

“DATAPHONE®” DIGITAL SERVICE
1.544-MB/S DIGITAL SERVICE WITH 1.344-MB/S OPTION
MAINTENANCE AND TROUBLE ISOLATION PROCEDURES

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1. GENERAL

1.01 This section contains the maintenance and trouble isolation concepts for the 1.544-Mb/s digital service including a 1.344-Mb/s digital service option.

1.02 If this section is reissued, the reason for reissue will be given in this paragraph.

1.03 Since it is important that the customer be able to report troubles to personnel trained in the recognition and handling of data trouble reports, access to the 1.344- or 1.544-Mb/s digital service facility from a data maintenance area such as a wideband data test center (WDTC) is normally provided. In some instances though, the 1.344- or 1.544-Mb/s digital service facility may consist simply

of two station arrangements connected by a relatively short T1-repeated loop; and access to a data maintenance area may not be provided if the facility would be made considerably longer as a result. When this occurs, an available data maintenance center which contains a wideband service bay or space for arranging a suitable test access to the circuit should be designated the trouble-reporting location. If no such area is available, it is desirable that a group be trained and designated to receive customer trouble reports. Personnel receiving these reports may either conduct the restoration procedures themselves or refer the reports to the appropriate maintenance forces for action, maintaining liaison with these forces until the circuit is restored.

1.04 Personnel receiving customer trouble reports should not overlook the customer's value as a source for understanding the trouble condition. The customer can describe the status of the lights at the station arrangement and the type of tests he has performed. It is recommended that the customer be involved as little as possible, however, in the trouble isolation procedures. If a customer does wish to participate, he could be given simple procedures to perform.

2. MAINTENANCE PLAN

A. General

2.01 Figure 1 shows an example of a 1.344- or 1.544-Mb/s digital service facility. Although the 1.344- and 1.544-Mb/s digital services provide different data rates, the transmission facilities between the station arrangements are the same. The basic maintenance plan is to isolate digital service troubles to one of three areas: (1) one of the station arrangements, (2) a T1 repeated facility or (3) the long-haul facility, if used.

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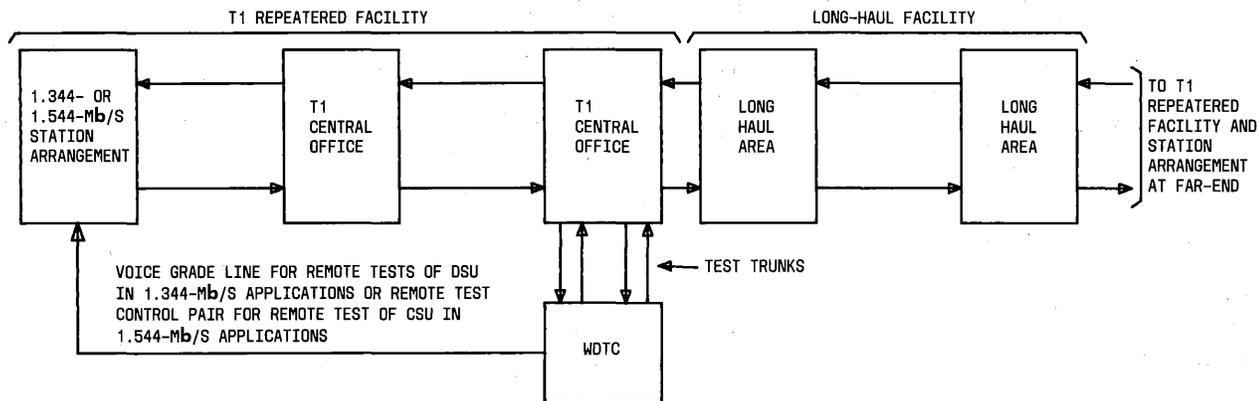


Fig. 1—Example of a 1.344- or 1.544-Mb/s Digital Service Facility

2.02 When trouble is indicated at the station arrangement, a telco employee must be sent to the customer's premises. The telco employee may be required to test the station arrangement or to fault-locate the T1 repeatered facility outgoing from the customer's premises. The telco employee should verify the installation of proper options in the DSU and CSU for 1.344-Mb/s service, or CSU, for 1.544-Mb/s service according to Sections 593-801-100 (DSU options) and 595-105-100 (CSU options).

2.03 The isolation and repair procedures of T1 repeatered facilities generally follow normal practices. However, the restoration procedures generally differ from standard procedures. For example, the standard procedure for restoring service on a failed T1 repeatered facility is to patch in a spare maintenance span. If the trouble is isolated to a loop span or to a nonstandard interoffice span, however, the actual cause of the trouble must be identified and cleared before service can be restored unless spares have been provided.

