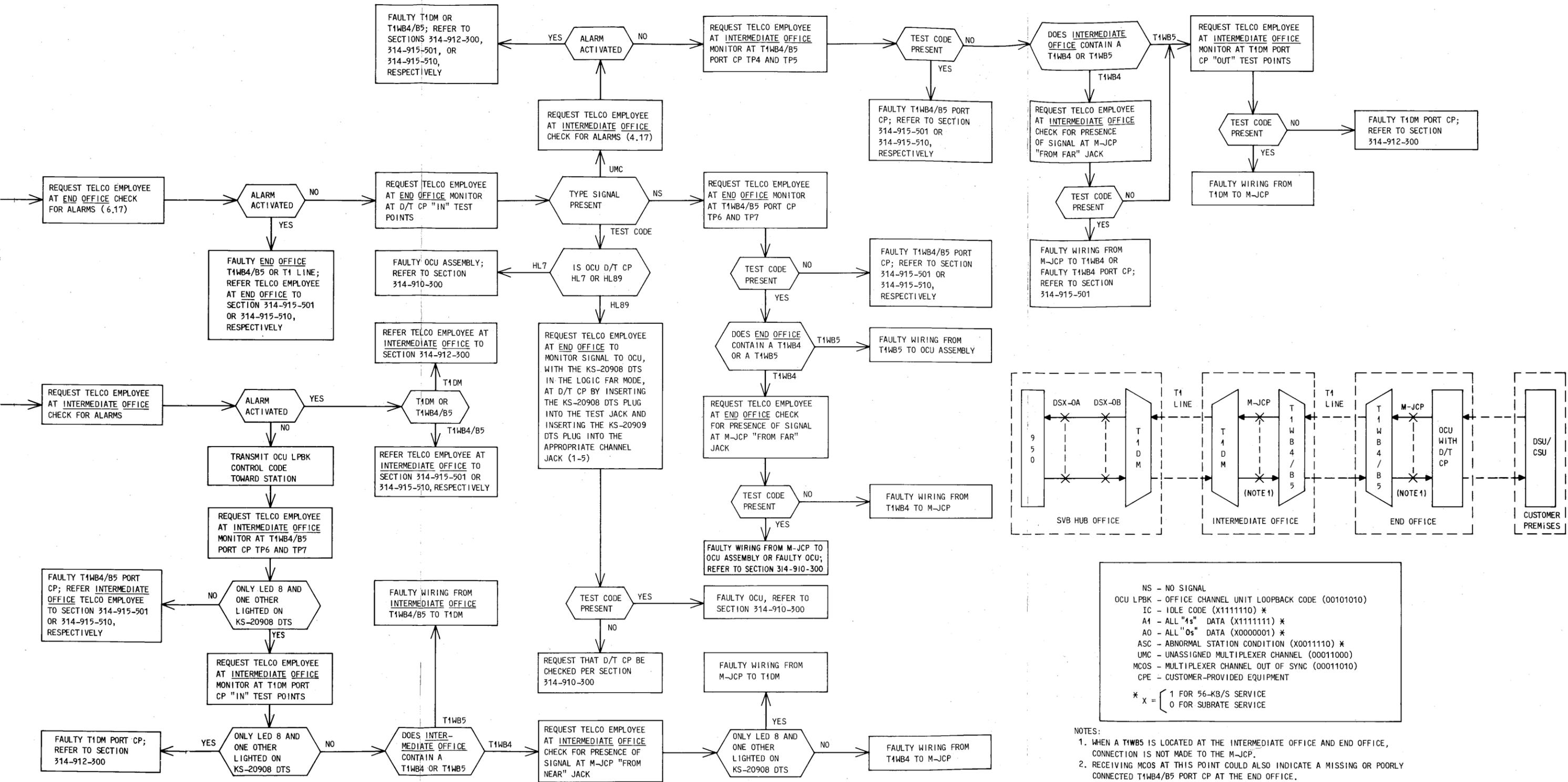
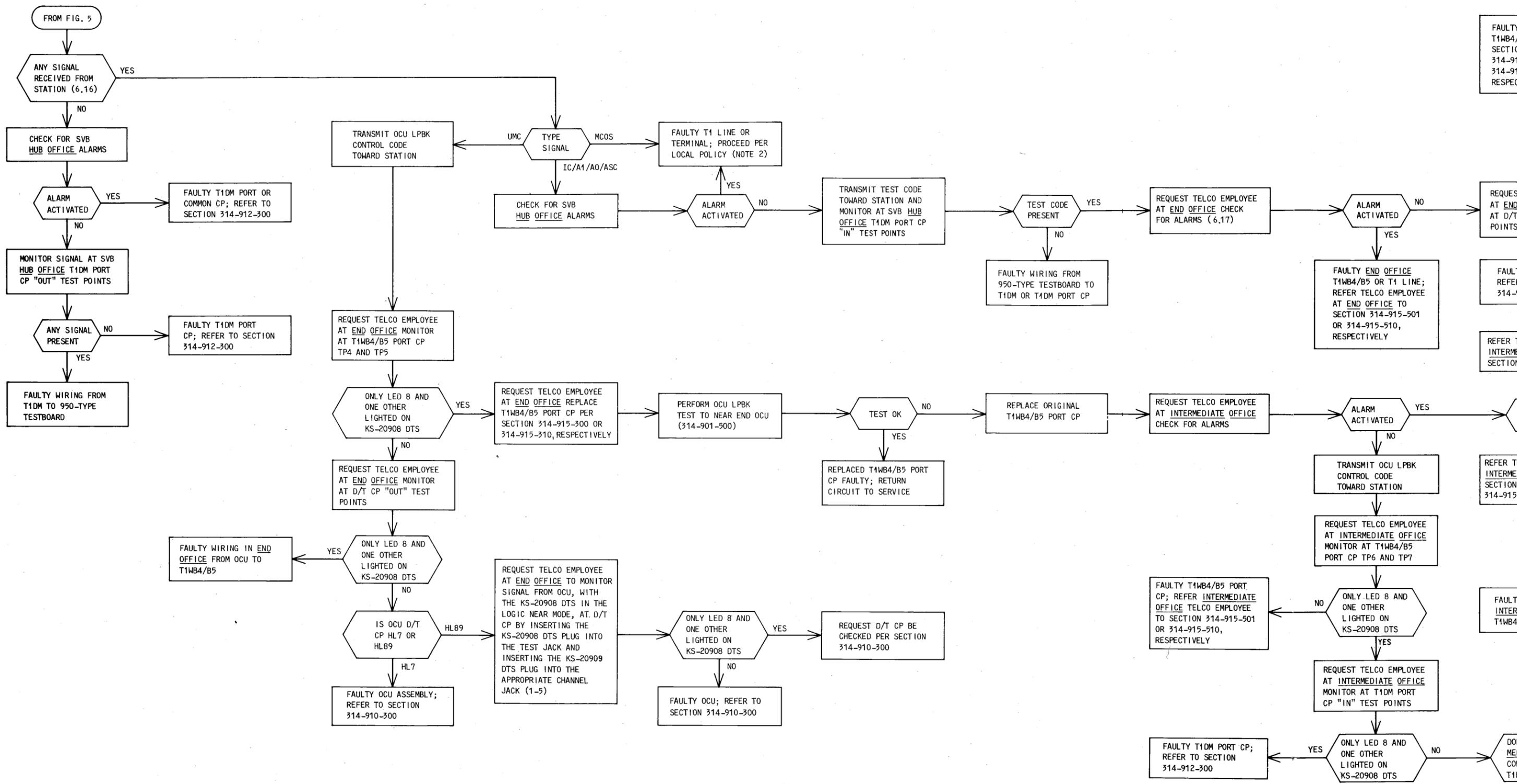
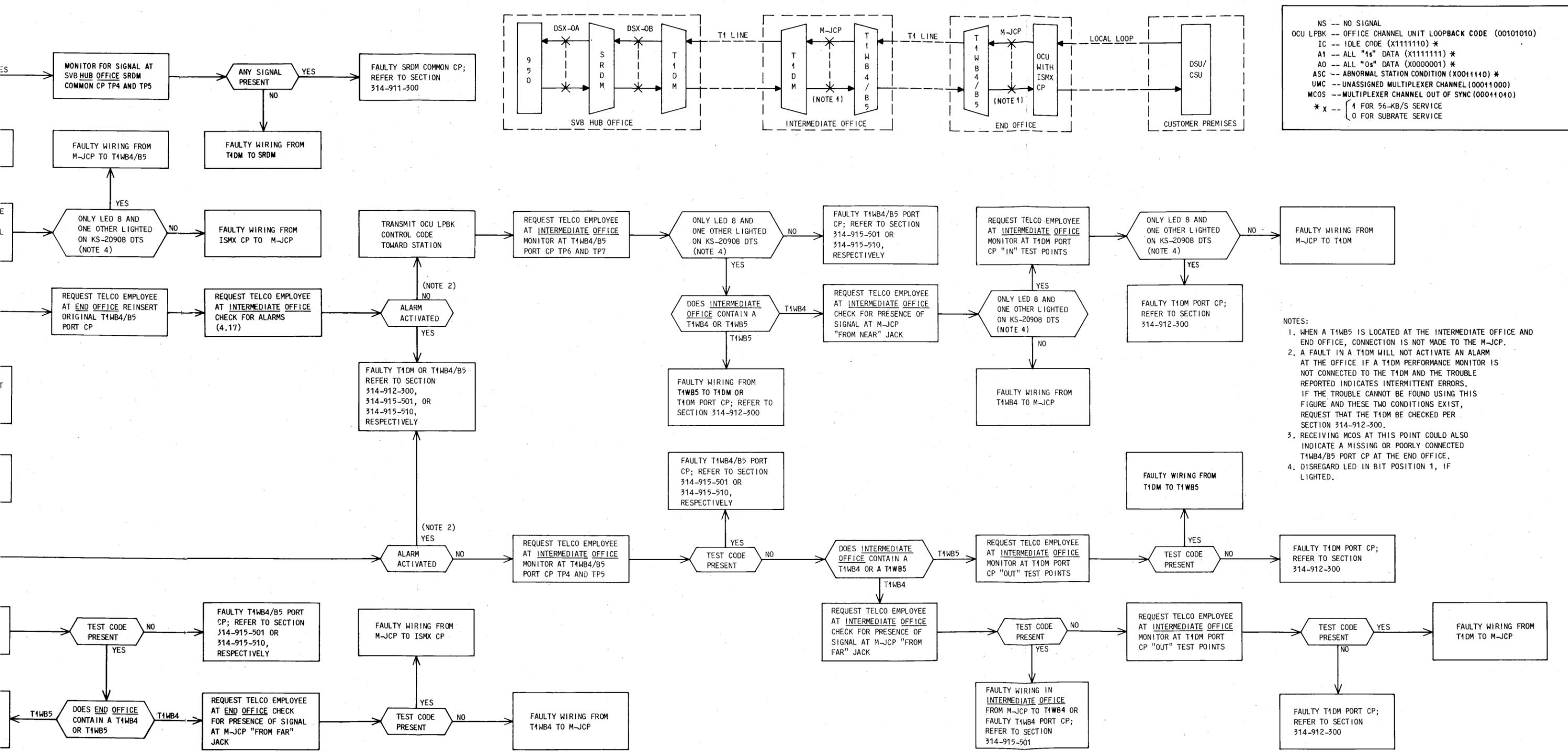


