DIGITAL DATA SYSTEM
LOCAL LOOP
MAINTENANCE PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section describes maintenance considerations and procedures used to locate trouble on a digital data system (DDS) local loop.

1.02 This section is reissued to incorporate information on maintenance procedures when Dataport facilities are used. In addition, maintenance procedures have been updated for the latest vintage equipment used in the field. Since these changes constitute a general revision, arrows normally used to denote changes have been omitted.

1.03 A DDS local loop consists of the following:

(1) A 500A-type data service unit (DSU) or a 550A-type channel service unit (CSU) located on customer premises.

(b) A connecting 4-wire circuit.

(c) An office channel unit (OCU) or OCU dataport (OCUDP) located in the serving central office (SCO) or for the OCU, in the hub office.

(d) Two repeaters where 56-kb/s service is provided.

(e) For 56-kb/s dataport service, an external OCU plus a DS-0 level dataport (DSODP).

Descriptive information on the DSU, CSU, and OCU is given in Sections 595-200-100, 595-100-100, and 314-910-100, respectively. The 56-kb/s repeater is described in Section 314-920-100.

1.04 The 4-wire circuit consists of cable to a serving office where DDS multiplexing equipment is located. In some cases the cable may

route through one or local (baseboard) offices. Nonloaded cable pairs as used for any of the common services (such as message telephone, DATAPHONE®, and short-haul carrier systems) can be used. Loop engineering guidelines are given in Section 880-601-115.

1.05 A DDS local loop trouble is indicated by:

(a) A satisfactory OCU loopback test and a failure of the channel loopback test.

(b) A satisfactory OCU and channel loopback test and a failure of the DSU loopback test.

(c) Intermittent error performance on channel and/or DSU loopback test.

1.06 Trouble analysis procedures and information in this section are based on the results of tests made under the following conditions:

(a) One-employee tests made at the OCU or local test desk (LTD).

Caution: A dc loop current in excess of 250 mA may damage the DSU/CSU at the station end. Do not use test equipment, for example, a breakdown test set, that applies a current greater than 250 mA to the cable pairs, unless the OCU or OCUDP has been unplugged and the DSU/CSU has been disconnected from the pairs.

(b) Two-employee tests made between the station and the OCU bay or OCUDP in the office, either for initial installation tests of the 4-wire channel or for more detailed tests during trouble analysis.

1.07 These various tests are outlined in Part 3 of this section. The step-by-step procedure for performing these tests is given in Section 314-410-510.

Trouble Reporting and Isolation

1.08 No routine maintenance is required for DDS local loops. Procedures for clearing trouble normally start at receipt of a trouble report.

1.09 Transmission faults on the local loop are not alarmed and will normally be detected and reported to the serving test center (STC) by the customer. The customer may be notified by lamp or interface lead indications on the DSU in the event of circuit trouble.

1.10 No routine maintenance is required for the digital 56-kb/s repeater. All circuit packs are plug in basis. In the event of a repeater failure, the defective circuit pack can be easily replaced.

1.11 Two green light emitting diodes (LEDs) on the central office (CO) mounted repeater monitor for the presence of data or idle code transmitted through the repeater in each direction. The TRMT DA LED, when illuminated, indicates the presence of data toward the station DSU or CSU. The RCV DA LED, when illuminated, indicates the presence of data towards the DDS network. The absence of data, due to facility trouble or component failure, will cause one or both of the LEDs to be off. A fuse failure will cause an office alarm.

1.12 Four jacks located on the CO mounted repeater shelf provide access for dc and ac testing of the loop facilities from the repeater location. The repeater can also be bypassed by operating a switch located at the front of the repeater or removing simplex current in the newer (List 2) version of the repeater. In the bypassed condition, testing of the entire loop (except the repeater) can be performed from the central office containing the OCU.

Note: The outside plant (OP) repeater can be remotely bypassed to allow dc tests to be performed by removing the dc simplex current from the loop. Normal OP repeater operation is restored by reapplying dc simplex current to the loop.

1.13 When a trouble report is received from the STC, the craft employee at the SCO must perform the one-employee tests on the local loop, and notify the STC of the results, within 15 minutes in order to meet the overall maintenance objectives for DDS service. If dispatch to the customer station is required, the STC will coordinate the dispatch.

2. ANALYSIS PROCEDURES

2.01 This part outlines the analysis procedures, shown in Fig. 1, that are used to isolate

and clear troubles on DDS local loops that do not contain 56-kb/s repeaters. The procedures may be made under the direction of the STC or, in some cases, directed by the local test desk (LTD). The procedure begins by the STC verifying (by loop-back tests) that the OCU loop-back is good and that the trouble is in the local loop.

Note: The following paragraphs (2.02 through 2.14) provide reference to the corresponding numbered blocks shown in Fig. 1.

2.02 The craft employee at the SCO performs tests A, B, and C at the OCU location. These tests are to be performed when directed during trouble periods and are listed in Table A. The procedures are given in Section 314-410-510. If results of test A, B, or C fail to meet test requirements, proceed to paragraph 2.10.

2.03 If results of tests A, B, and C meet requirements, check the simplex voltage by performing test D before replacing the OCU with a spare OCU. If simplex voltage is missing, check the fuse in the bay clock, power, and alarms (BCPA) unit or local timing supply (LTS) (non-Dataport applications). Then, replace the OCU or OCUDP with a new unit of the correct bit rate and proper options and repeat the channel loop-back test.

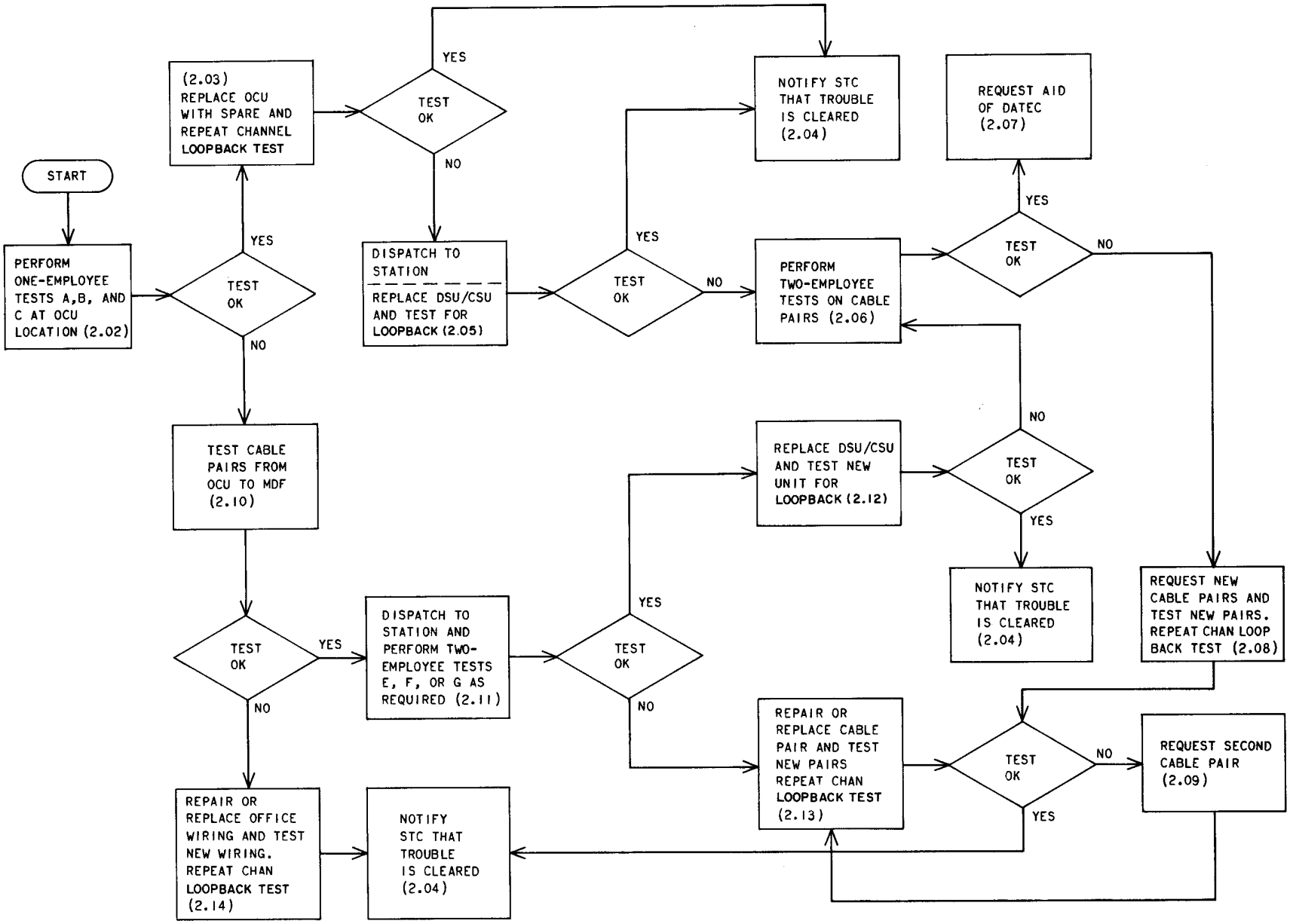

Fig. 1—Local Loop Trouble-Clearing Procedures

TABLE A

SERVING CENTRAL OFFICE (ONE-EMPLOYEE) TESTS

NAME OF TEST	TEST APPARATUS REQUIRED*	PROBABLE CAUSE OF TEST FAILURE
A. Foreign Voltage	(1) KS-14510-L1 Multimeter (2) 789A Tool For Dataport configuration use ED3C947 tool for D3 channel banks and ED3C948 tool for D4 channel banks instead of 789A tool.	Short circuit to another cable pair
B. Insulation Resistance		Short or ground in cable pairs
C. Loop Resistance		Open or short in cable pairs
D. OCU Simplex Voltage		Fuse in BCPA unit or battery wiring

* The 789A, ED3C947, and ED3C948 tools are not required if tests are performed at the LTD.