2.04 When long-haul facilities are part of the digital service, normal maintenance procedures will apply. Initially, the 1A-Radio Digital System (1A-RDS) will be used for long-haul.

B. DS-1 Service Center

2.05 The DS-1 service center (DS1SC) may be a WDTC, a Digital Data System (DDS) Serving Test Center (STC), or a designated on-line office with test access to the service, which has total responsibility for the 1.544 Mb/s service/facility and for the 1.344 Mb/s option. The DS1SC must

be able to receive trouble reports, to perform service testing and trouble isolation, to coordinate trouble clearing procedures, to process interruption allowance reports, to handle escalations, etc. When more than one DS1SC is on a digital service facility, one DS1SC will be designated as circuit "control".

2.06 The DS1SC test access may be the DSX-1 jacks themselves, or miscellaneous jacks extended from the DSX-1 bay and mounted in a bay in one of these test centers. The DS1SC must have full duplex test access during testing so that it may send or receive or monitor both directions. The DSX-1 or the DS-1 test access arrangement must meet standard engineering requirements for cable restrictions and for equal level testing. This may require the construction of intra-office T1 spans using Line Terminating Units (LTU) or Extended Cross-Connect Packages (EXCP). Maintenance of these spans must be arranged for by local procedures.

C. 551A CSU for 1.544-Mb/s Digital Service

2.07 The 551A CSU (Fig. 2) has several features to aid in maintenance and testing. It is provided with a remote test (RT) relay that loops the received data output to the transmit data input at the customer side. This feature allows loopback testing of the T1 repeatered facility and the CSU circuitry. The RT relay is remotely controlled over the remote test control pair. It should be noted that the loopback relay contacts are on the customer side of the CSU. Test signals received from the line and looped back will have any bipolar violations removed by the signal monitor circuit;

and the test results may, therefore, be distorted. To eliminate the effects of the signal monitor circuit, the signals can be looped back manually by patching between the R-OUT and the L-IN jacks on the face of the CSU.

2.08 The CSU can optionally be provided with a 598-type fault-locating filter. This filter, along with the fault-locating pair, allows remote testing of the 206-type repeater in the CSU from the serving central office using standard T1 fault-locating procedures. Fault locating from the customer premises to the serving central office requires repair personnel at the CSU location with portable T1 fault-locating equipment. To aid in this procedure, the CSU is equipped with fault-locating and order-wire access jacks. The standard jacks associated with the 206-type repeater are also available. In addition, the input and output leads on the customer side of the CSU are provided with jack access.

2.09 The average density monitor light and the 16-zero monitor light are useful in determining the characteristics of the customer's transmit signal. The average density light illuminates for one-fourth of a second each time the average density of "ones" in the customer's transmitted signal falls below a prescribed value. The 16-zero light illuminates

for one-fourth of a second each time 16 consecutive zeros are counted in the customer's transmitted signal. Both of these lights indicate the customer is not meeting the T1 line signal requirements.

Note: With encrypted signal transmission from some customers, the 16-zero lamp will light frequently without the average pulse density falling below a satisfactory level and causing bit stream alteration. The 16-zero lamp lighting with the transmission of encrypted signals should not be used as a basis for notifying the customer of unacceptable or otherwise unsatisfactory transmission.

2.10 When trouble occurs in the 4019DA signal monitor, the 206-type repeater, or the fault-locating filter, the defective circuit should be replaced.

D. DSU for 1.344-Mb/s Digital Service

2.11 As discussed in Section 314-645-100, the DSU (306A-L1/2 data set) is used to provide 1.344-Mb/s digital service over a 1.544-Mb/s digital service facility. This arrangement provides several maintenance and testing features. Two test features are the local and remote tests (Fig. 3).