Fig. 14—Hub-to-End Office Via an Intermediate Office—T1WB4/B5 Second Link, 56-kb/s or Nonsubmultiplexed Subrate Channel Trouble Isolation Procedures

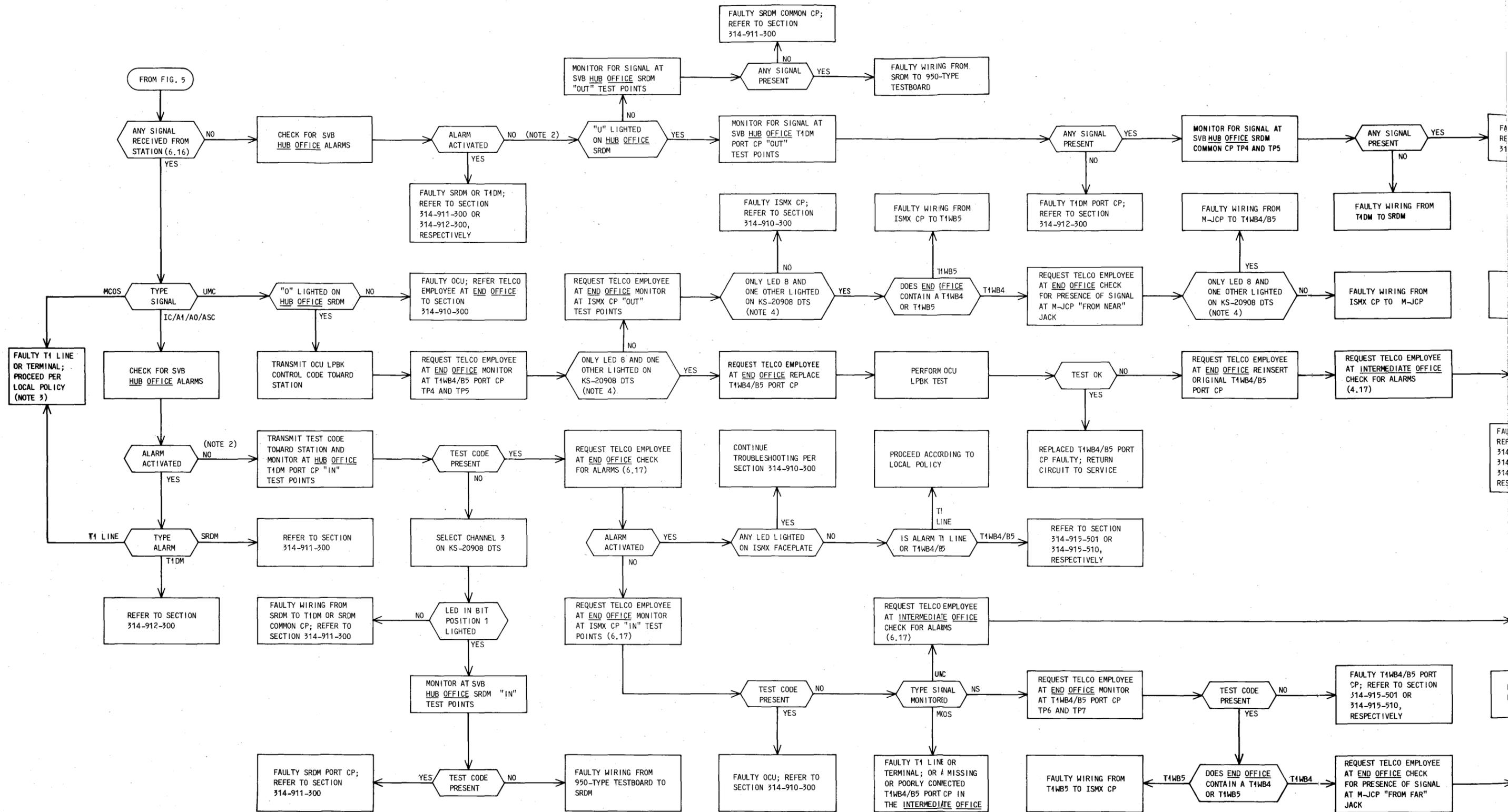




NS -- NO SIGNAL
 OCU LPBK -- OFFICE CHANNEL UNIT LOOPBACK CODE (00101010)
 IC -- IDLE CODE (X1111110) *
 A1 -- ALL "1s" DATA (X1111111) *
 AO -- ALL "0s" DATA (X0000001) *
 ASC -- ABNORMAL STATION CONDITION (X0011110) *
 UMC -- UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS -- MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 * X -- 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

- NOTES:
1. WHEN A T1WB5 IS LOCATED AT THE INTERMEDIATE OFFICE AND END OFFICE, CONNECTION IS NOT MADE TO THE M-JCP.
 2. A FAULT IN A T1DM WILL NOT ACTIVATE AN ALARM AT THE OFFICE IF A T1DM PERFORMANCE MONITOR IS NOT CONNECTED TO THE T1DM AND THE TROUBLE REPORTED INDICATES INTERMITTENT ERRORS. IF THE TROUBLE CANNOT BE FOUND USING THIS FIGURE AND THESE TWO CONDITIONS EXIST, REQUEST THAT THE T1DM BE CHECKED PER SECTION 314-912-300.
 3. RECEIVING MCOS AT THIS POINT COULD ALSO INDICATE A MISSING OR POORLY CONNECTED T1WB4/B5 PORT CP AT THE END OFFICE.
 4. DISREGARD LED IN BIT POSITION 1, IF LIGHTED.

Fig. 15—Hub-to-End Office Via an Intermediate Office—T1WB4/B5 Second Link, ISMX Submultiplexed Subrate Channel Trouble Isolation Procedures



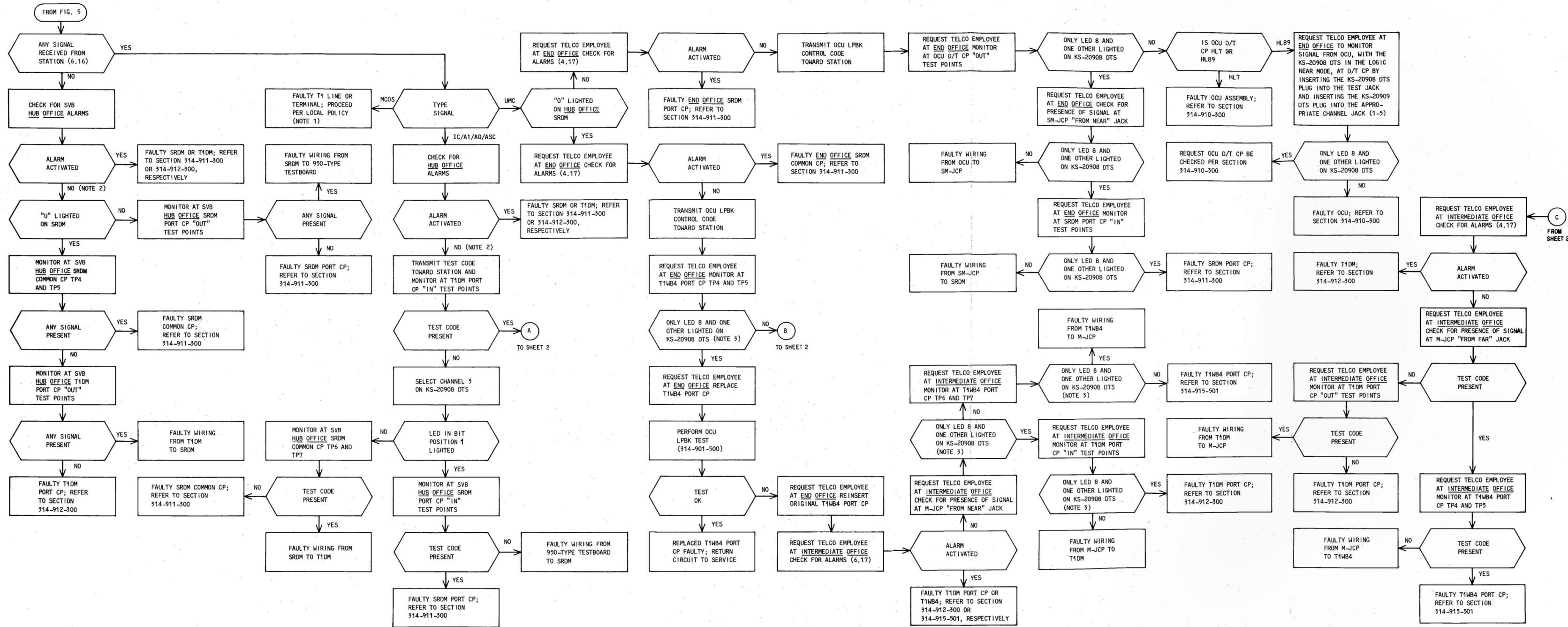


Fig. 16—Hub-to-End Office Via an Intermediate Office—T1WB4 Second Link. SMDR Submultiplexed Substrate Channel Trouble Isolation Procedure (Sheet 1 of 2)