Note: Set the fixed line build-out (FLBO) on the OCU network option given on the circuit layout record card (CLRC) as shown below.

FLBO NETWORK OUT	FLBO NETWORK IN
S1 C	0
S2 C	0
S3 0	C
S4 0	C

C = Screw switch closed
0 = Screw switch open

2.04 If the channel loop-back test results are good, notify STC and report that local loop trouble is cleared.

2.05 If the channel loop-back test results are bad, a craft employee must be dispatched to the station with a DSU/CSU for the right speed. Replace the DSU/CSU and test according to Sections 595-200-500 and 595-100-500, respectively. Then, repeat the channel loop-back tests.

2.06 If the channel loop-back test results are still bad, perform the two-employee tests (E through J) between the OCU and customer station locations as required. The tests to be performed during trouble periods are listed in Table B. The procedures are given in Section 314-410-510.

2.07 If the two-employee test results on the cable pairs are good and loop trouble has not been located, request aid of data technical support group (DATEC) through normal lines of supervision.

2.08 If the two-employee test results on the cable pair are bad, notify cable assignment desk and request new nonloaded cable pairs. Test the new cable pairs by performing all the two-employee tests listed in Table B. The procedures are given in Section 314-410-510. If all cable test results are good, repeat the channel loop-back test, and if test is successful, notify STC that loop trouble has been cleared.

2.09 If results of two-employee tests on the new cable pairs are bad, request a second reassignment and repeat the two-employee tests. If the second cable pairs are also bad, request aid of DATEC through normal lines of supervision.

2.10 If the results of the one-employee tests A, B, or C are bad, test the cable pairs between the OCU and the main distributing frame (MDF).

2.11 If the results of the tests performed in paragraph 2.10 are good, dispatch a craft employee to the customer station end and perform

TABLE B

SERVING CENTRAL OFFICE-TO-STATION (TWO-EMPLOYEE) TESTS

NAME OF TEST	TEST APPARATUS REQUIRED*	PROBABLE CAUSE OF TEST FAILURE
E. Foreign Voltage	(1) KS-14510-L1 Multimeter (2) 789A Tool	Short circuit to another cable pair
F. Insulation Resistance	(1) KS-14510-L1 Multimeter (2) 789A Tool	Short or ground in cable pairs
G. Loop Resistance	(1) KS-14510-L1 Multimeter (2) 789A Tool	Open or short in cable pairs
H. Insertion Loss	(1) Two HP-3550B Test Sets (2) 789A Tool (3) P2ES Cord	Inaccurate cable records, load coils, bridged taps
I. Background Circuit Noise	(1) Two 6F NMSs (2) 789A Tool (3) P2ES Cord	Pair imbalance
J. Impulse Noise	(1) Two 6F NMSs (2) 789A Tool (3) P2ES Cord	Pair imbalance

* For Dataport configuration use ED3C947 tool for D3 channel banks and ED3C948 tool for D4 channel banks instead of 789A tool.

the two-employee tests E, F, or G as required and as listed in Table B. The procedures are given in Section 314-410-510.

2.12 If the two-employee test results are good, replace the DSU/CSU at station end and test according to Sections 595-200-500 and 595-100-500, respectively. Then request STC to repeat the channel loop-back tests. If the loop-back test is now good, notify STC that loop trouble is cleared. If loop-back test results are still bad, refer to paragraph 2.06 and perform remaining two-employee tests H, I and J.

2.13 If the two-employee test results on the cable pair are bad, notify the cable assignment desk and request new cable pairs. Test the new cable pairs by performing all the two-employee tests listed in Table B. The procedures are given in Section 314-410-510. If cable test results are now good, repeat the channel loop-back test, and if test is successful, notify STC that loop trouble is cleared. If test results are bad, refer to paragraph 2.09.

2.14 If test of wiring between OCU and MDF indicates trouble, repair the office wiring and repeat tests listed in paragraph 2.10. If these test results are now good, repeat the channel loop-back test, and if test is successful, notify STC that trouble has been cleared at the office. If tests results are still bad after repair or replacement of wiring, escalate problem by referring problem to higher levels of supervision.

3. ANALYSIS PROCEDURES FOR LOOPS CONTAINING 56-KB/S REPEATERS

3.01 This part outlines the analysis procedures that are used to isolate and clear troubles

on the DDS local loop containing a 56-kb/s repeater. Figure 2 shows the various loop arrangements that can be configured for 56-kb/s service and the various types of loop sections (A through H type) that may be involved. Trouble clearing procedures are shown in Fig. 3 through 11. The procedures begin under the direction of the STC, starting with its verifying (by channel loop-back tests) that the trouble is in the local loop.

Note: The following paragraphs (3.02 through 3.52) provide reference to the corresponding numbered blocks shown in Fig. 3 through 11.

3.02 For non-Dataport circuits, repeat all loop-back (LB) tests at the OCU location to verify that the OCU loop-back is good and the trouble fault is in the local loop. The loop-back tests, made using the KS-20908 and KS-20909 test sets, include the DSU/CSU loop-back, the channel loop-back at each repeater location, and the OCU loop-back.

3.03 If all loop-back tests fail, remove the OCU and insert a spare OCU with the same option installed as the defective OCU.

3.04 If all loop-back tests fail, remove OCU and insert 789A tool in its slot. Check for simplex voltage at the OCU by performing test D.

3.05 If simplex voltage is missing, check the fuse in the bay clock, power, and alarms (BCPA) unit or local timing supply (LTS).

3.06 If the channel loop-back test results are good, notify the STC and report that the local loop trouble has been cleared. If the channel loop-back test results are still bad, proceed to paragraph 3.07.

3.07 Insert the 789A tool in place of the OCU. Bypass all repeaters [both central office (CO) and outside plant (OP) type]. Bypassing the repeaters, if they are of the early or List 1 type, may require the assistance of other personnel in the same or other offices.

3.08 Loop sections consist of cable facilities which terminate in 56-kb/s repeaters, OCUs, DSUs, or CSUs. A faulty loop section can be recognized by a satisfactory loop-back test at the end of the loop section nearest the SCO and a loop-back test failure at the end farthest from the SCO. Comparison of the loop section being tested with Fig. 2 will identify the type of faulty loop section and the correct procedure to be selected in Fig. 3.

3.09 Perform the one-employee tests A, B, and C at the OCU location. A benchmark value should be recorded on the loop record card for this measurement.

3.10 Check the power unit simplex voltage and reversal of simplex voltage using the procedures given in Section 314-920-500.

3.11 If results of the simplex voltage test are bad, repair or replace the faulty circuit pack or shelf wiring; then repeat the channel loop-back tests. If the loop-back test results are now good, notify the STC and report that loop trouble has been cleared. If test results are still bad, proceed to paragraph 3.12.

3.12 Dispatch a craft employee to the OP repeater with operable circuit packs (CPs) for the repeater.

3.13 Replace each CP in the repeater in turn and notify the SCO test employee.

3.14 Perform all LB tests from the OCU until the defective CP is located. If changing a given CP does not clear the trouble, put it back in the repeater.

3.15 If the DSU/CSU, channel, and OCU loop-back test results are good, notify the STC and report that the local loop trouble has been cleared.

3.16 If results of the loop-back tests are still bad, perform the two-employee tests (E through J as listed in Table B) between the OCU and OP repeater as required. The procedures are given in Section 314-410-510. A benchmark value should be recorded on the loop record card for this measurement.

3.17 If the two-employee test results indicate a bad cable pair, notify cable assignment desk and request new nonloaded cable pairs. Test the new cable pairs by performing all the two-employee tests listed in Table B. The procedures are given in Section 314-410-510. If all cable test results are good, repeat the channel loop-back test. If the test is successful, notify the STC that loop trouble has been cleared.

3.18 If the two-employee test results on the cable pairs are good but loop-back tests fail and loop trouble has not been located, request the aid of DATEC through normal lines of supervision.

3.19 If results of the one-employee dc tests at the OCU are bad, perform the two-employee dc tests (E, F, and G). These tests are made between the OCU and the loop-side of the MDF in the OCU office. A benchmark value should be recorded on the loop record card for this measurement.