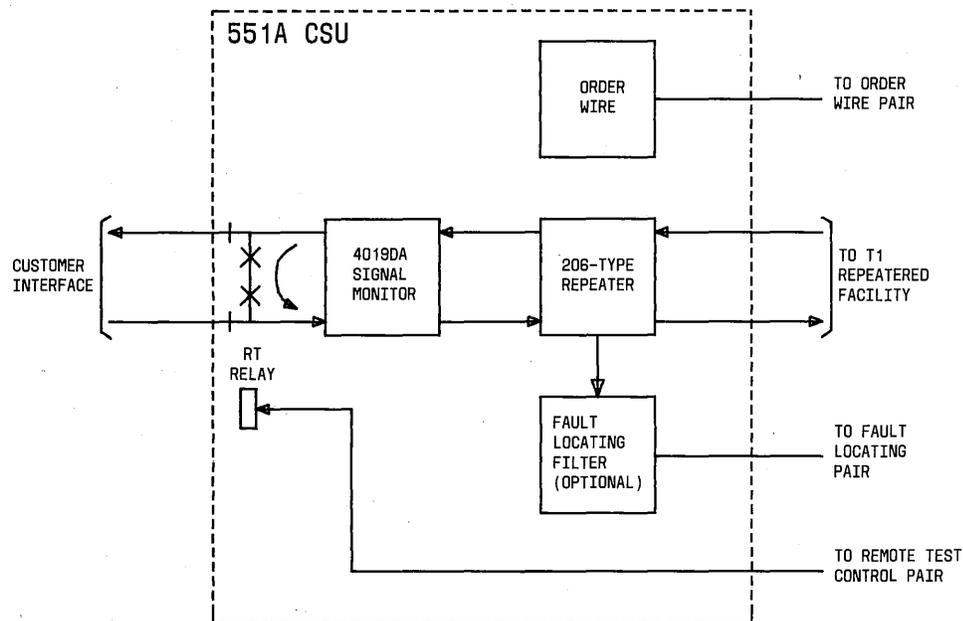


Fig. 2—551A CSU for 1.544-Mb/s Digital Service

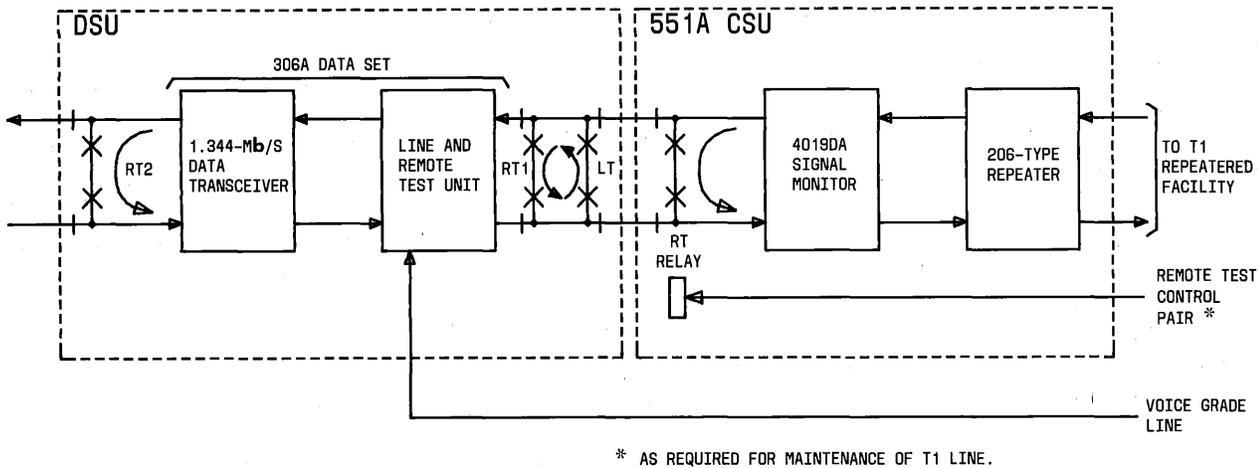


Fig. 3—DSU and CSU for 1.344-Mb/s Digital Service

Note: The LT and RT1 test features described below cannot be utilized unless Option B is installed in the 32A1 data unit, which is part of the DSU.

2.12 The local test (LT) disconnects the DSU from the T1 repeatered facility at the CSU and establishes a loopback, allowing the customer's data to be transmitted through the complete data set and to be checked by the customer. The LT condition also terminates the lines between the DSU and CSU causing the absence of a signal at the input to the CSU. The CSU recognizes the absence of a signal, generates a signal containing all ones and sends it to the serving central office to allow a signal to be maintained on the T1 repeatered facility. The DSU can be placed in the LT mode in one of the following ways:

- Operating the LT key on the DSU or
- Having the customer establish an ON signal on the LT lead of the customer interface.

2.13 The remote test (RT) consists of two loopback conditions: remote test 1 (RT1) and remote test 2 (RT2). RT1 loops the line between the DSU and the CSU allowing remote testing of the T1 repeatered facility and the CSU. Test signals received from the line and looped back will have any bipolar violations removed by the signal monitor circuit in the CSU; and the test results may, therefore, be distorted. RT2 loops the line between the DSU and the customer's equipment allowing

remote testing of the complete DSU. In addition, a voice grade line must be provided from the testing location since the remote tests are activated by sending a 2800-Hz tone over a voice grade line.