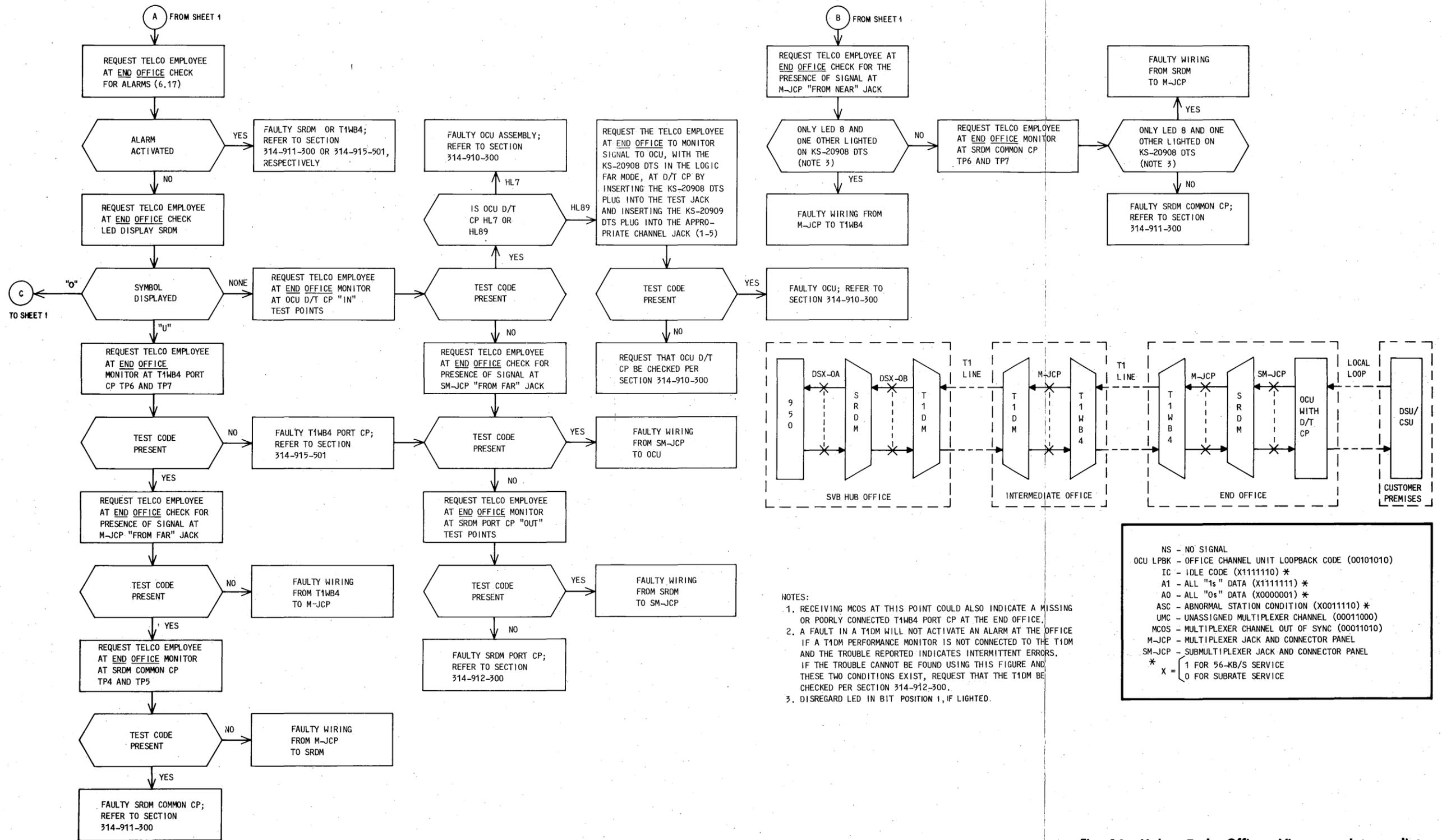


Fig. 16—Hub-to-End Office Via an Intermediate Office—T1WB4 Second Link, SMDR Submultiplexed Subrate Channel Trouble Isolation Procedures (Sheet 2 of 2)

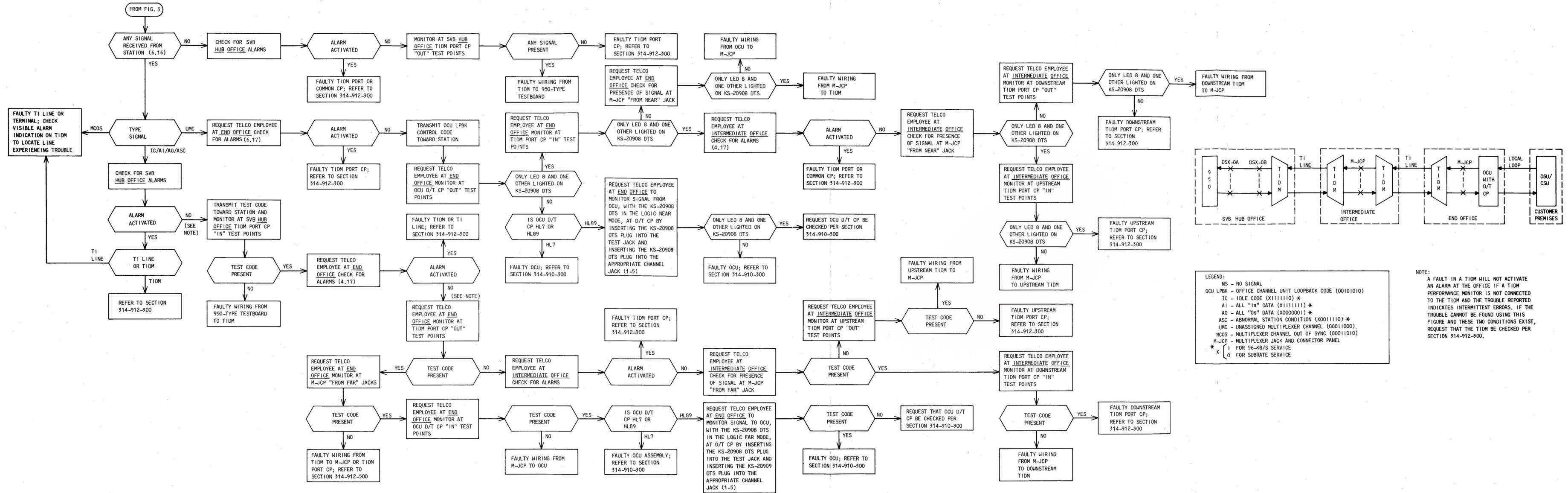


Fig. 17—Hub-to-End Office Via an Intermediate Office—T1DM Second Link, 56-kb/s or Nonsubmultiplexed Subrate Channel Trouble Isolation Procedures

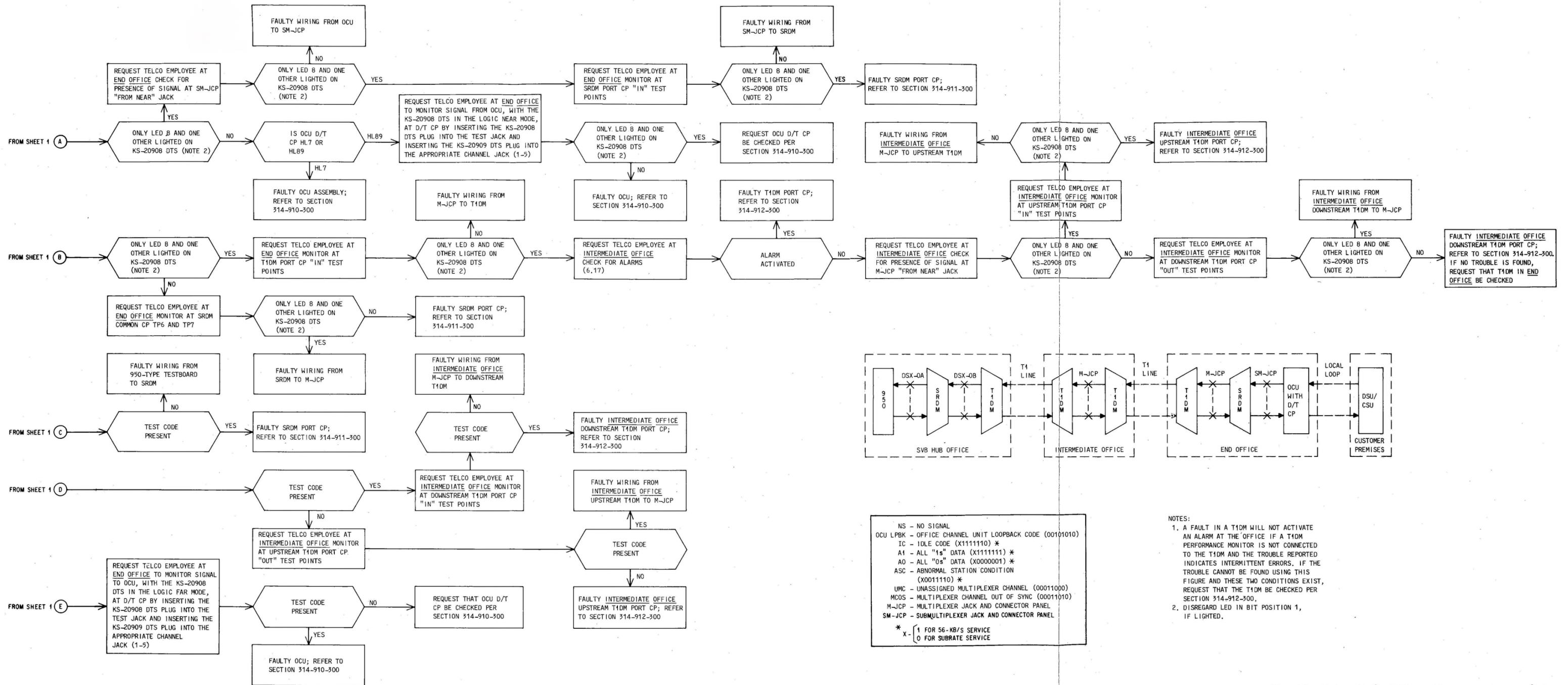
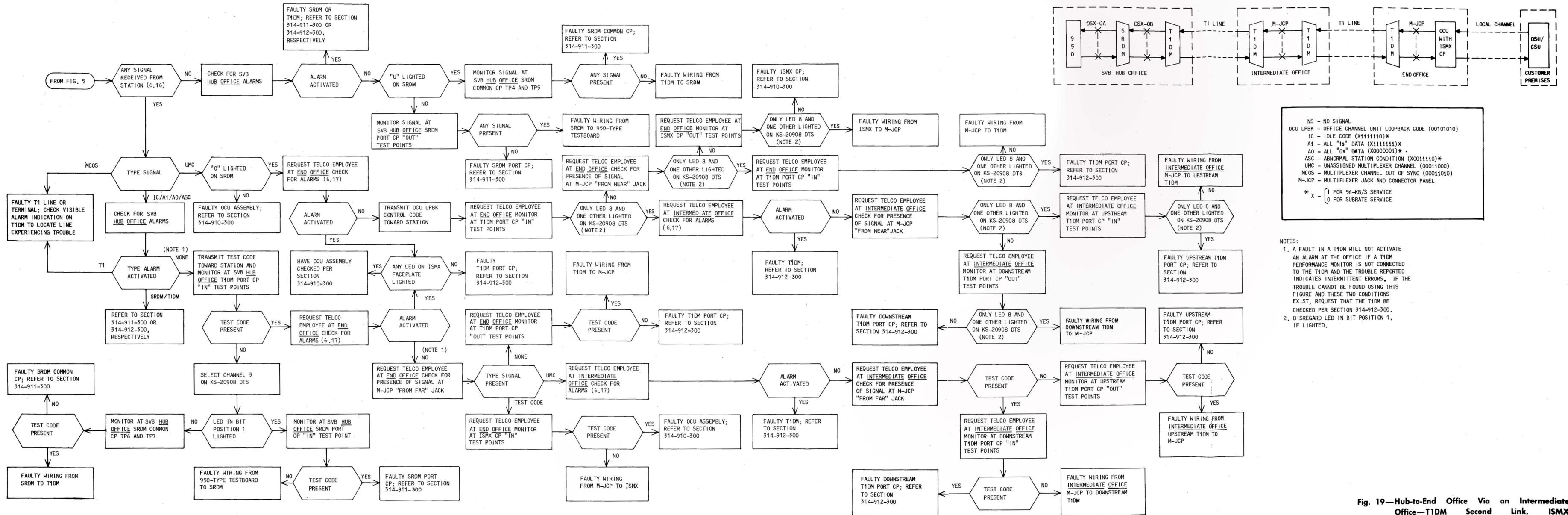