3.20 Repair or replace the wiring and repeat the two-employee tests (E, F, and G). If these test results are now good, repeat the channel loop-back tests. If test results are good, notify the STC that the trouble has been cleared at the office.

3.21 Perform the two-employee dc tests (E, F, and G). These tests are made between the MDF at the office and the OP repeater.

3.22 If the dc test results are good but loop-back tests still fail, replace the circuit packs in the OP repeater, one at a time.

3.23 If the channel loop-back test results are bad, dispatch a craft employee to the station end with a properly equipped and operable DSU/CSU.

3.24 Replace the DSU/CSU and test according to Sections 595-200-500 and 595-100-500, respectively. Then repeat the channel loop-back tests.

3.25 If the channel loop-back test results are still bad, perform the two-employee dc tests (E through G as listed in Table B) between the OCU and station as required. A benchmark value should be recorded on the loop record card for this measurement.

> ***Note:*** Both the CO and OP repeaters (if used in the loop section under test) must be bypassed in order to perform these tests. If trouble is found and cleared, remove the repeaters from the bypass mode and repeat the channel loop-back test.

3.26 Perform the two-employee ac tests (H, I, and J). These tests are made between the OP repeater and the station end. A benchmark value should be recorded on the loop record card for this measurement.

3.27 Replace the DSU/CSU and test according to Sections 595-200-500 and 595-100-500, respectively.

3.28 If results of the two-employee dc tests from the OCU to the station are bad, perform the same dc tests on just the station wiring.

3.29 After the tester reaches the OP repeater, perform the two-employee dc tests. These tests are made between the OP repeater and the station end.

3.30 Dispatch a craft employee to the CO repeater office if the office is unoccupied. The office should have spare repeater CPs and test equipment for performing dc and ac tests.

3.31 Perform the two-employee ac tests (H, I, and J). These are made between the CO repeater and the OCU.

3.32 After the tester reaches the CO repeater office, make the two-employee dc tests. These tests are performed between the MDF of the CO repeater and the OCU. A benchmark value should be recorded on the loop record card for this measurement.

3.33 If test results of repeater power and voltage reversals are good, perform the two-employee ac and dc tests (E through J). These tests are made between the CO repeater and the station end. The procedures are given in Section 314-410-510.

3.34 After the tester reaches the CO repeater office, make the two-employee dc tests. These tests are performed between the OCU and the station side of the last MDF. A benchmark value should be recorded on the loop record card for this measurement.

3.35 After the tester reaches the station, perform the two-employee dc tests. These tests are performed between the station and the MDF of the last office.

3.36 Dispatch a craft employee to the simplex power unit in the CO if office is unoccupied.

3.37 If test results of LB tests are bad, perform the two-employee dc and ac tests (E through J). These tests are made between the simplex power unit and the second OP repeater.

3.38 After the tester reaches the first OP repeater, make the two-employee dc and ac tests (E through J). These tests are made between the first OP repeater and the second OP repeater. The procedures are given in Section 640-251-107.

3.39 After the tester reaches the simplex power unit in the central office, perform the two-employee dc tests (E, F, and G). These tests are made between the OCU and the station side MDF at the simplex power unit. A benchmark value should be recorded on the loop record card for this measurement.

3.40 If dc test results between the OCU and the MDF are bad, perform the same dc tests from MDF to the MDF at the office.

3.41 After the tester reaches the first OP repeater, make the two-employee dc tests (E, F, and G). These tests are made from the simplex power unit in the office to the first OP repeater.

3.42 After the tester reaches the OP repeater, make two-employee dc tests (E, F, and G). These tests are made from the station side MDF at the CO repeater office to the OP repeater.

3.43 After the tester reaches the CO repeater office, check the simplex power at the CO repeater as received from the OP repeater.

3.44 If test results of loop-back tests are bad, perform the two-employee dc tests (E, F, and G). These tests are made from the OCU to the CO repeater. A benchmark value should be recorded on the loop record card for this measurement.

3.45 After the tester reaches the OP repeater, make the two employee ac tests (H, I, and J). These tests are made between the OP repeater and the CO repeater.

3.46 After the tester reaches the OP repeater, make the two-employee tests (E, F, and G). These tests are made from OP repeater to the MDF of the CO repeater.

3.47 If the one-employee dc test results are bad when testing a loop containing two CO repeaters, the probable fault is the loop between the repeaters. Sectionalize this type of trouble by performing the two-employee dc test (E, F, and G).

3.48 Check the simplex power and reversals through the CO repeater.

3.49 Repair the CO repeater to correct the simplex power or simplex reversal problem. Then repeat the channel loop-back tests.

3.50 Perform the two-employee dc and ac tests from the CO repeater to the OP repeater.

3.51 Perform the dc tests on office wiring from the MDF to the repeater.

3.52 Check the simplex power and reversals from the first CO repeater at the input to the second CO repeater.

3.53 Perform the two-employee dc and ac tests (E through J) from CO repeater to CO repeater.

4. TESTING

A. Serving Central Office (One-Employee) Tests

4.01 Serving central office tests are made at the SCO and consist of dc measurements performed by one employee at the OCU or the LTD. The tests to be performed are listed and briefly summarized in Table A. The DSU (or CSU) will normally be transmitting a data signal on the T1, R1 pair during these tests. Since the KS-14510 multimeter will not respond to the data signal, the ac data signal will not interfere with the dc measurements.

4.02 This part describes each test and indicates when it is performed. The procedure and test requirements for these tests are given in Section 314-410-510.

Apparatus Required

4.03 The following is a list of test apparatus required for performing these tests on the local loop:

- One portable volt-ohm-milliammeter (VOM), KS-14510-L1 or KS-16979-L1 or equivalent.
- One 789A tool (not required if test is performed at LTD). For the Dataport configuration, at 2.4, 4.8, or 9.6 kb/s, use the ED 3C947 tool for D3 channel banks or the ED 3C948 tool for D4 channel banks.

4.04 The following information is obtained from the CLRC before starting the tests:

- The cable pair loop resistance, measured during initial installation tests.
- The option selected for the FLBO network in the DSU (or CSU), 56-kb/s repeaters, and OCU or OCUDP, and the bit rate of the data service.

Test A. Foreign Voltage

4.05 This test is made to check that no foreign voltage is present on the line pairs. A foreign voltage indicates that a cable fault exists.

4.06 The test is made at the OCU bay using the 789A tool. For the Dataport configuration, use the ED 3C947 tool for D3 channel banks or the ED 3C948 tool for D4 channel banks. Connect the VOM between the following test points: T to R; T1 to R1; and T, R, T1, and R1 to ground. The voltage reading between any of these points should be less than 1 volt.

Test B. Insulation Resistance

4.07 The insulation resistance test measures the resistance from line terminals T, R, T1, and R1 to ground to insure adequate isolation between conductors and ground.

Test C. Loop Plus Terminal Resistance

4.08 Loop resistance measurement is the sum of the loop resistance of the cable pair, the line circuit resistance of the DSU (or CSU), and the resistance of any bypassed 56-kb/s repeaters in the loop. Both the transmit and receive cable pairs are measured. The value of the loop resistance of the cable pair was measured during the initial installation tests and should be recorded on the CLRC.

4.09 The DSU (or CSU) line circuit resistance depends on the bit rate if the FLBO network is installed. A CO repeater adds approximately 36 ohms to the line resistance when bypassed. An OP repeater adds 5758 ohms to the line resistance when bypassed.

Test D. OCU Simplex Voltage

4.10 The OCU simplex voltage measurement requires the use of the multimeter to measure the office battery voltage which is used as a simplex line voltage. The test is made at the OCU location, and the voltage is measured between the BAT and GRD test points on the 789A tool, the ED 3C947 tool, or the ED 3C948 tool. If no voltage is present, check the simplex current fuse associated with the OCU shelf in the BCPA unit or LTS.

4.11 If the simplex voltage measurement is made at the LTD or MDF, the simplex voltage is measured between T and T1 and also between R and R1, looking toward the OCU. The first measurement is made with the STC transmitting a 2047-bit word; the second measurement is made with the STC transmitting the channel loop-back code. The polarity of the simplex voltage must reverse in the second measurement. If no voltage is measured, check the following:

(a) Cable pair continuity between OCU and MDF or LTD.

(b) Simplex current fuse in BCPA or LTS.

(c) Replace OCU or OCUDP (install the FLBO network option listed on the CLRC). Refer to Section 314-410-510 for procedures. Then retest for reversal.

B. Serving Central Office-to-Station (Two-Employee) Tests

4.12 Serving central office-to-station tests consist of dc and ac measurements performed by two employees between the station and the OCU bay or, for Dataport, the channel bank bay in the central office. These measurements will require

that the pairs be opened, shorted, or terminated. The DSU (or CSU) is removed from the local loop before these tests are performed. The tests are performed between the 789A tool, the ED 3C947 tool, or the ED 3C948 tool and the station terminal block. The tests to be performed are listed and briefly summarized in Table B.