3. TROUBLE ISOLATION PROCEDURES

A. General

3.01 The basic maintenance plan is to isolate troubles to the faulty station arrangement, the T1 repeatered facility, or the long-haul facility, if used. After the customer has reported trouble, the WDTC must determine which part of the digital service facility is faulty.

3.02 A series of monitoring and loopback tests have been devised to aid in trouble isolation. These tests, which are located in Section 314-645-500, include monitoring for pulses and bipolar violations and error-rate measurements. All monitoring tests are performed using a Bowmar Model 271B, error-rate, test set. The 271B is also used to perform most error-rate measurements. The exception is the RT2 in the DSU station arrangement which requires a 912A wideband data test set (WDTS) or equivalent and a 306A-type data set at the WDTC.

3.03 The WDTC should keep in close touch with long-haul maintenance forces. Initially, the 1A-RDS (using data under voice) will be used for the long-haul facility. It is recommended that recorders be maintained on both ends of the 1A-RDS

to avoid troubleshooting a fade condition and to determine benchmark operating conditions.

3.04 When troubles are difficult to locate or where the signal on the data under voice facilities are showing partial response violations, a bit rate test (see Section 314-645-500) should be performed to determine the accuracy of the station arrangement clock.

B. Flowcharts

3.05 The overall trouble isolation routine for 1.344- and 1.544-Mb/s digital service facilities is given in flowchart form in Fig. 4. START A of the flowchart is used when the digital service uses 1A-RDS long-haul facilities. START B is used when the digital service *does not* use long-haul facilities; ie, the digital service contains only T1 repeatered spans.

3.06 When the customer reports his trouble condition, several questions should be asked. They are as follows:

- (1) Are you (the customer) receiving data? If so, does it contain a high amount of errors or all errors?
- (2) What direction of transmission is faulty?
- (3) What self tests have you performed?
- (4) Are any lamps lit on the DSU and/or CSU?
- (5) What time of day and for how long did the trouble occur?
- (6) Is the 306A-L1/2 data set receiving power? (1.344-Mb/s service only)

These questions may help to isolate troubles or determine what may have been the cause of a trouble.

4. REFERENCES

4.01 The following sections provide more detail maintenance and test information.

SECTION	TITLE
103-493-110	Digital Transmission Systems-Bowmar Model 271B Error-Rate Test Set
314-645-500	DATAPHONE® Digital Service—1.544-Mb/s Digital Service with 1.344-Mb/s Option—Tests
365-228-500	Digital Data System—T1 Line—Qualification Tests
593-801-100	Wideband Data Station Using Data Set 306—Point-to-Point, Limited Distance—Description and Operation
593-801-500	Wideband Data Station Using Data Set 306—Point-to-Point, Limited Distance—Test Procedures
595-105-100	551A-Type Channel Service Unit—Description
595-105-300	551A-Type Channel Service Unit—Maintenance
595-105-500	551A-Type Channel Service Unit—Test Procedures

