

## 10-TYPE DATA LINE CONCENTRATOR SYSTEM (DLCS) MAINTENANCE PROCEDURES

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DDD-In Station . . . . .	10	1.01 This section covers the procedures to be followed when trying to isolate a trouble condition in the 10-type Data Line Concentrator System (DLCS). The procedures described herein should enable the Telephone Company (TELCo) employee to isolate the trouble condition to a particular link in the system. This is accomplished by analyzing the trouble report(s) to determine whether it is a single or multiple station-reported trouble and whether it is an access or transmission difficulty. Once the trouble has been isolated to a specific link, the Bell System Practice (BSP) maintenance procedures for that link (see Part 2) should be consulted in order to identify the faulty unit.	
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## SECTION 591-810-300

1.02 This section is reissued to:

- (a) Replace the present maintenance plan with a more functional plan.
- (b) Include information pertaining to the dual access 10B Data Line Concentrator.
- (c) Remove all reference to the acronym DATREX.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 This practice assumes that the reader has a general knowledge of the 10-type DLCS. This information may be found in the section entitled 10-Type Data Line Concentrator System—Description (591-810-100).

1.04 No routine maintenance is required for the data sets, circuit packs, and data mountings which make up the 10-type DLCS. Routine maintenance of any teletypewriters (TTYs) that may be used in the system should be in accordance with the appropriate Field Maintenance Practice (FMP).

1.05 It is recommended that a *Data Set 109H-L1* (one for each concentrator employed in the system) be stocked and stored at the concentrator for use when performing the tests described in the section entitled 10-Type Data Line Concentrator System—Test Procedures (591-810-500).

1.06 This BSP, along with the section entitled Engineering and Implementation Methods for Data Line Concentrator Service (591-810-190), should be considered during the *preservice planning meeting* that is held with the customer prior to installation of the system.

1.07 The diagram in Fig. 1 shows a typical 10-type DLCS layout. The preferred method for maintenance of the system is for the customer to adopt a centralized trouble reporting system whereby the outlying stations report troubles directly to the computer center. This allows the computer center, which is in the best position to determine the trouble area from the pattern of the reports, to make the initial analysis. Once this initial analysis is made, troubles which appear to be TELCO problems are forwarded to the control serving test center (CSTC). After the CSTC personnel has

further analyzed the report, its responsibility is to isolate the trouble to a particular link in the system and either forward the trouble report to the serving test center (STC) responsible for that area or coordinate the troubleshooting activities of the STCs involved.

1.08 If the centralized trouble reporting procedure described in 1.07 is not practical for the system, the following procedure is recommended as an alternative. In this case, the customer at the outlying station reports the trouble to the STC serving that station. The STC personnel will then make the initial analysis and, if the trouble cannot be immediately resolved or appears to be outside of the area, forward the report to the CSTC for the final analysis and trouble isolation.

1.09 It is highly recommended that the computer be equipped to keep track of trunk usage and hold times. This provides a means for quickly identifying the particular trunk which may be in trouble.

## 2. MAINTENANCE AIDS

2.01 The following circuit descriptions (CDs) and schematic drawings (SDs) may be helpful when performing these maintenance activities.

SECTION	TITLE
SD- & CD-73055-01	Data Systems Station—10A Data Line Concentrator
SD- & CD-1D212-01	Data Systems Station—10B Data Line Concentrator
SD- & CD-1D200-01	Data Systems—Private Line/DLCS Interconnection Circuit (Line Side)
SD- & CD-1D197-01	Data Systems Station—DDD Incoming Circuit for the DLCS
SD- & CD-1D164-01	Data Systems Station—Data Set 109C-Type
SD- & CD-1D172-01	Data Systems Station—Data Set 109D-Type
SD- & CD-1D198-01	Data Systems Station—Data Set 109E-Type

SD- & CD-1D199-01 Data Systems Station—Data Set 109F-Type

SD- & CD-\_\_\_ Data Systems Station—Data Set 109H-Type

SD- & CD-3D024-01 Data Systems Station—Data Set 108A-Type

SD- & CD-3D032-01 Data Systems Station—Data Set 108C-Type

SD- & CD-3D031-01 Data Systems Station—Data Auxiliary Sets 820D- and 820E-Type

SD- & CD-1D176-01 Data Systems Station—28-Type Data Mounting

SD- & CD-1D183-01 Data Systems Station—27-Type Data Unit

SD- & CD-1D148-01 Data Systems Station—1A Data Station 43B1 Carrier System

SD- & CD-1D208-01 Data Systems Station—Data Set 113B-L1 and 32A1 Data Mounting.