4.13 This part describes each test. The step procedure and requirements for these tests are given in Section 314-410-510.

Apparatus Required

4.14 The following is a list of apparatus required for these tests on the local loop:

- Two 6F noise measuring sets (NMSs) with 50-kHz network (479F), or equivalent NMSs with 50-kilobit noise weighting filters.
- Two Hewlett Packard 3550B test sets, or equivalent.
- One KS-14510-L1 multimeter.
- Three 135-ohm resistors.
- One 386B plug (310 plug with a 135-ohm termination).
- One P2ES cord (specify 8- or 12-foot cord length for use with 7- or 11-foot bays).

4.15 The following information is required before starting the tests:

- The cable pair loop resistance, measured during initial installation tests and recorded on the CLRC. [If the measurement result is not available, measure the loop resistance (Test G) and record on the CLRC.]
- The expected measured loss (EML) for the cable pair.

Test E. Foreign Voltage

4.16 Remove DSU (or CSU) at the station end. The test is described in paragraphs 4.05 and 4.06. For loops containing 56-kb/s repeaters, the repeaters must be bypassed.

Test F. Insulation Resistance

4.17 Measure the insulation resistance between the test points on the 789A tool, the ED3C947 tool, or the ED3C948 tool as follows:

T and R; R and R1

T and T1; R and T1

T1 and R1; T and R1

and

T and GRD; R and GRD

T1 and GRD; R1 and GRD.

Test G. Loop Resistance

4.18 Loop resistance measurement checks the dc resistance of the transmit and receive cable pairs while they are shorted together at the station end. The measurement reading is taken at the OCU location in the office using the 789A tool or, for Dataport, ED-type tool and KS-14510 multimeter. If this is an initial installation test, record the value on the CLRC. For loops containing 56-kb/s repeaters, the repeaters must be bypassed.

4.19 If the dc measurements do not meet requirements, the cable fault-locating procedures given in Section 634-310-501 can be used to locate the trouble. This procedure is normally done by the cable repair crew.

Test H. Insertion Loss

4.20 Insertion loss measurement is made using test signal at various frequencies. The test check that the receive signal level will be within the normal operating range. It also verifies that the loops do not have load coils or long bridged taps.

4.21 The HP-3550B test set at the office is connected to the line using the 789A tool or for Dataport, ED-type tool and the P2ES cord and transmits the test signals to the station.

4.22 The HP-3550B test set at the station uses the voltmeter portion of the set to measure (in dBm) the level of the received signal.

CONTENTS PAGE

4.23 If the insertion loss measurement on the cable pairs fails to meet the test requirements, as based on the EML, the problem may be inaccurate cable records or excessive bridged taps. If the measurement at the top test frequency is 20 or more dB above the EML, the trouble is probably one or more loading coils.

Test I. Background Circuit Noise

4.24 The noise measurement is made on the receive side of both cable pairs. At the OCU location, the 789A tool, the ED3C947 or ED3C948 tool, and the P2ES cord are used to access the line.

> ***Note:*** Tests I and J must be made separately for each segment of a loop equipped with 56-kb/s repeaters. For example, each loop section from OCU to first repeater, first repeater to second repeater, and second repeater to DSU/CSU.

4.25 The noise measurement is made using two 135-ohm resistors at the office to terminate both pairs and two 135-ohm resistors at the station to terminate both pairs. The 6F NMS at the station is connected to the T, R pair and the 6F NMS at the office is connected to the T1, R1 pair. The FUNCTION switches on both 6F NMSs are set to the 600 OHM BRIDGING position.

4.26 Instructions for operating the 6F NMS are given in Section 103-626-100. Noise measurements can be made at any time; however, it is preferable that they be made during a peak traffic load or busy-hour period.

Test J. Impulse Noise

4.27 The impulse noise measurement is normally made after the background circuit noise test is completed and uses the noise counter of the 6F NMS. The NMS is set to operate for a period of 15 minutes at a threshold value that depends on bit rate.

CONTENTS PAGE

5. REFERENCES

5.01 The following sections can be referenced for additional information on maintaining local loops:

SECTION	TITLE
103-626-100	6F and 6FR Voiceband Noise Measuring Sets—(J94006F and J94006FR)—Description, Operation, and Maintenance
107-600-100	Digital Data System—KS-20909 Data Test Set (Transmitter)
107-601-100	Digital Data System—KS-20908 Data Test Set (Receiver)
314-410-510	Digital Data System—Local Loop—Tests and Requirements
314-910-100	Digital Data System—Office Channel Unit—Description
314-910-300	Digital Data System—Office Channel Unit—Maintenance
314-910-500	Digital Data System—Office Channel Unit—Test Procedures
314-920-100	Digital Data System—56-kb/s Repeater—Description
314-920-500	Digital Data System—56-kb/s Repeater—Test Procedures
365-150-107	Digital Transmission Systems—D3B Channel Bank—Dataport Operation—Description, Installation, Maintenance and Tests
595-100-100	Digital Data System—550A-Type Channel Service Unit—Description
595-100-300	Digital Data System—550A-Type Channel Service Unit—Maintenance
595-100-500	Digital Data System—550A-Type Channel Service Unit—Test Procedures

SECTION	TITLE
595-200-100	Digital Data System—500A-Type Data Service Unit—Description and Operation
595-200-300	Digital Data System—500A-Type Data Service Unit—Maintenance
595-200-500	Digital Data System—Data Service Unit 500A-Type—Test Procedures
634-310-501	Locating Cable Faults With the 96A Test Set
640-251-106	468F Apparatus Case—Description and Installation
640-251-107	468F Apparatus Case—Maintenance and Acceptance Testing
666-600-100	Digital Data System—950A Testboard (J70176A and B)—Description and Operation
880-601-115	Digital Data System—Local Loops — Engineering Guidelines.