Fig. 18—Hub-to-End Office Via an Intermediate Office—T1DM Second Link, SRDM Submultiplexed Subrate Channel Trouble Isolation Procedures (Sheet 2 of 2)



NS - NO SIGNAL
 OCU LPBK - OFFICE CHANNEL UNIT LOOPBACK CODE (00101010)
 IC - IDLE CODE (X1111110)*
 A1 - ALL "1s" DATA (X1111111)*
 A0 - ALL "0s" DATA (X0000001)*
 ASC - ABNORMAL STATION CONDITION (X0011110)*
 UMC - UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS - MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 M-JCP - MULTIPLEXER JACK AND CONNECTOR PANEL
 * X - 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

- NOTES:
1. A FAULT IN A T1DM WILL NOT ACTIVATE AN ALARM AT THE OFFICE IF A T1DM PERFORMANCE MONITOR IS NOT CONNECTED TO THE T1DM AND THE TROUBLE REPORTED INDICATES INTERMITTENT ERRORS. IF THE TROUBLE CANNOT BE FOUND USING THIS FIGURE AND THESE TWO CONDITIONS EXIST, REQUEST THAT THE T1DM BE CHECKED PER SECTION 314-912-300.
 2. DISREGARD LED IN BIT POSITION 1, IF LIGHTED.

Fig. 19—Hub-to-End Office Via an Intermediate Office—T1DM Second Link, ISMX Submultiplexed Subrate Channel Trouble Isolation Procedures

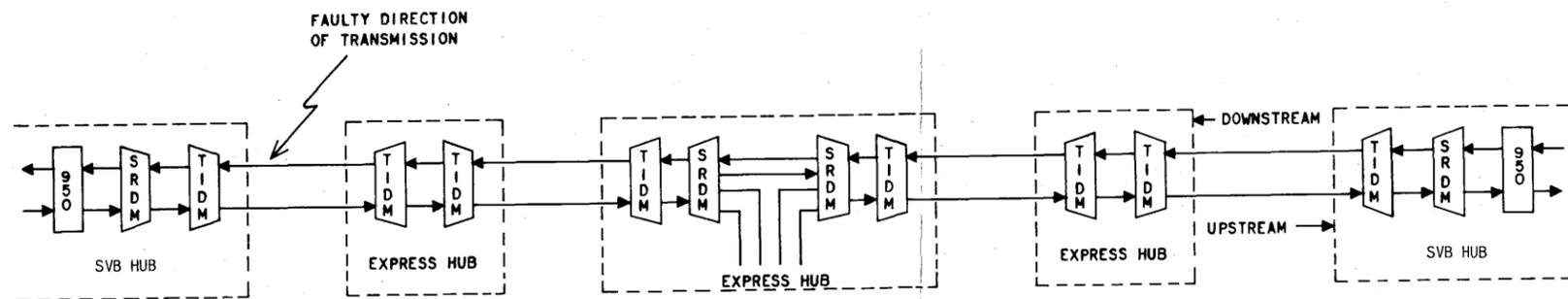
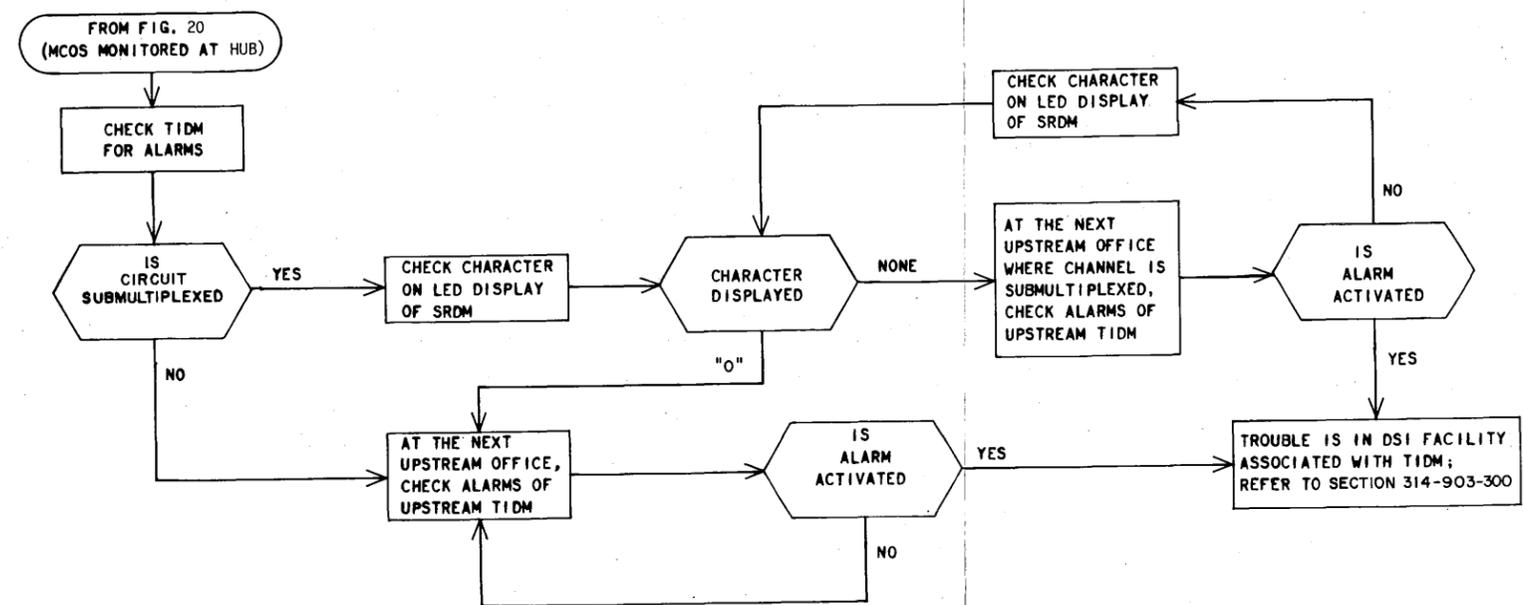
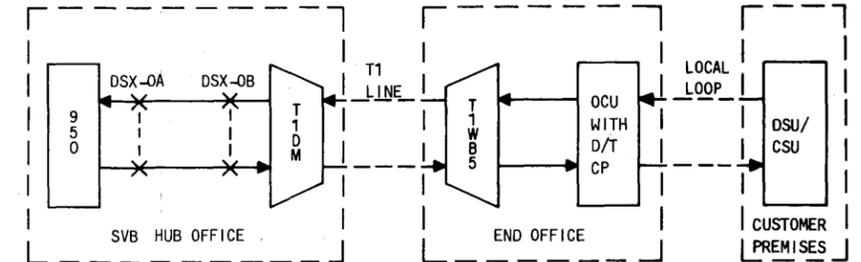
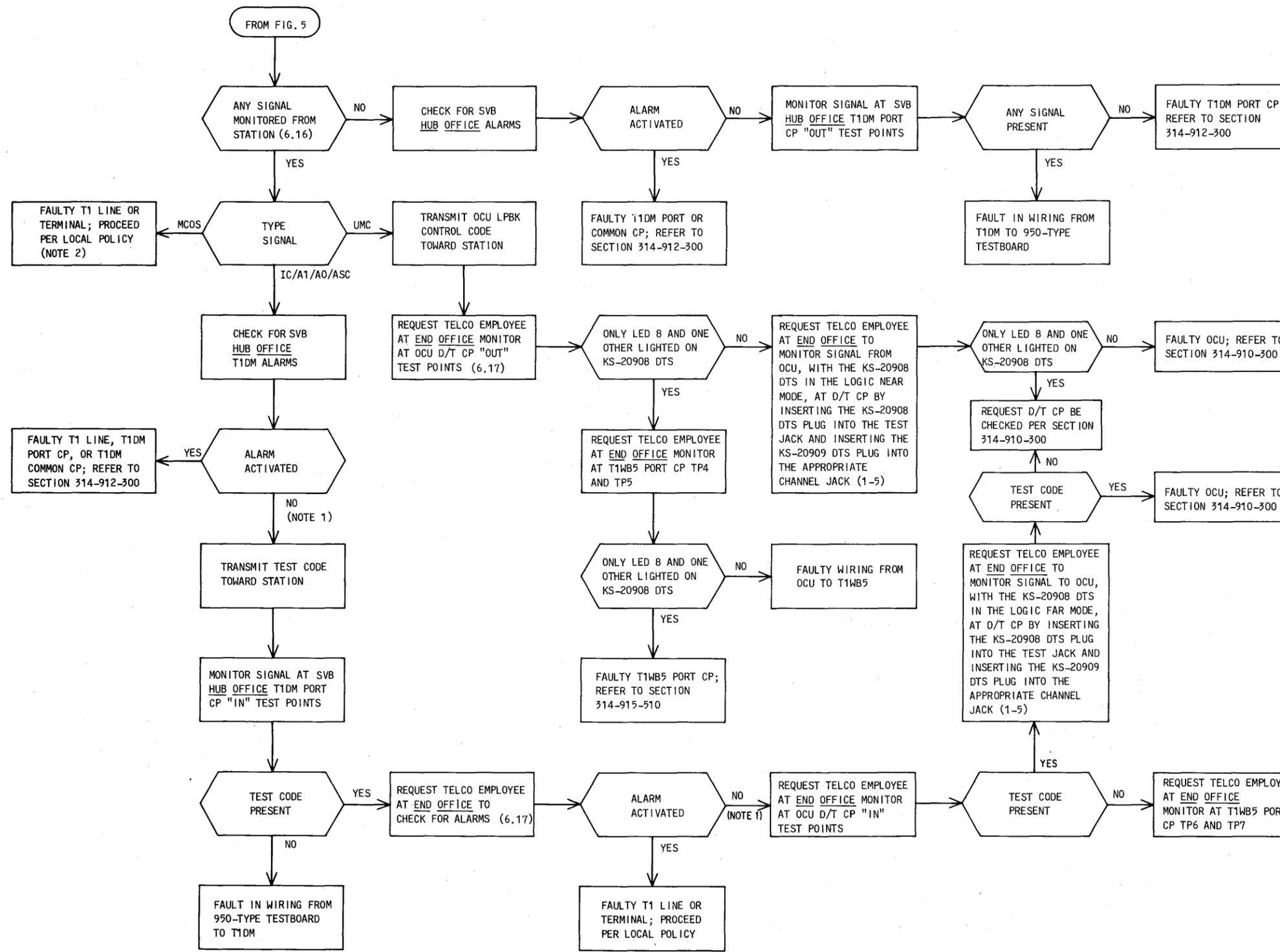


Fig. 21—Inter-DSA Trouble Procedures, DS1 Level Fault



LEGEND:

- IC - IDLE CODE (X1111110) *
- A1 - ALL "1s" DATA (X1111111) *
- A0 - ALL "0s" DATA (X0000001) *
- ASC - ABNORMAL STATION CONDITION (X0011110) *
- UMC - UNASSIGNED MULTIPLEXER CHANNEL (00011000)
- MCOS - MULTIPLEXER CHANNEL OUT OF SYNC (00011010)

* X - 1 FOR 56-KB/S SERVICE
0 FOR SUBRATE SERVICE

NOTES:

1. A FAULT IN A T1DM WILL NOT ACTIVATE AN ALARM AT THE OFFICE IF A T1DM PERFORMANCE MONITOR IS NOT CONNECTED TO THE T1DM AND THE TROUBLE REPORTED INDICATES INTERMITTENT ERRORS. IF THE TROUBLE CANNOT BE FOUND USING THIS FIGURE AND THESE TWO CONDITIONS EXIST, REQUEST THAT THE T1DM BE CHECKED PER SECTION 314-912-300.
2. RECEIVING MCOS AT THIS POINT COULD ALSO INDICATE A MISSING OR POORLY CONNECTED T1WB5 PORT CP AT THE END OFFICE.