591-813-Z00 Series 1A Data Station Multi-Channel Arrangement

591-811-Z02 Series Private Line Interconnection Arrangement for Line Side of the Data Line Concentrator

591-811-Z03 Series DATA-PHONE® Interconnection Arrangement for Line Side of the Data Line Concentrator

591-811-Z04 Series DATA-PHONE Interconnection Arrangement for the Trunk Side of the 10B Data Line Concentrator

591-813-Z00 Series 113B Data Station.

**2.02** The following BSPs will be required when attempting to locate a faulty unit after isolating a trouble to a particular link of the DLCS.

SECTION	TITLE
591-811-Z00 Series	10A Data Line Concentrator
591-811-Z01 Series	10B Data Line Concentrator
591-031-Z01 Series	Data Set 109C-Type Station
591-029-Z01 Series	Data Set 109D-Type—Multiple Data Set Arrangement
591-036-Z01 Series	Data Set 109E-Type—Multiple Data Set Arrangement
591-035-Z01 Series	Data Set 109F-Type Station
591-037-Z01 Series	Data Set 109H-Type Station
591-023-Z10 Series	Data Set 108A- or 108C-Type Station

**3. SERVING TEST CENTER (STC) TROUBLE REPORT ANALYSIS AND MAINTENANCE ACTIVITIES**

**3.01** This part covers the procedures to be followed by the STC when a trouble report is received from either the CSTC or the customer. It is recommended that the trouble report questions suggested in Table A be included on the circuit layout record card to expedite the handling of troubles reported by the customer.

**3.02** When centralized reporting (1.07) is used on the DLCS, the CSTC will have received the initial trouble report from the customer. By reporting all troubles to one office, the CSTC is in a better position to localize the problem through analyzation of the trouble reports. If the trouble does *not* appear to be in the CSTC maintenance territory, the report will be referred to the STC responsible for the problem section. In all instances, the CSTC shall retain overall maintenance responsibility and provide assistance and guidance to other STCs in testing the DLCS.

**3.03** When the STC receives a trouble report directly from the customer (1.08) the STC is required to make initial checks by customer-interrogation per steps given in Table A. This should minimize any delay in restoring service to stations where the trouble is obviously of local origin (ie, TTY paper jams, etc).

**3.04** A list of suggested questions is given in Table A to aid an STC in the analysis of

trouble reports received directly from the customer. In cases of total system trouble or common section problems, the CSTC should be notified immediately so that further analysis can be made.



*When a single station reports a trouble (especially during a low-traffic hour), the possibility that it is the first of a series of similar trouble reports should be considered. In this case, it is suggested that the STC personnel call two or three other stations within the maintenance area and inquire whether they are experiencing the same trouble.*

**3.05** Provided the station is equipped for local mode operation, the attendant should place the terminal equipment in the local mode and perform the *Local Test* as instructed in the *Customer Operation Manual* or *"How to Operate"* book *before* reporting a trouble. If the Local Test has not been performed [1], request that the station attendant perform the test.

**3.06** If the station does not meet the requirements of the Local Test [2] or is not properly powered [3], refer the trouble either to the customer for a station using a customer-provided terminal (CPT) or to the appropriate TELCo employee for a station using a Bell System-provided TTY.

**3.07** When a station meets the requirements of the Local Test and is found to be properly powered, it must be determined whether [4] the trouble is with access or transmission. An access trouble is indicated when the station initiates a call and receives no answer-back from the computer, no camp-on signal from the concentrator; no dial tone from the central office (10B concentrator with DDD access only). A transmission trouble is indicated when the station receives a garbled copy. The next fact that must be determined is whether the trouble occurs on all calls or only occasionally [5] and, if a 10B concentrator (dual access) is involved, does the trouble occur on both trunk groups [6].

**3.08** If the trouble report indicates that any of the following conditions exist, immediately forward it, along with any information pertaining to whether any other stations in the area are

experiencing the same trouble [7], to the CSTC for further analysis.

- (1) The reporting station cannot be accessed from an STC or CSTC
- (2) Transmission trouble
- (3) Access trouble on occasional calls
- (4) Trouble occurs when using either trunk group (dual access only).

**3.09** If the trouble is an access trouble on all calls and involves a remote private line (PL), DDD-in, or remote multiplexed station having access troubles on all calls, request the station attendant to initiate a call. Check to see that the station is applying the proper frequency or voltage to the loop in accordance with Table B. If the proper signal is not received, verify the transmission facility. If the transmission facility is found to be good, dispatch a TELCo employee to repair or replace the faulty data set. If not, repair or replace the facility. When the station is found to be presenting the proper frequency or voltage to the loop, send the trouble report to the CSTC for further analysis.