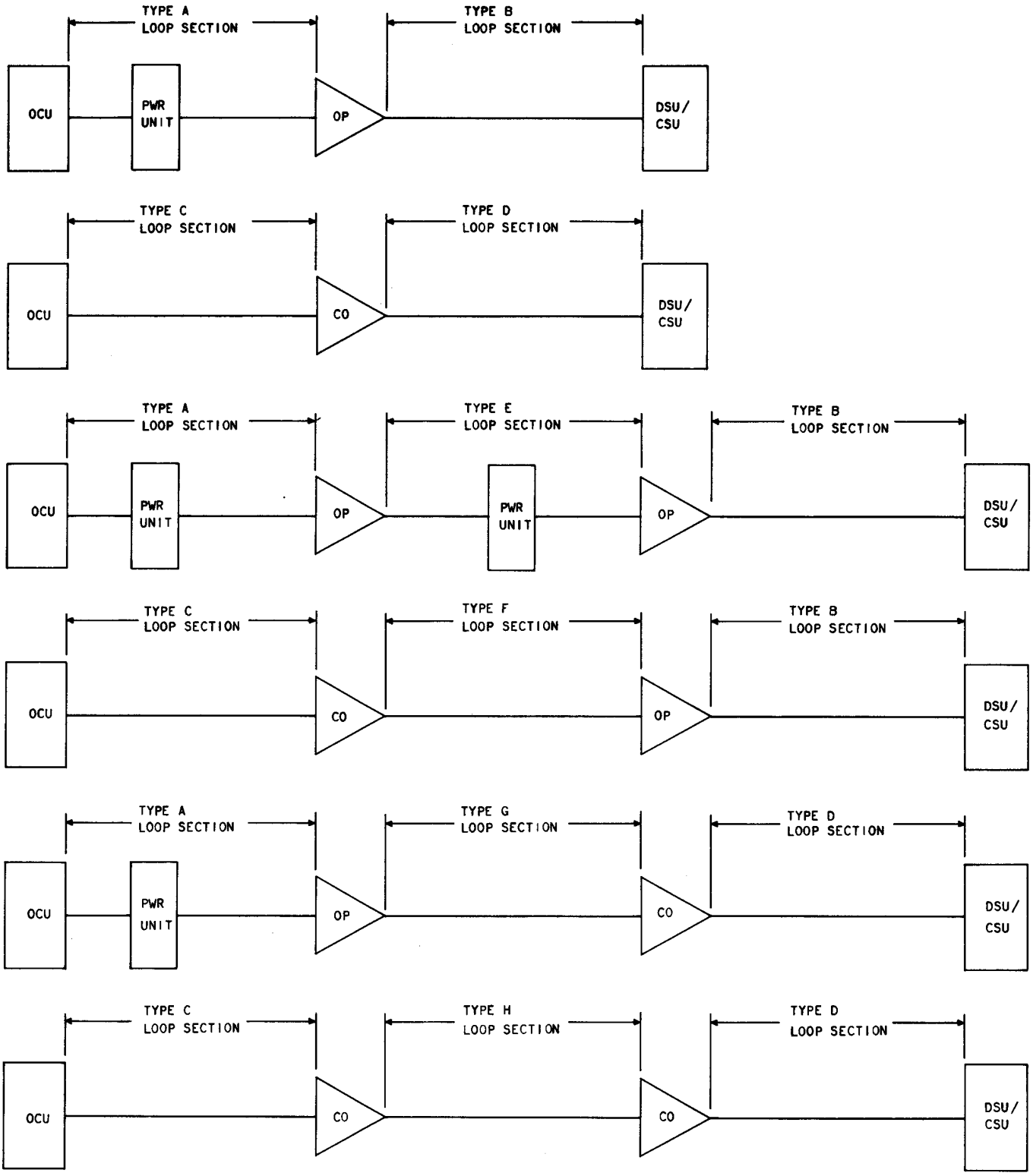

Fig. 2—Local Loop Containing 56-kb/s Repeater—Trouble Clearing Procedures

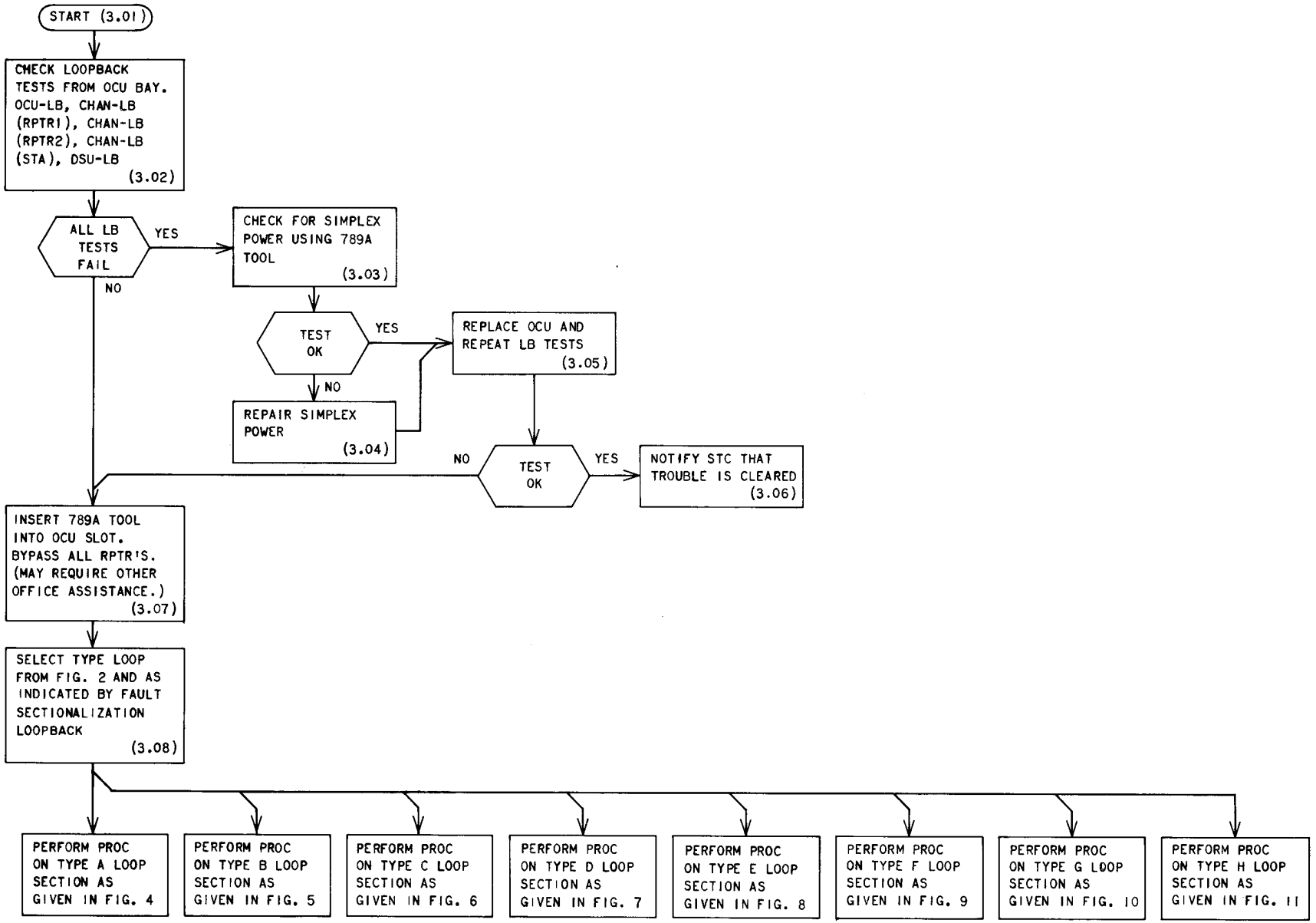

Fig. 3—Local Loop Containing 56-kb/s Repeaters—Initial Trouble Clearing Procedures