Fig. 22—Hub-to-End Office—T1DM in Hub Office, T1WB5 in End Office, 56-kb/s or Nonsubmultiplexed Subrate Channel Trouble Isolation Procedures

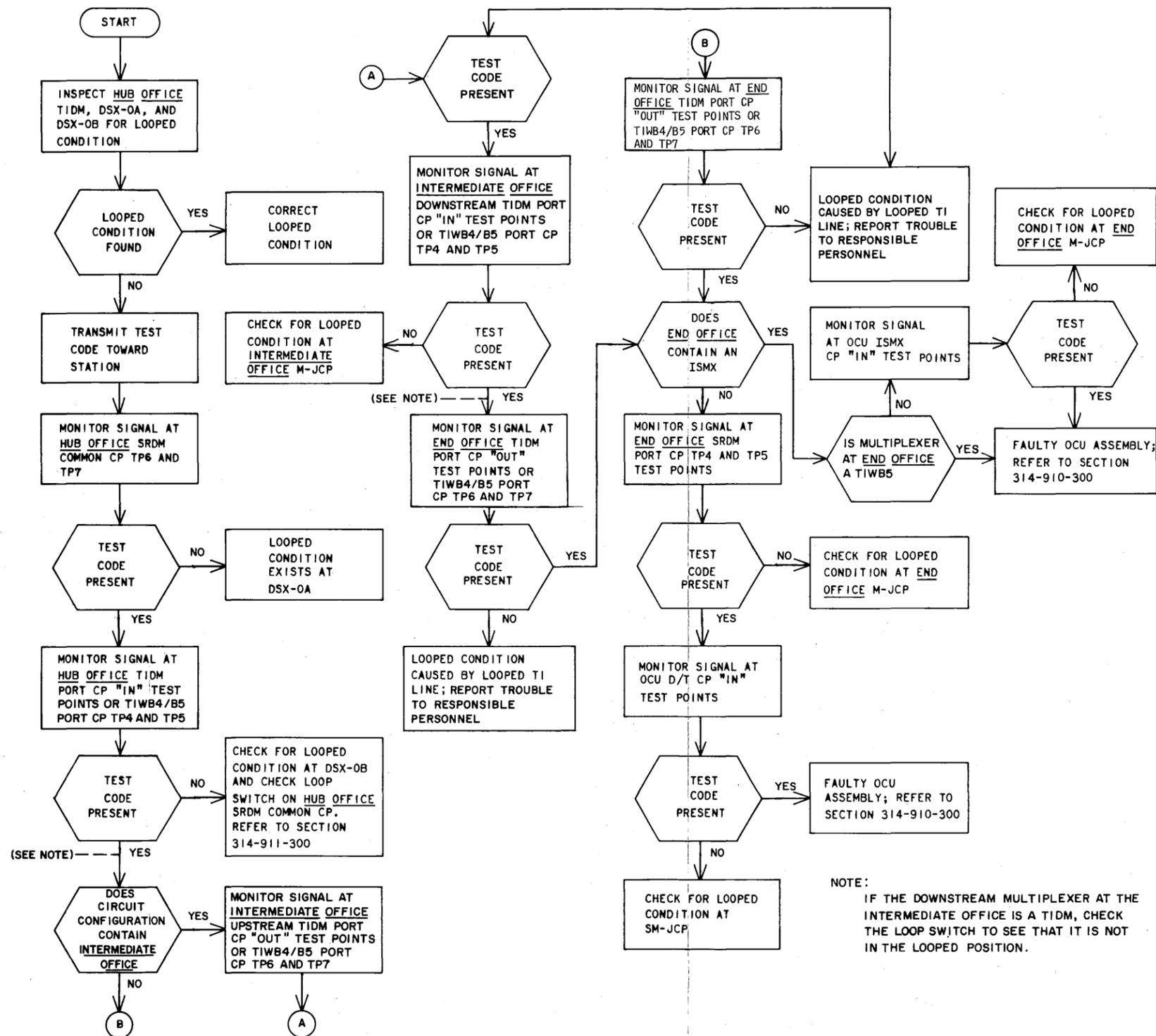


Fig. 26—Looped Circuit Trouble Isolation Procedures

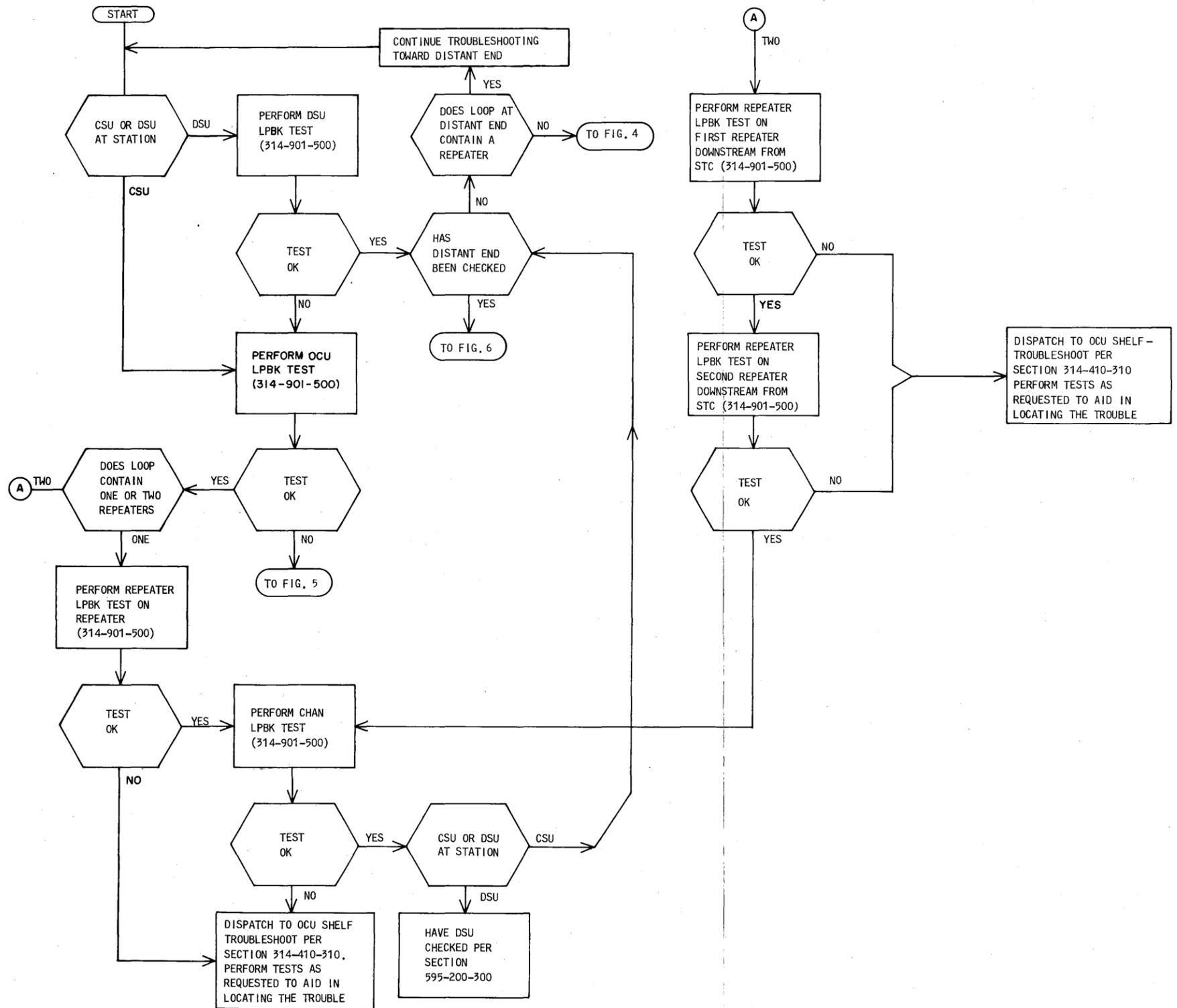
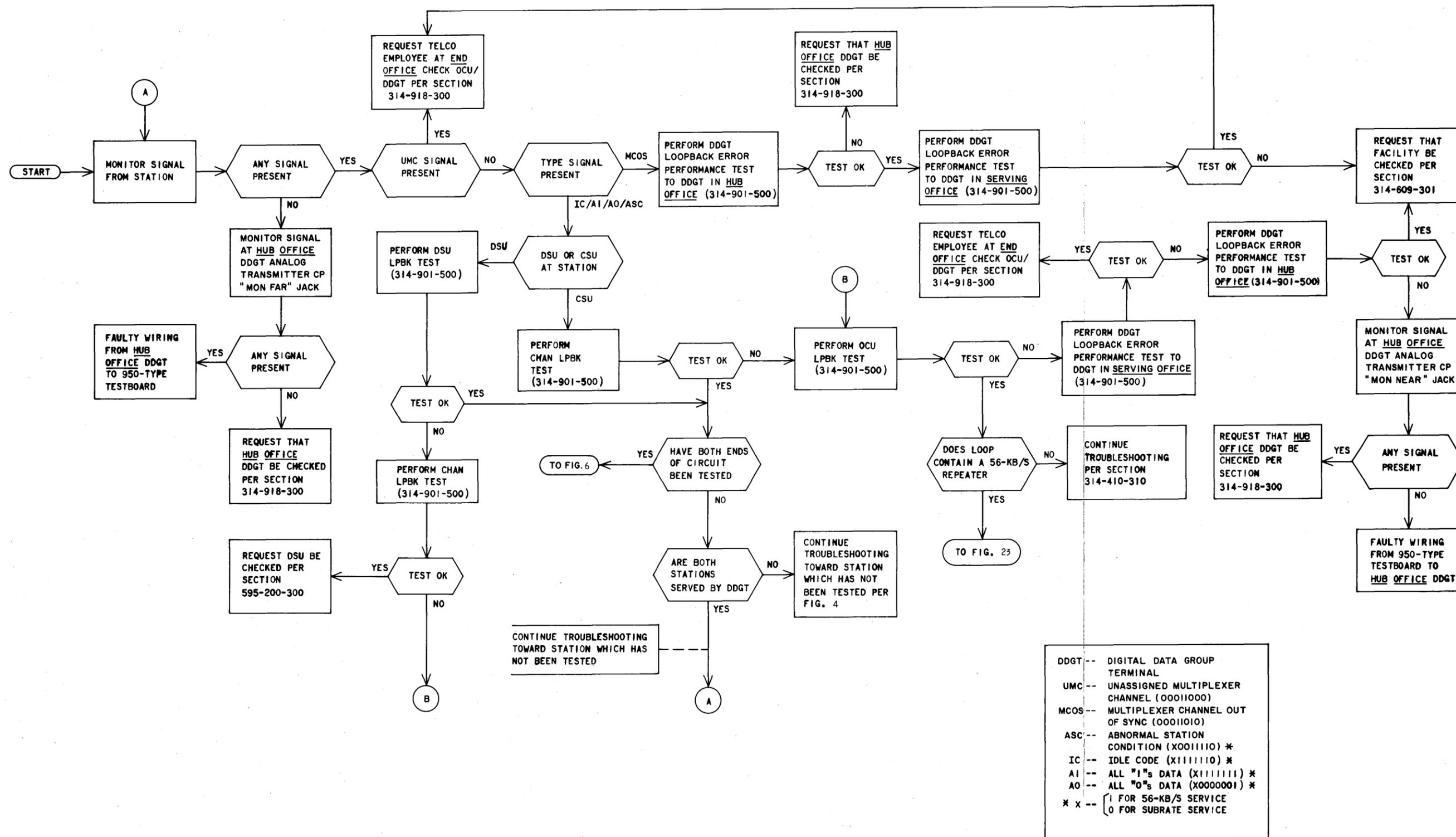
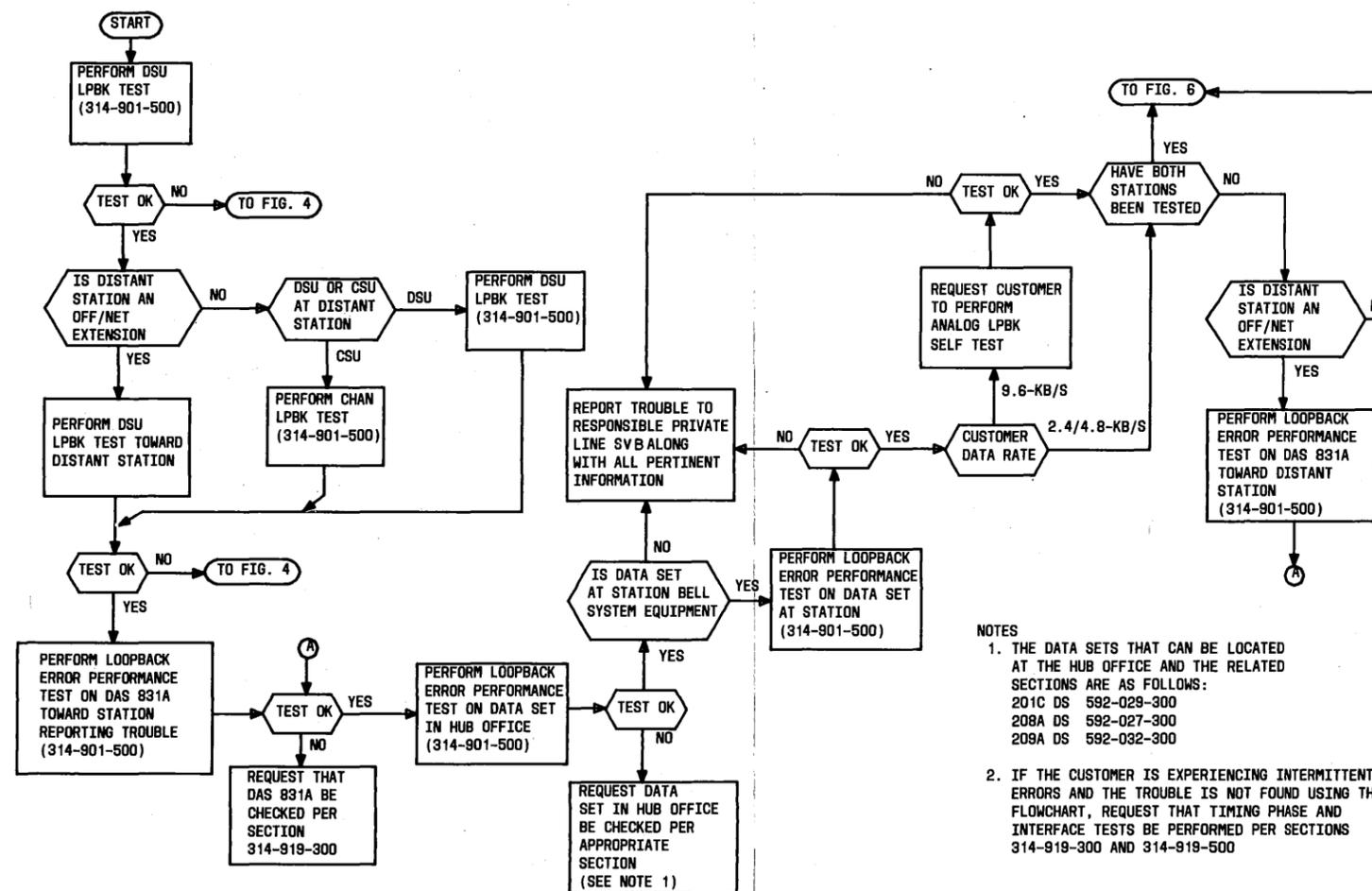


Fig. 27—Trouble Isolation Procedures for Loop Containing 56-kb/s Repeaters



DDGT -- DIGITAL DATA GROUP TERMINAL
 UMC -- UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS -- MULTIPLEXER CHANNEL OUT OF SYNC (00011010)
 ASC -- ABNORMAL STATION CONDITION (X0011110) *
 IC -- IDLE CODE (X1111110) *
 AI -- ALL "1"s DATA (X1111111) *
 AO -- ALL "0"s DATA (X0000001) *
 * X -- 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

Fig. 28— Trouble Isolation Procedures for Stations Served by DDGT