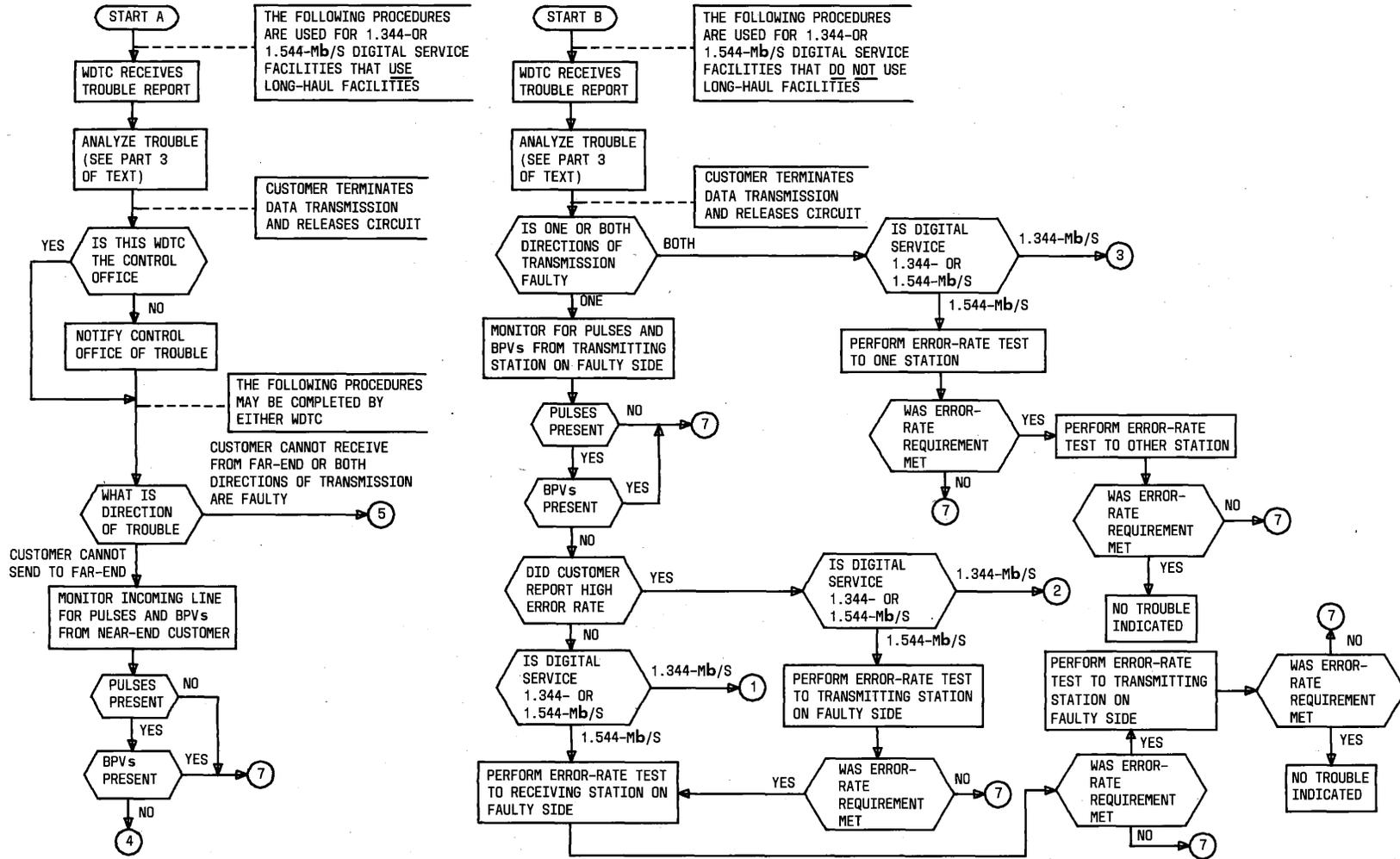


Fig. 4—Trouble Isolation Procedures (Sheet 1 of 6)