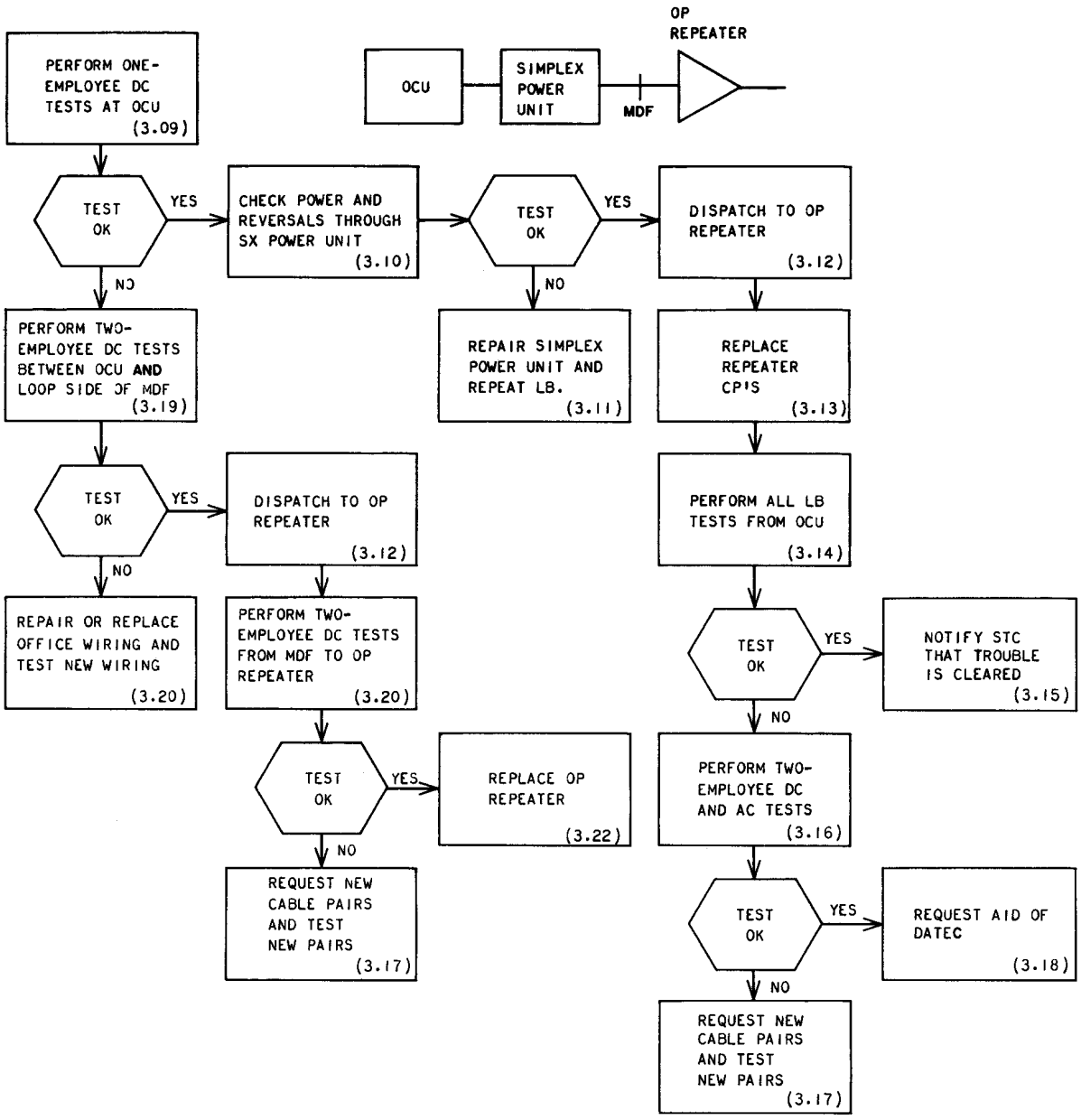

Fig. 4—Trouble Clearing Procedures on Type A Loop Section

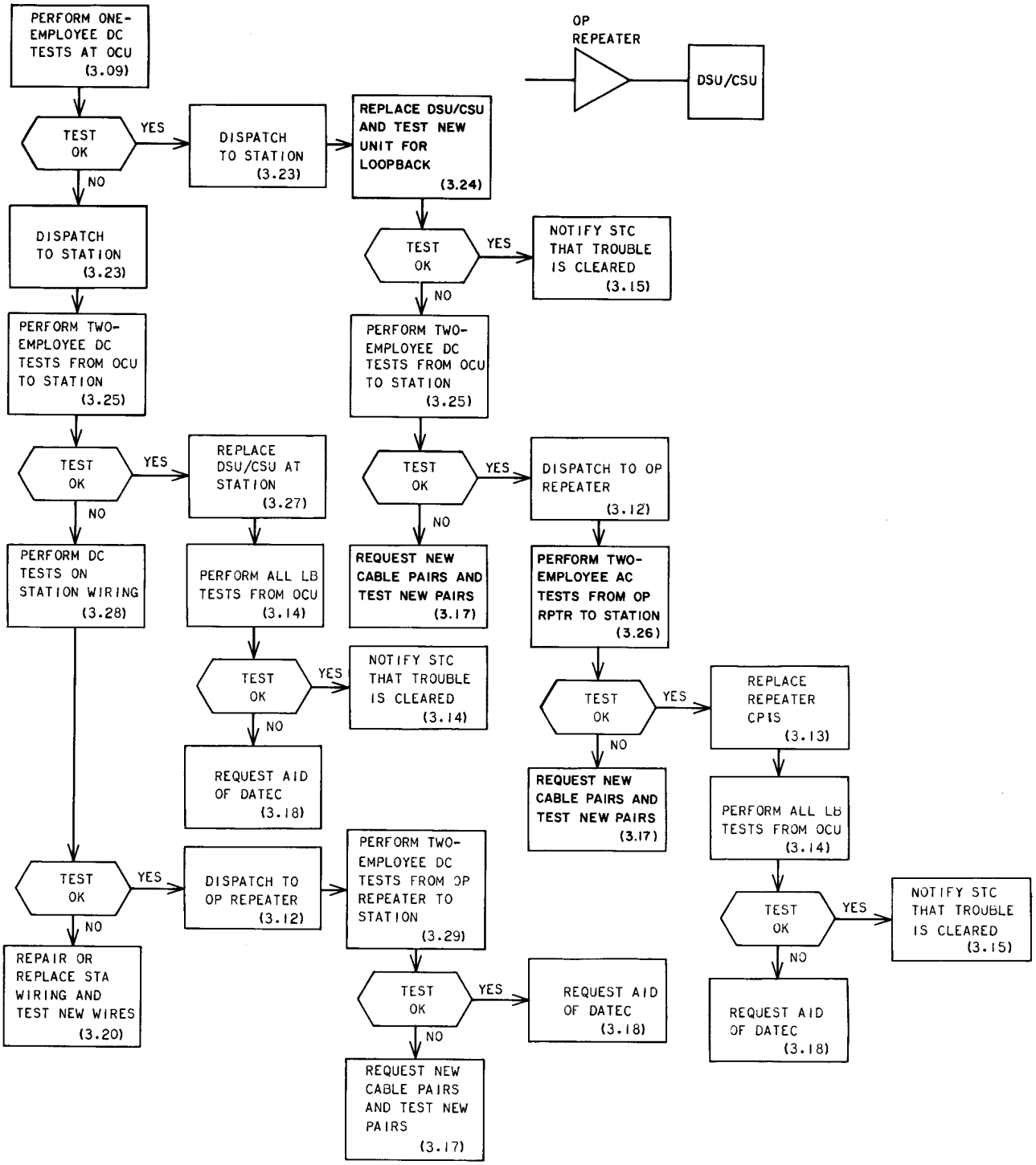

Fig. 5—Trouble Clearing Procedures on Type B Loop Section

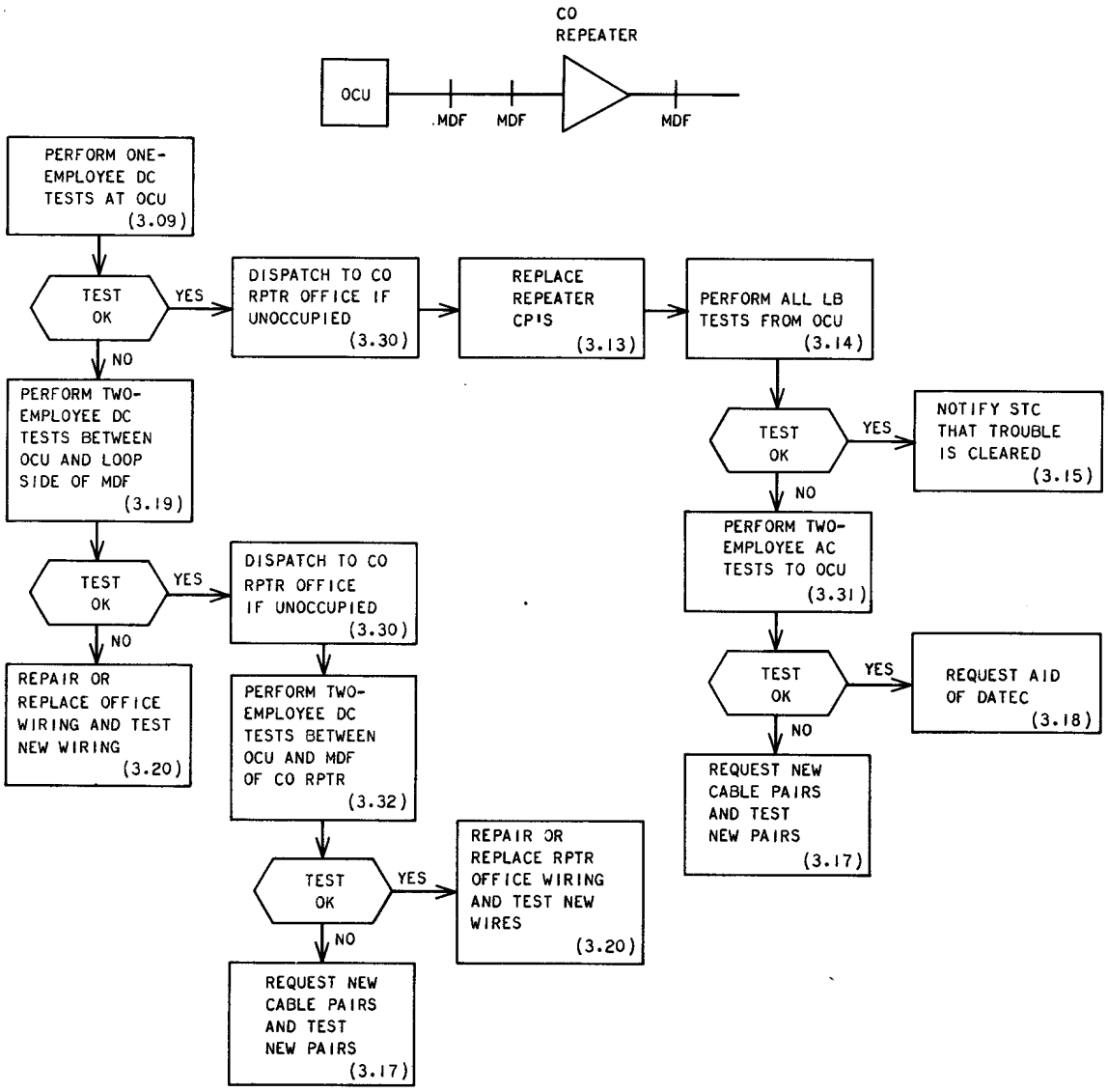