- NOTES
1. THE DATA SETS THAT CAN BE LOCATED AT THE HUB OFFICE AND THE RELATED SECTIONS ARE AS FOLLOWS:
201C DS 592-029-300
208A DS 592-027-300
209A DS 592-032-300
 2. IF THE CUSTOMER IS EXPERIENCING INTERMITTENT ERRORS AND THE TROUBLE IS NOT FOUND USING THIS FLOWCHART, REQUEST THAT TIMING PHASE AND INTERFACE TESTS BE PERFORMED PER SECTIONS 314-919-300 AND 314-919-500

Fig. 29—Trouble Isolation Procedures for Stations Which Are Subrate

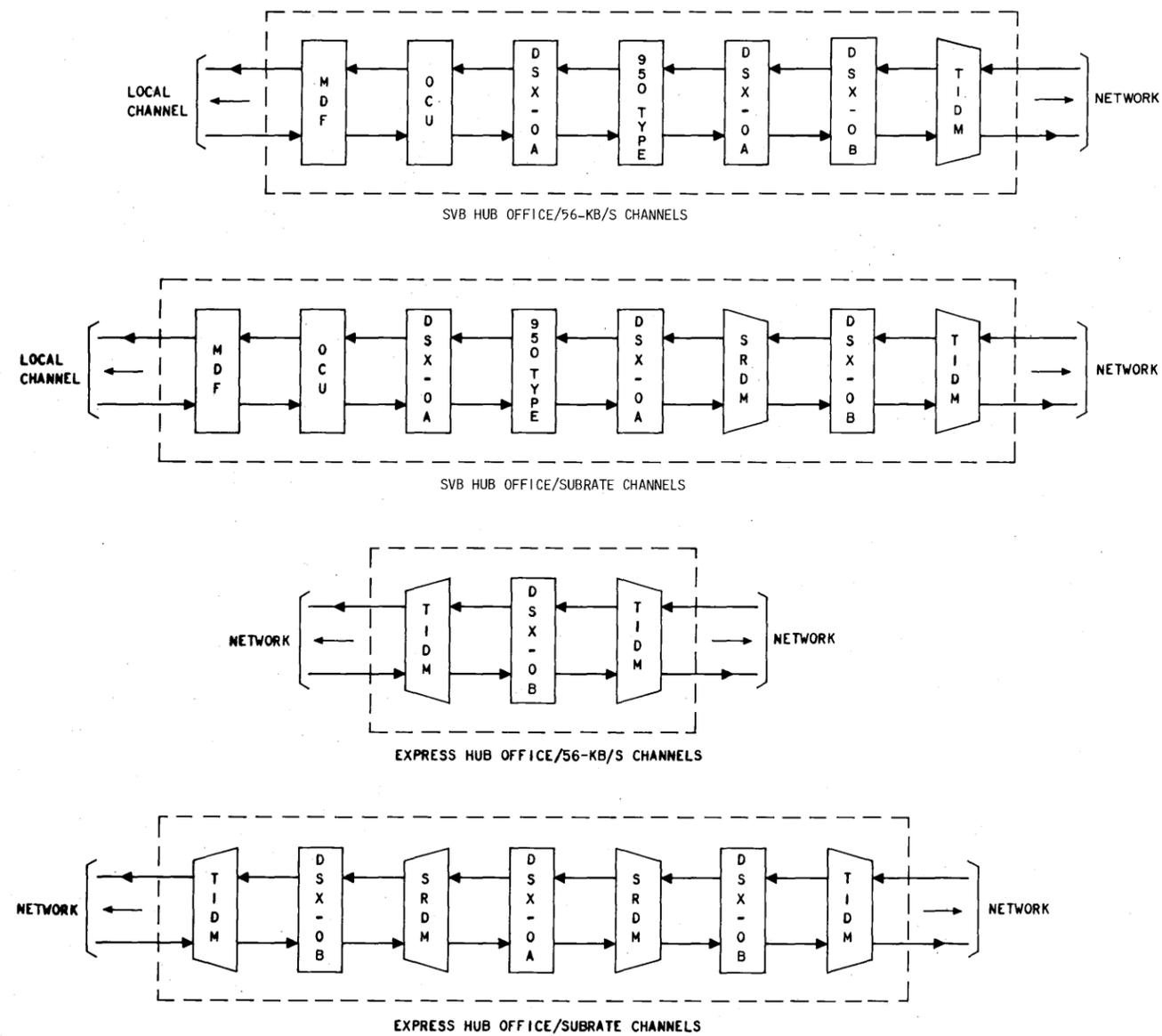
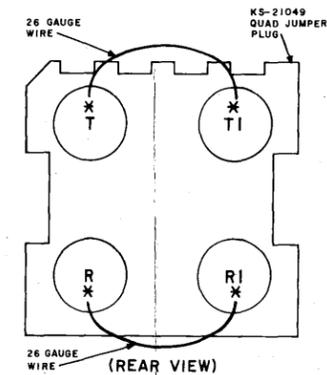


Fig. 30—Hub Office Arrangements—Intraoffice Cable Routing



NOTE:
 AS AN ALTERNATE METHOD, A STANDARD QUAD JUMPER MAY BE USED TO CONSTRUCT A LOOPBACK PLUG BY SPLICING THE RED LEAD TO THE WHITE LEAD AND THE GREEN LEAD TO THE BLACK LEAD.
 * SEE BSP 314-914-300 FOR DETAILS ON QUAD JUMPER PLUG SOCKET EXTRACTION, CRIMPING, AND INSERTION PROCEDURES.