#### 4. CSTC TROUBLE REPORT ANALYSIS AND MAINTENANCE ACTIVITIES

##### A. General

**4.01** This part covers the procedures to be followed by the CSTC when a trouble report is received from the customer or an STC. The tests referenced in the following text are described in the section entitled 10-Type Data Line Concentrator System—Test Procedures (591-810-500).

**4.02** All trouble reports will fall into one of the two following categories.

- Single station-reported troubles
- Multiple station-reported troubles.

Within each of these categories the troubles can be any one of the following four types.

- Access trouble on all calls

TABLE A  
SAMPLE STC OR CSTC TROUBLE REPORT FORM

QUESTION	ANSWER
1. *Has Local Test of the terminal been done?	
2. *Does station meet requirements of the Local Test?	
3. Is terminal properly powered (eg, no blown fuses, if station is on a switched power outlet, is switch turned ON)?	
4. Is trouble with transmission (garbled reception) or access (no response from computer, concentrator, or CO†)?	
5. Does trouble occur on all calls or only occasionally?	
6. ‡Does trouble occur when using both trunk groups? If not, which trunk group?	
7. Have any other stations reported similar troubles?	

\* If station is equipped for local mode operation.

† 10B concentrator with DDD access in one trunk group only.

‡ Local station associated with 10B concentrator only.

- Access trouble on occasional calls
- Transmission trouble on all calls
- Transmission trouble on occasional calls.

In addition, a trouble report indicating that a particular trunk has little or no usage or an unusually short hold time may be received from the computer center. In this case, a faulty trunk is indicated and the appropriate trunk loop maintenance practice (see 2.02) should be consulted for the proper troubleshooting procedures.

**4.03** Single station-reported troubles are those where only one station has reported a trouble or more than one station has reported troubles which are not similar in nature. Multiple station-reported troubles are those where more than one station has reported trouble and the troubles are of the same nature.



***When only one station reports trouble (especially at a low-traffic hour), the possibility that it is the first of a multiple station-reported trouble must***

***be considered. In this case, call two or three similar stations served by some common equipment or the STC serving that station and determine whether any other stations are having similar problems.***

**4.04** An access trouble is indicated when a station places a call and does not receive answer-back from the computer, camp-on signal from the concentrator, or dial tone from the CO (local stations associated with 10B concentrator having access to the DDD network in one trunk group). A transmission trouble is indicated by reception of distorted (garbled) data at the station.

**4.05** When a trouble report is received from the computer center, the CSTC must perform the trouble report analysis and maintenance activities prescribed for the STC in Part 3 of this section prior to performing the CSTC procedures. If the trouble report is received from an STC, the STC will have already performed the procedures in Part 3 of this section.

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**4.06** When the trouble report is first received, careful analysis of the questions given in Table A should make it easy to determine which link of the DLCS is in trouble, thereby indicating where to start troubleshooting. When the trouble is obviously a single station trouble and the local tests prove good per Table A, maintenance should commence in Part 4B. When the report involves multiple station-reported troubles, maintenance should commence with Part 4C.

**4.07** When a faulty unit is located, replace it with a unit that is known to be operating properly and repeat the test. If the replacement unit *meets* the test requirements, request the customer to verify that service is restored by requesting service to the computer (access troubles) or exchanging data with the computer (transmission troubles). If not, request help from the immediate supervisor.

**4.08** If the customer can satisfactorily gain access to and/or exchange data with the computer,

return the station to service. If not, proceed as outlined in the troubleshooting flowchart.

**B. Single Station-Reported Troubles**

**4.09** When the trouble report indicates that only one station is involved and the local tests prove good per Table A, commence troubleshooting in accordance with the type station reporting the trouble and the nature of the trouble.

**Local Station (Fig. 2, 3, 4, and 5)**

**4.10** When a local station reports access trouble on all calls, it indicates a faulty station data set, transmission facility (line loop), or concentrator line circuit. In this case, commence troubleshooting on Fig. 2 as follows.

- (1) Dispatch, a TELCo employee to the station to perform tests in accordance with the

**TABLE B  
REMOTE STATION OUTPUT FOR SERVICE REQUEST**

TYPE STATION	OUTPUT SIGNAL
Remote PL equipped with Data Set 108A-type	2225 Hz
Remote PL equipped with Data Set 108C-type	1270 Hz
Remote PL equipped with Data Set 109-type	4 volts
Remote Multiplexed ----- Channel 21	750 Hz
22	1090 Hz
23	1430 Hz
24	1770 Hz
25	2110 Hz
26	2450 Hz
27	2790 Hz
28	3130 Hz

appropriate station maintenance and test BSPs (see 2.02).