Fig. 6—Trouble Clearing Procedures on Type C Loop Section

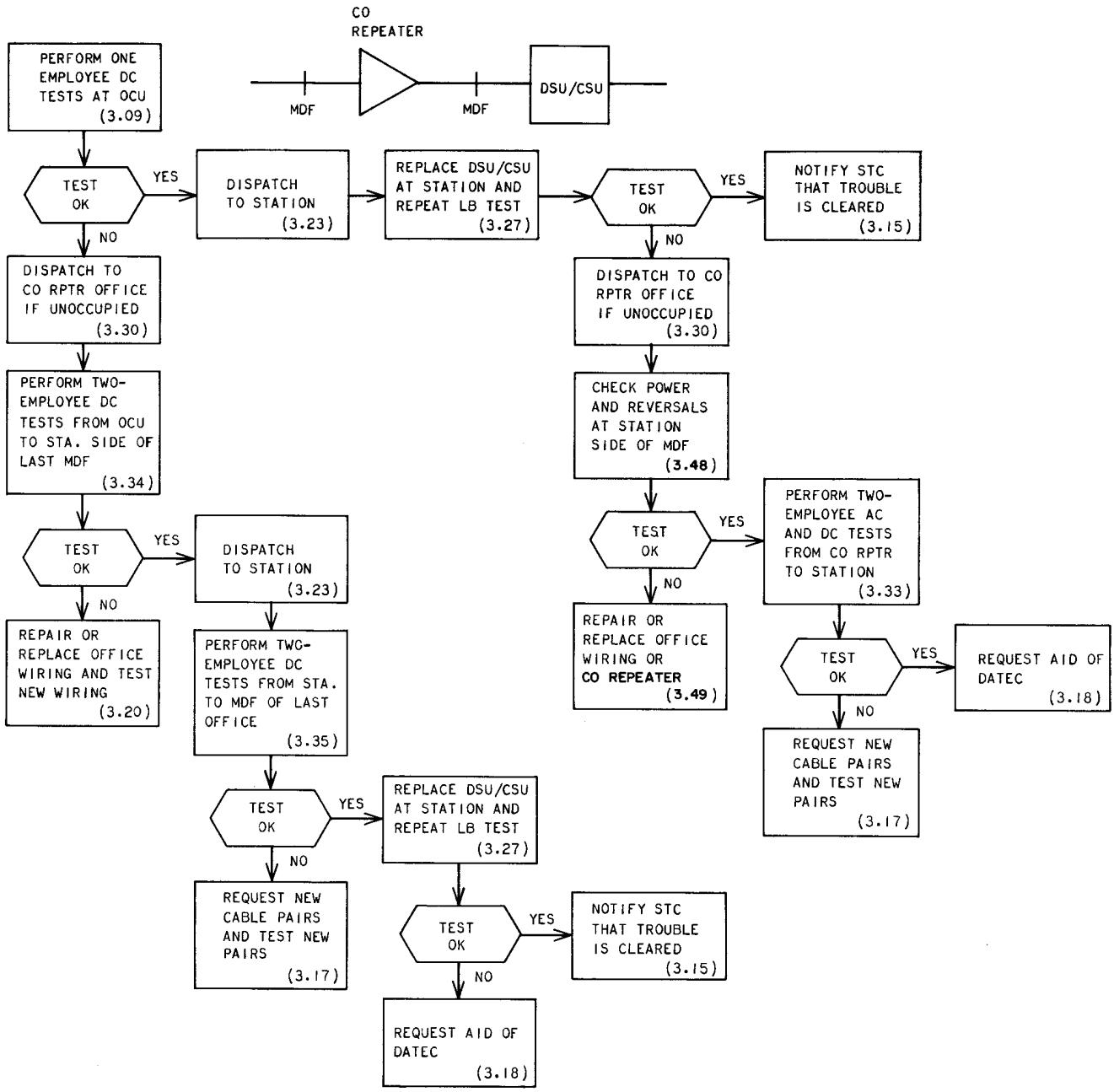

Fig. 7—Trouble Clearing Procedures on Type D Loop Section

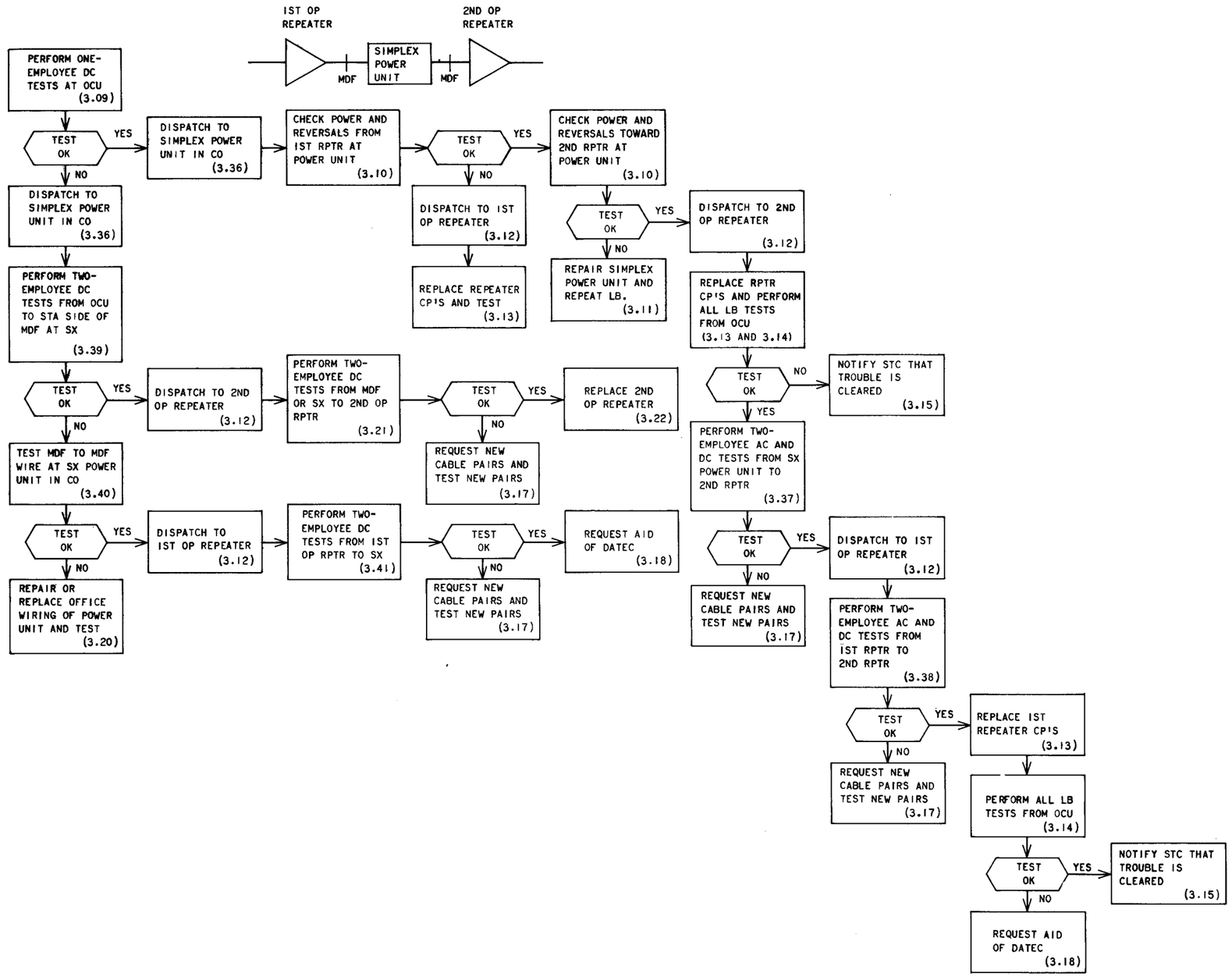

Fig. 8—Trouble Clearing Procedures on Type E Loop Section

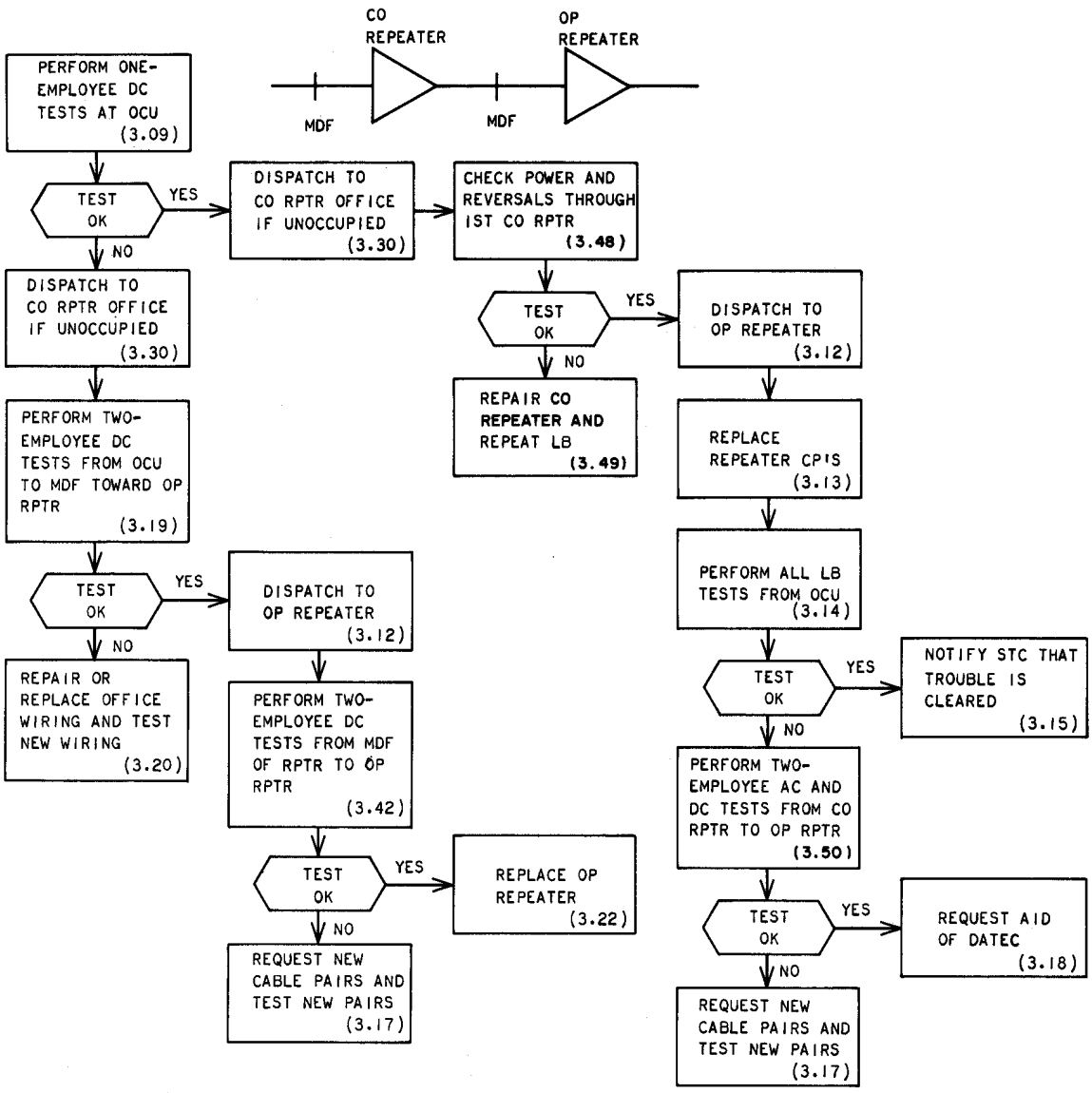