Fig. 31—DSX-0—Loopback Plug Diagram

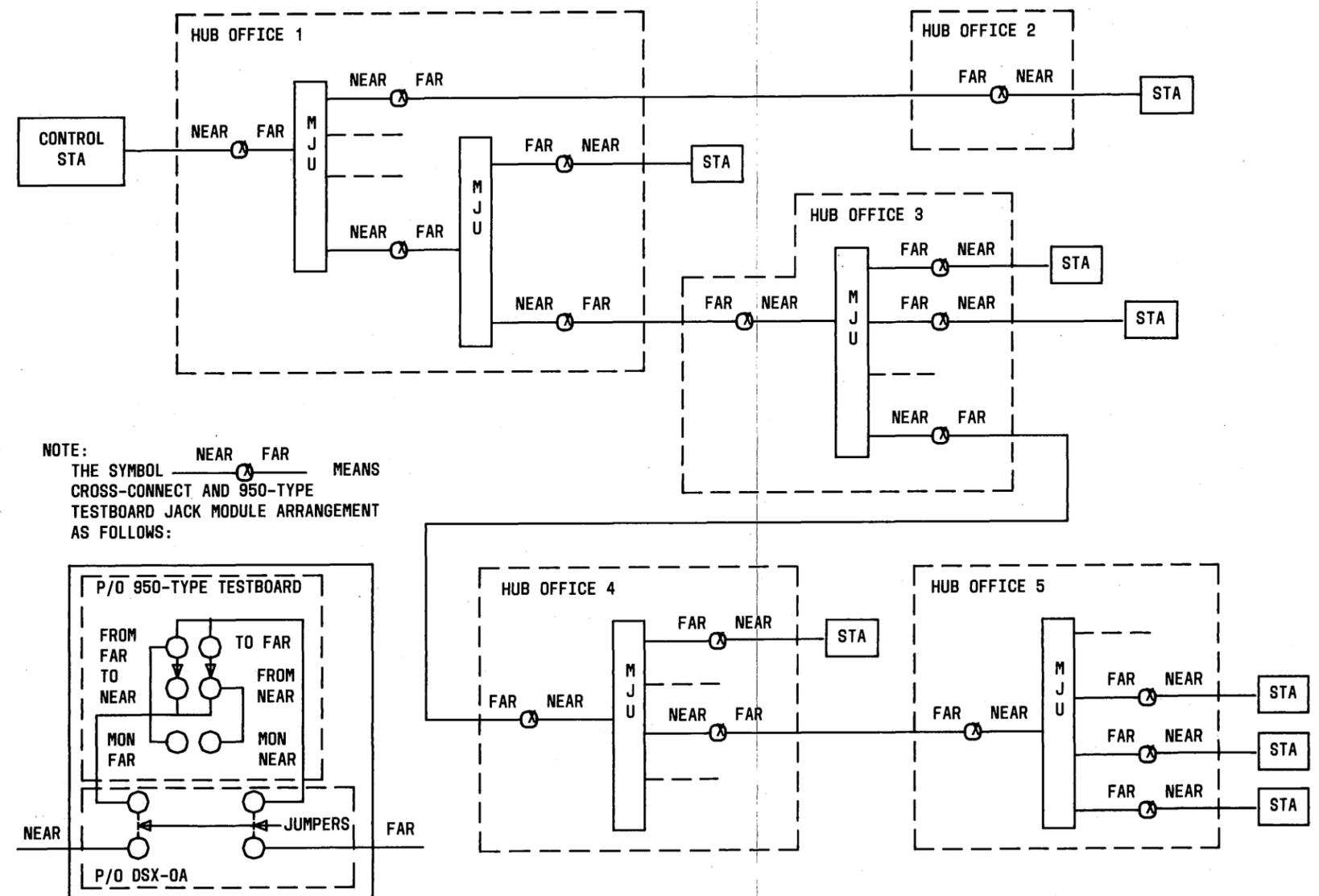


Fig. 32—Access Point Designations on a Multipoint Circuit Arrangement

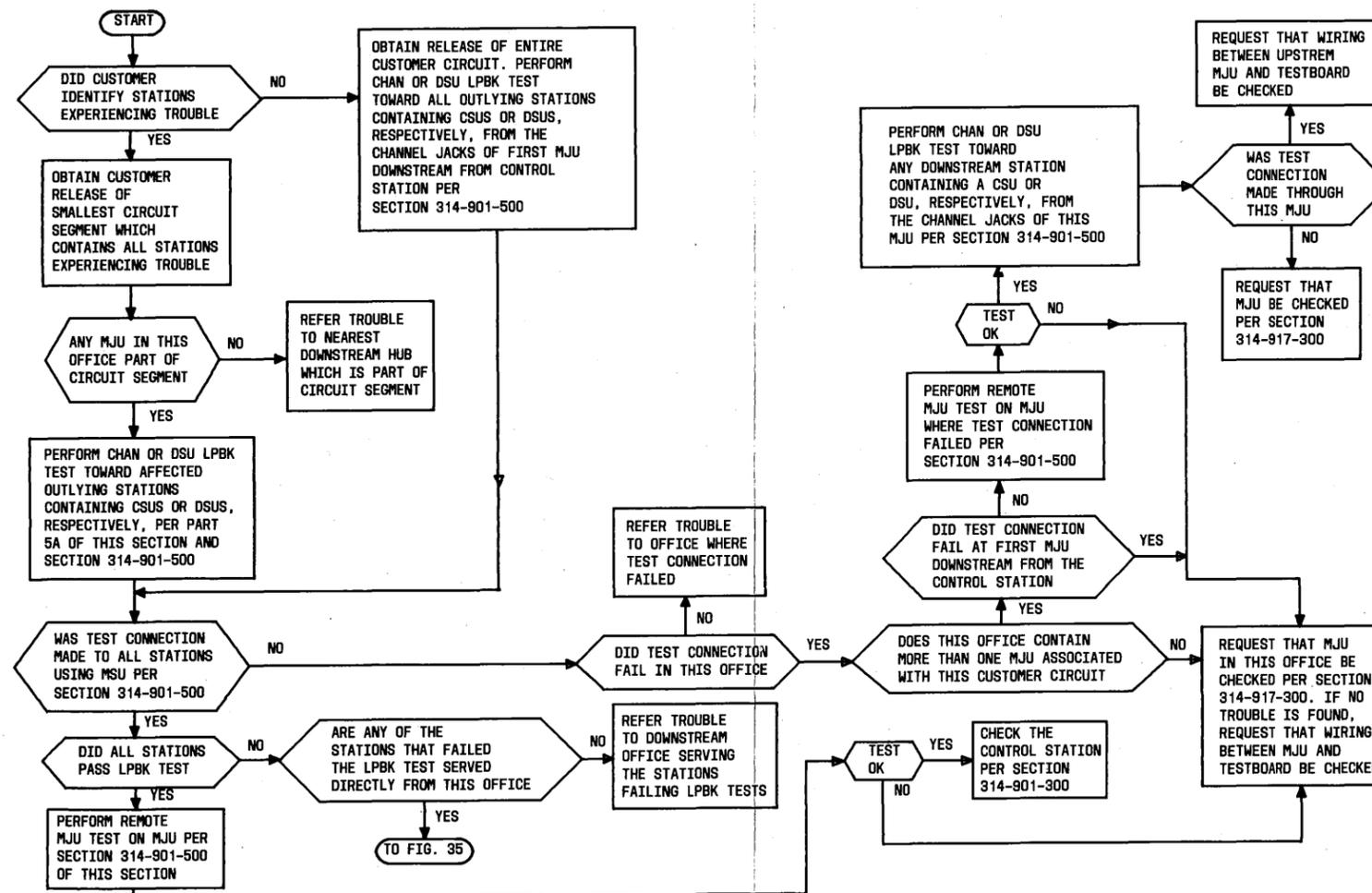


Fig. 33—Preliminary Trouble Isolation Procedures From Control Office (SVB Hub or CTC/Hub)