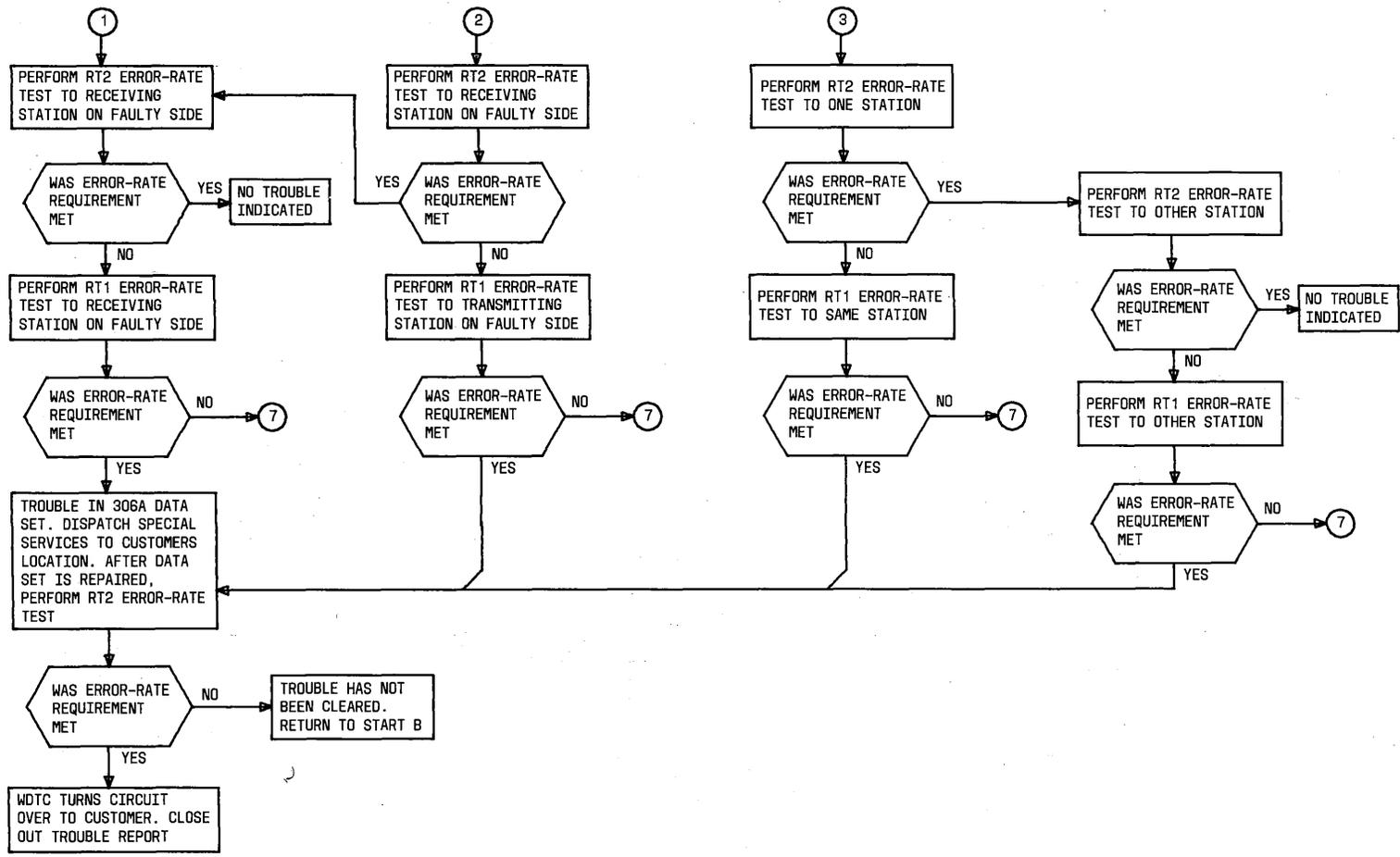


Fig. 4—Trouble Isolation Procedures (Sheet 2 of 6)