Fig. 9—Trouble Clearing Procedures on Type F Loop Section

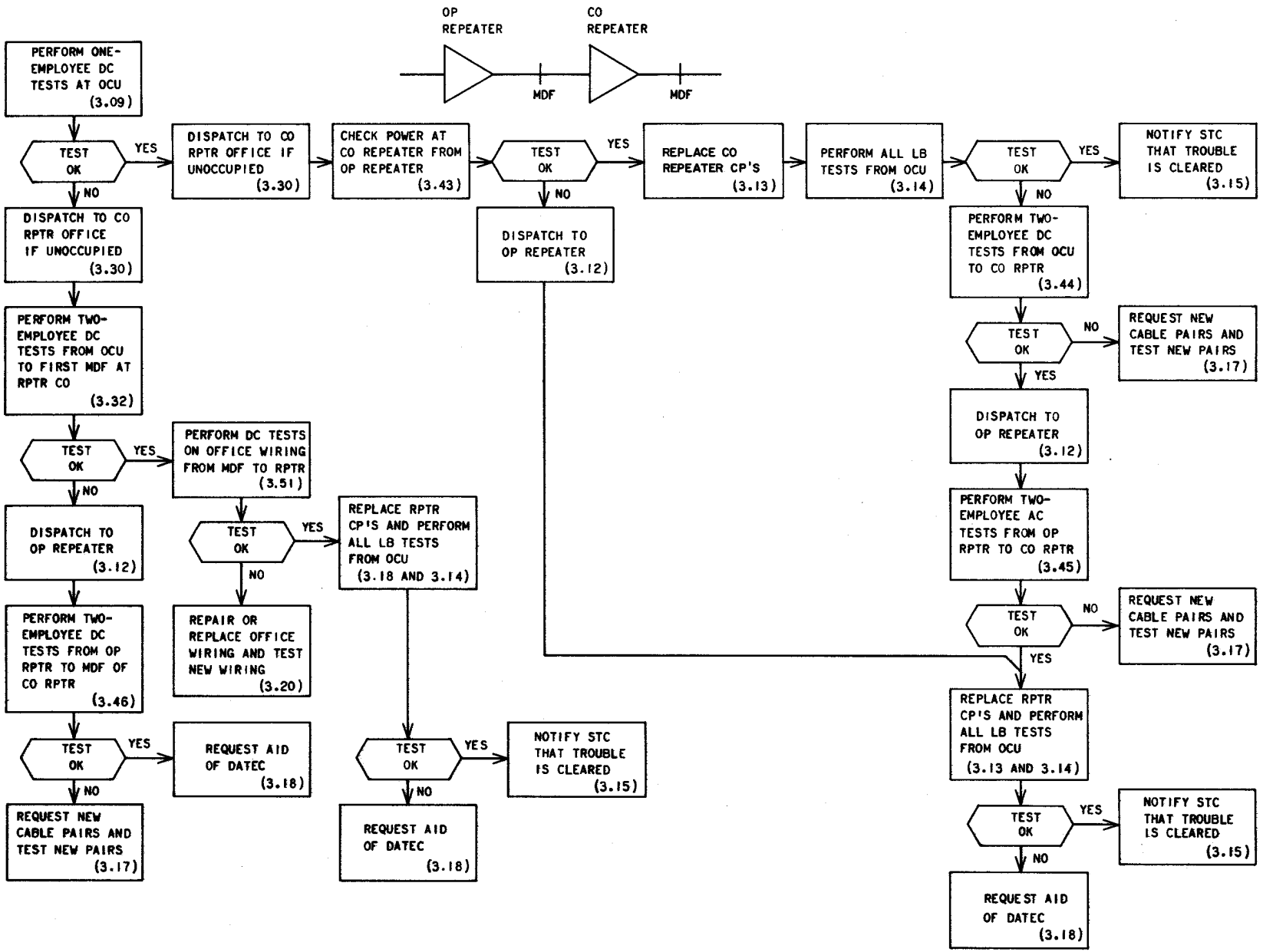

Fig. 10—Trouble Clearing Procedures on Type G Loop Section

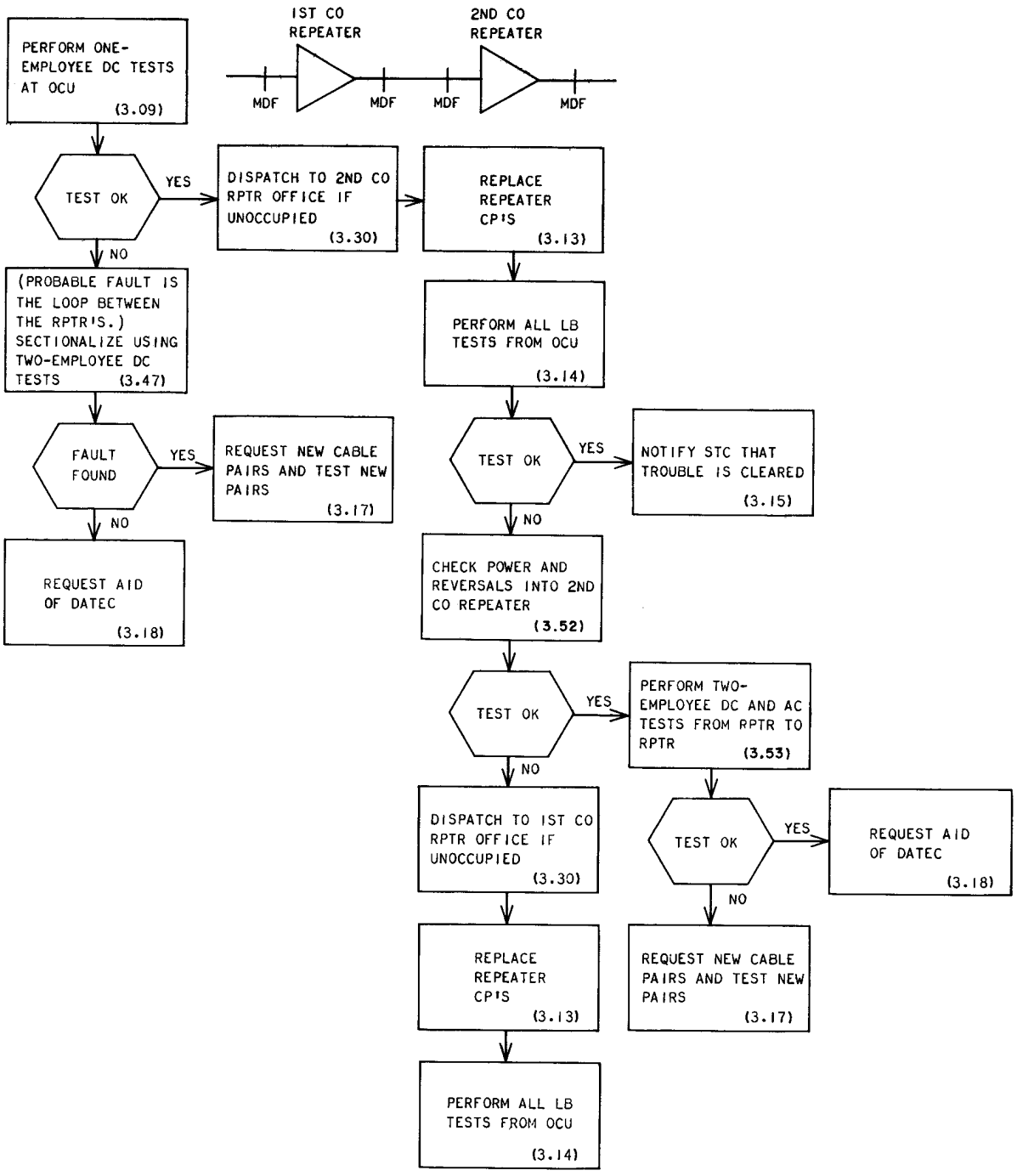

Fig. 11—Trouble Clearing Procedures on Type H Loop Section