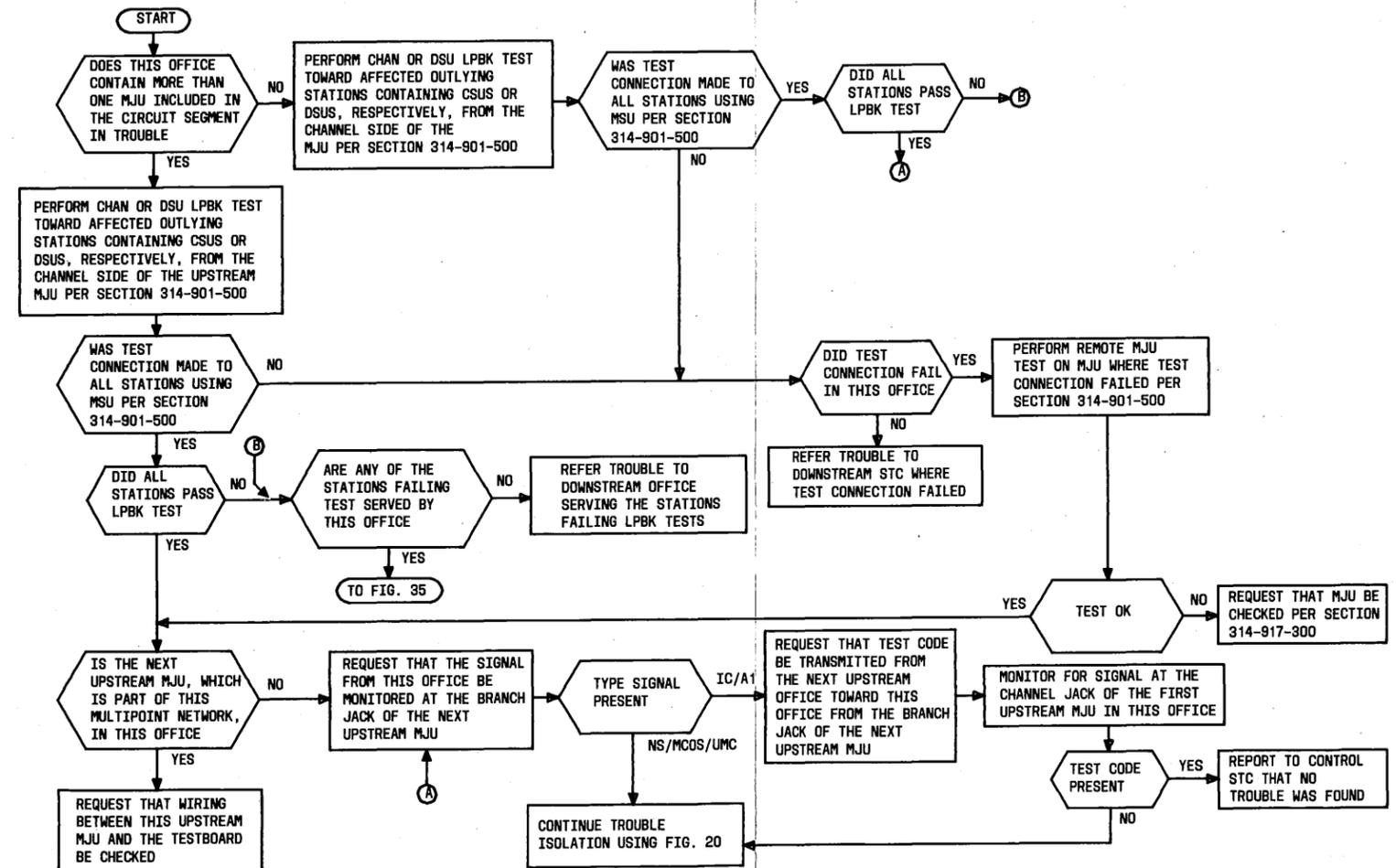


Fig. 34—Trouble Isolation Procedures for Use at a Noncontrol Hub

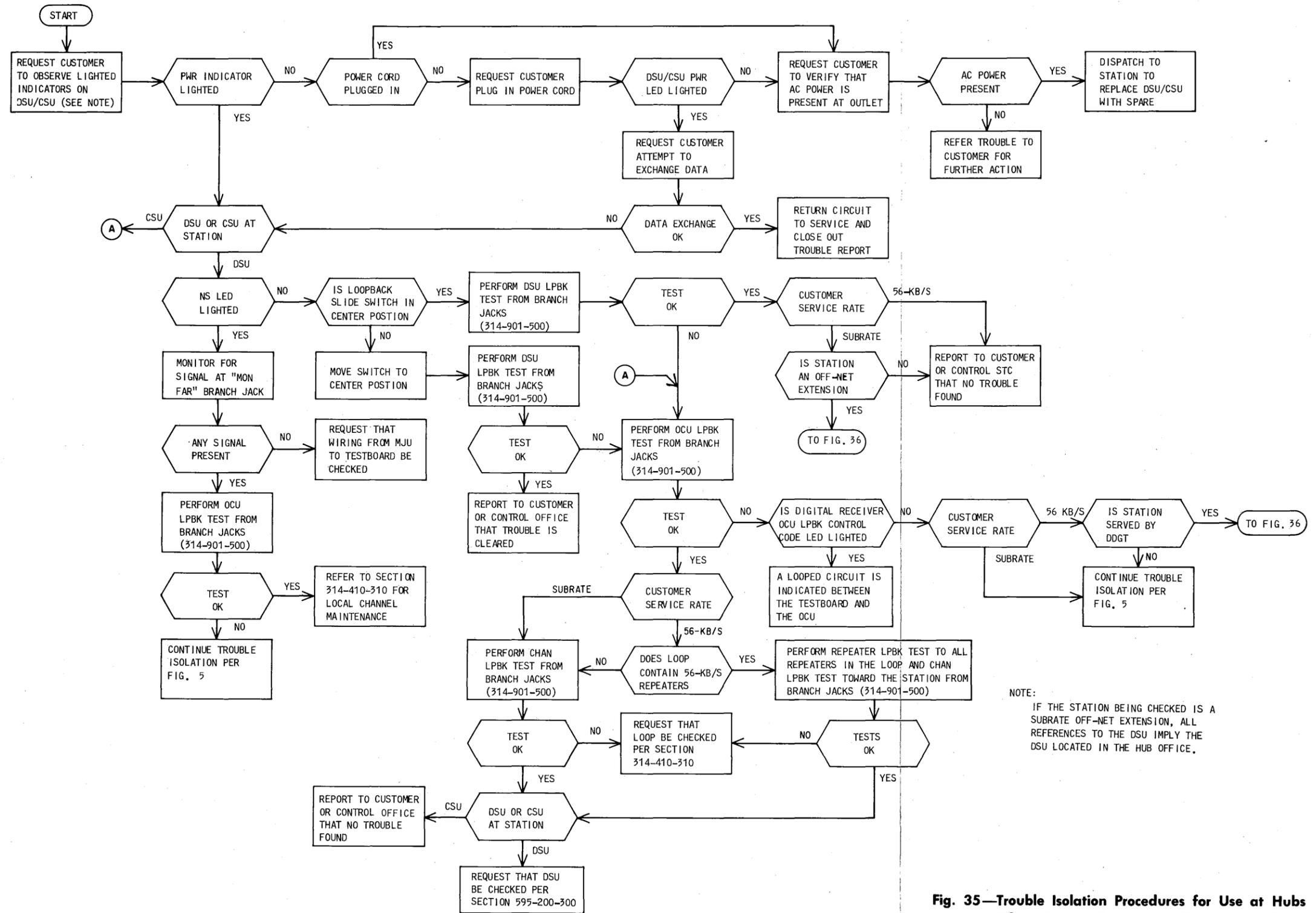
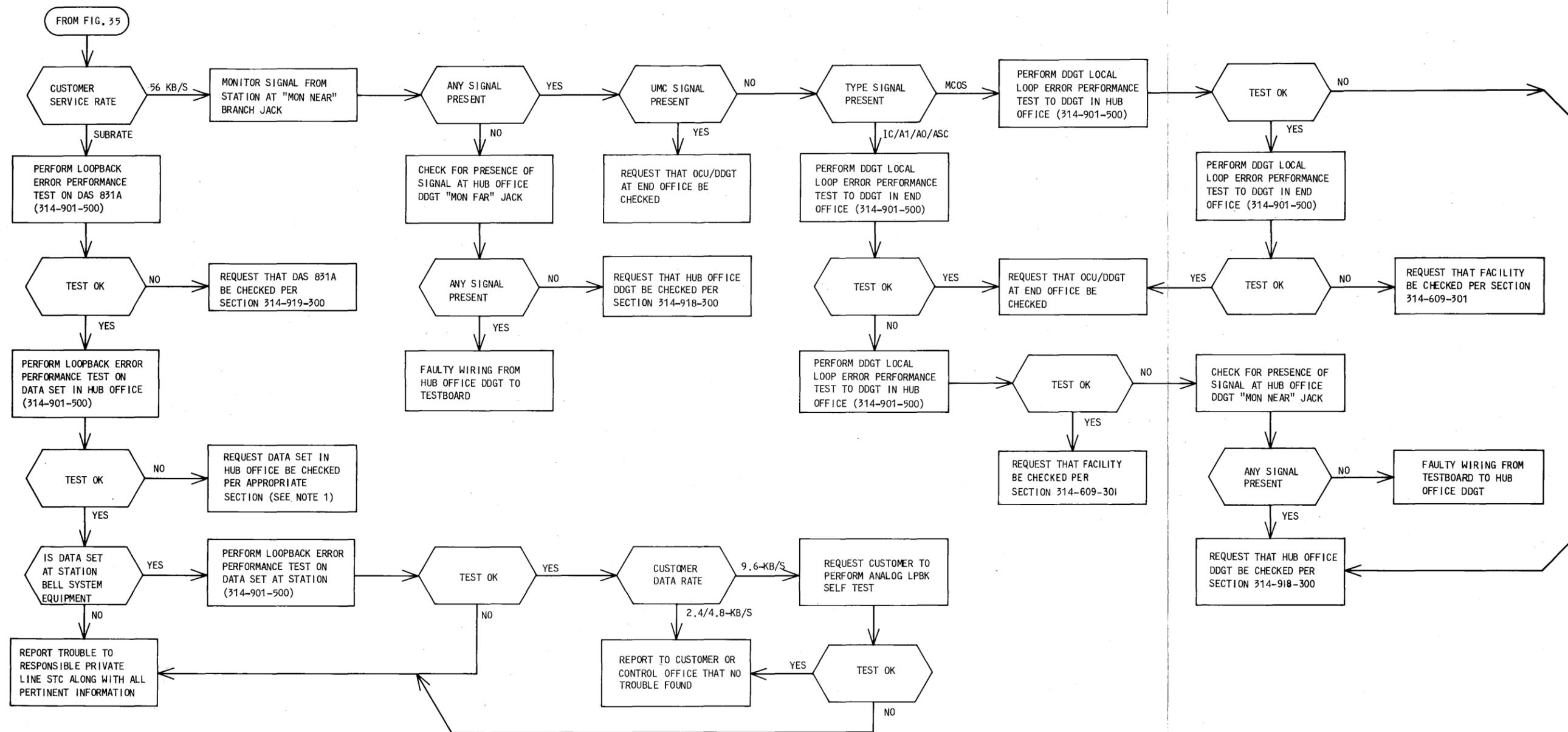


Fig. 35—Trouble Isolation Procedures for Use at Hubs Where Serving Stations are Experiencing Trouble



IC - IDLE CODE (X1111110) *
 A1 - ALL "1"s DATA (X1111111) *
 A0 - ALL "0"s DATA (X0000001) *
 ASC - ABNORMAL STATION CONDITION (X0011110) *
 UMC - UNASSIGNED MULTIPLEXER CHANNEL (00011000)
 MCOS - MULTIPLEXER CHANNEL OUT OF SYNC (00011010)

* X - { 1 FOR 56-KB/S SERVICE
 0 FOR SUBRATE SERVICE

- NOTES:
- THE DATA SETS THAT CAN BE LOCATED AT THE HUB OFFICE AND THE RELATED SECTIONS ARE AS FOLLOWS:
 201C DS 592-029-300
 208A DS 592-027-300
 209A DS 592-032-300
 - IF THE CUSTOMER IS EXPERIENCING INTERMITTENT ERRORS AND THE TROUBLE IS NOT FOUND USING THIS FLOWCHART, REQUEST THAT TIMING PHASE AND INTERFACE TESTS BE PERFORMED PER SECTIONS 314-919-300 AND 314-919-500.

Fig. 36— Trouble Isolation Procedures for Stations Served by an Off-Net Extension Arrangement