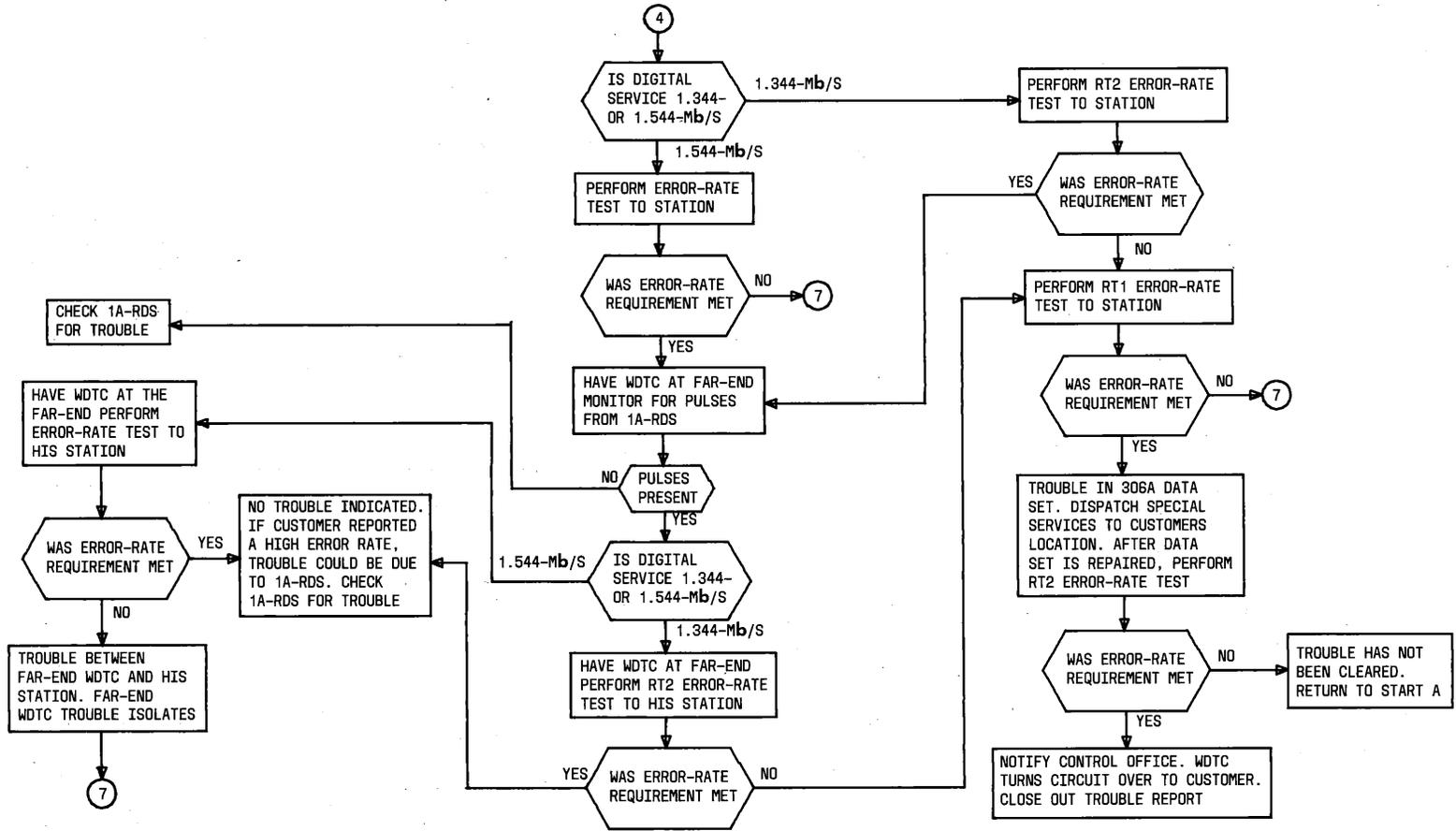


Fig. 4—Trouble Isolation Procedures (Sheet 3 of 6)

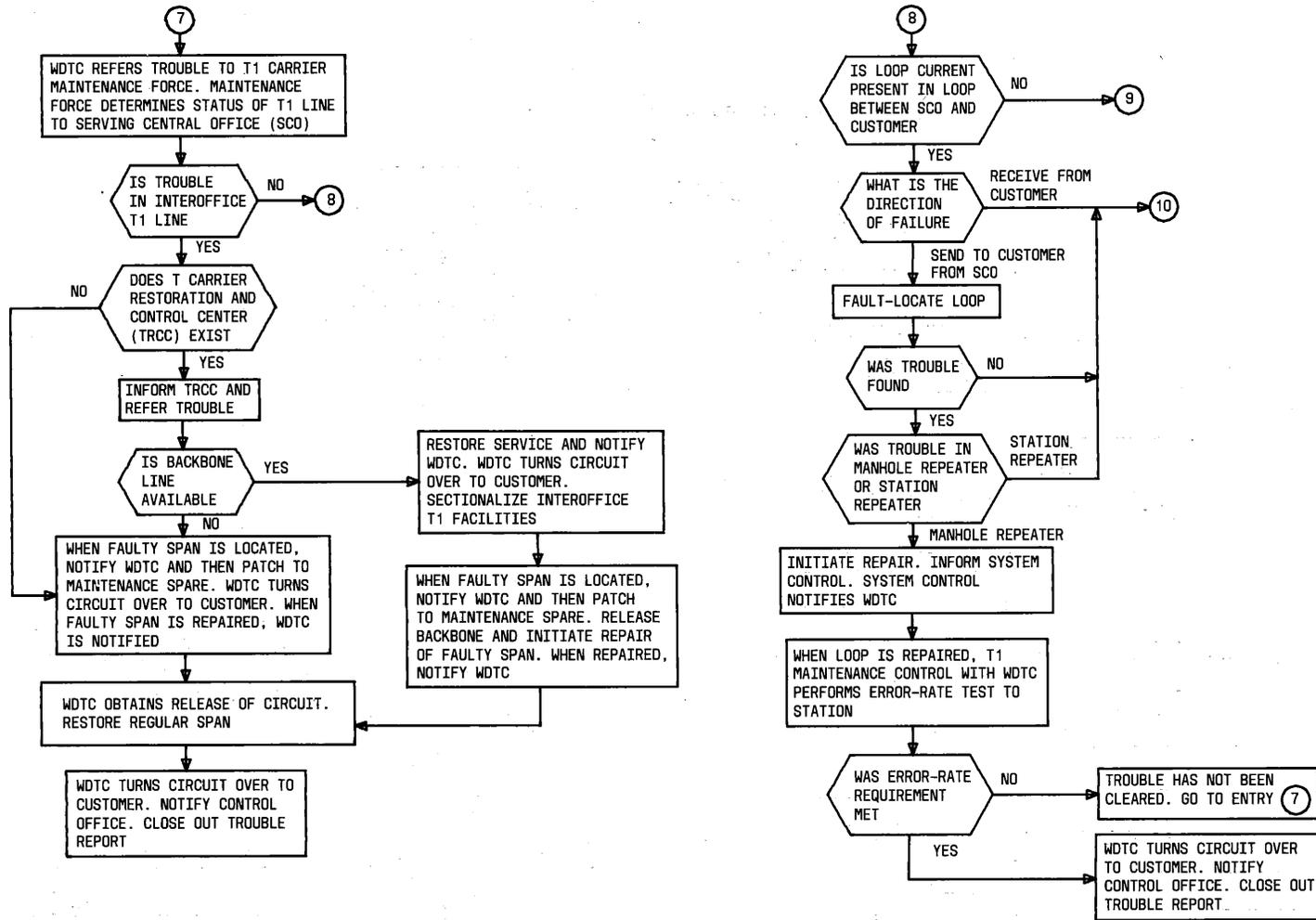


Fig. 4—Trouble Isolation Procedures (Sheet 5 of 6)

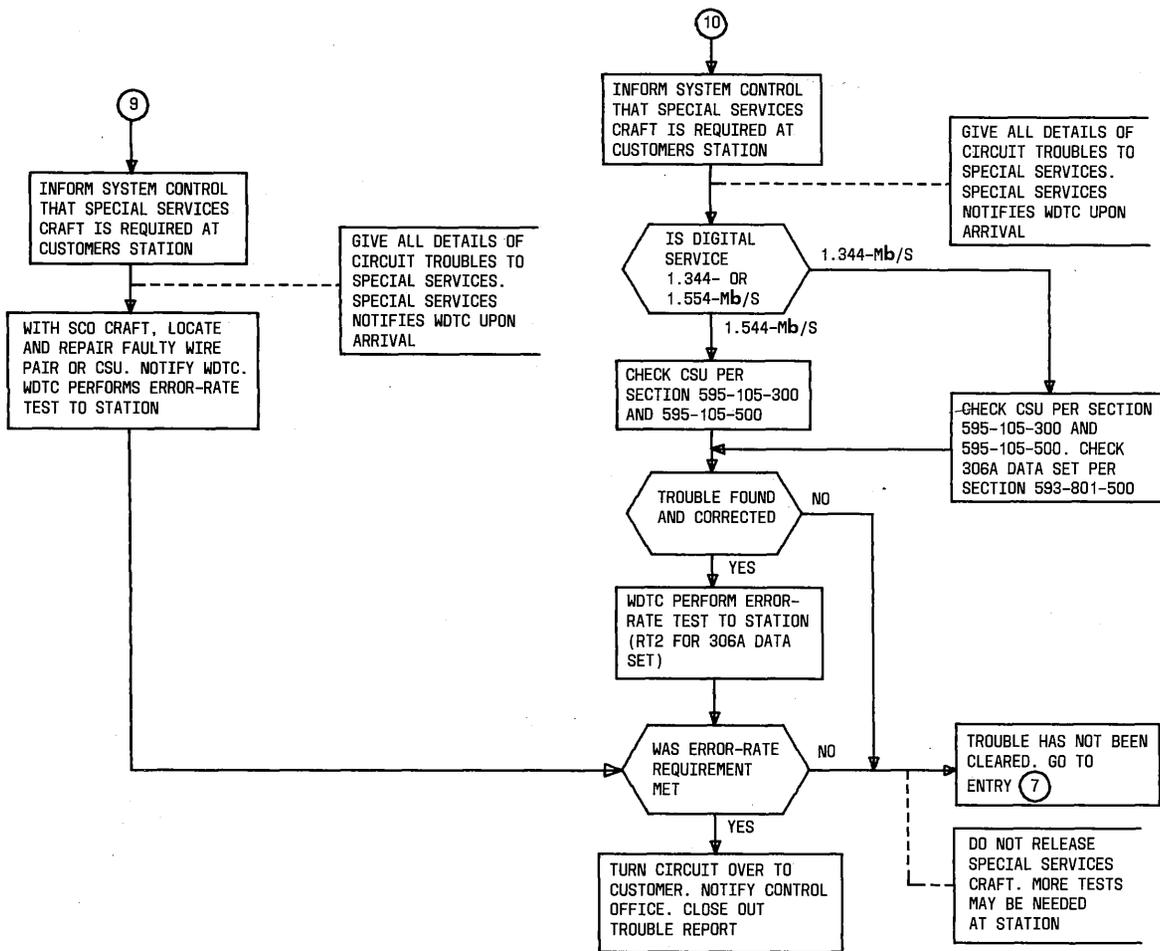


Fig. 4—Trouble Isolation Procedures (Sheet 6 of 6)