- (2) If the station **fails to meet** the test requirements, replace the faulty unit and repeat the test.
- (3) If the station **meets** the test requirements, dispatch a TELCo employee to the associated concentrator to perform the Local Station Loop Continuity Test (Test A).
- (4) If the transmission facility **fails to meet** the test requirements, repair or replace the transmission facility and repeat Test A.
- (5) If the transmission facility **meets** the test requirements, perform the Concentrator Line Circuit Test (Test B).
- (6) If the line circuit **fails to meet** the test requirements, ensure the other line associated with the circuit pack is idle, replace the line circuit with one that is known to be operating properly, and repeat Test B.
- (7) If the line circuit **meets** the test requirements, test the associated concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (8) If the faulty unit can be located, replace it and repeat the test.

**4.11** When a local station reports transmission trouble on all calls, it indicates faulty station terminal equipment, noisy station data set, or noisy transmission facility. In this case, commence troubleshooting on Fig. 3 as follows.

- (1) Determine whether the loop is arranged to operate in the half-duplex (HDX) or full-duplex (FDX) mode.
- (2) If the loop is arranged for FDX operation, dispatch a TELCo employee to the associated concentrator to perform the FDX Station Loop-Back Test (Test C).
- (3) If the station is arranged for HDX operation or the FDX loop **fails to meet** the test requirements for Test C, dispatch TELCo employees

to both the station and the associated concentrator to perform the Station-to-Concentrator Distortion Test (Test D).

- (4) If the loop **fails to meet** the test requirements for Test D, test the station and concentrator in accordance with the appropriate maintenance and test BSPs (Refer to 2.02).
- (5) If the loop **meets** the test requirements for Test C and/or D, determine whether station uses a CPT or Bell System-provided TTY.
- (6) If the station uses a CPT, refer the trouble to the customer for further action.
- (7) If the station uses a TTY, test the terminal equipment in accordance with the appropriate 574-layer TTY BSP.
- (8) If the faulty unit **is** located, replace or repair it and have the customer verify that service has been restored by exchanging data with the computer.
- (9) If the faulty unit cannot be located or has been repaired and replaced and service is still not restored, perform the Computer Port-to-Station Loop-Back Test (Test L) for FDX stations or Computer Port-to-Station End-to-End Test (Test M) for HDX stations.
- (10) If the loop **meets** the requirements for Test L or M, refer the trouble to the customer. If not, request help from immediate supervisor.

**4.12** When a local station reports access trouble on occasional calls, it indicates a faulty ferreed switch in the concentrator or possibly an intermittent problem in the line circuit, data set, or TTY. In this case, verify that all connections at the station and concentrator are secure. If the trouble is not located in this manner continue troubleshooting on Fig. 4 as follows.



***A single station-reported access trouble on occasional calls (especially during nonbusy hours) may be the first call of a multiple station-reported trouble.***

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- (1) Dispatch a TELCo employee to the associated concentrator to test the concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (2) If the faulty ferreed switch *is* located, replace the line and switch module data mounting (18A1, 19A1, or 20A1) with one that is known to be operating properly.
- (3) Using the Data Auxiliary Set (DAS) 803E1 (provided with the concentrator), force a connection between the station and the trunk associated with the replacement ferreed switch.

**4.13** When a local station reports transmission trouble on occasional calls, it may indicate:

- (a) Distortion in that link is high enough that some trunks combined with it exceeds the limits.
- (b) The transmission facility (line loop), station data set, and/or station terminal equipment is located near some equipment (ie, motor generator, electric motor, etc) which is inducing noise onto the line.
- (c) The customer-provided ac outlet which powers the station is on the same line as other heavy equipment (ie, elevator, motor generator, etc).

In this case, commence troubleshooting on Fig. 5 as follows.



***A single station-reported transmission trouble on occasional calls (especially during nonbusy hours) may be the first call of a multiple station-reported trouble.***

- (1) Determine whether station is arranged for HDX or FDX operation.
- (2) If FDX, dispatch a TELCo employee to the serving concentrator and perform Test C.
- (3) If HDX or the FDX station *meets* the requirements of Test C, dispatch TELCo employees to both the station and the serving concentrator and perform Test D.
- (4) If the station *meets* the requirements of Test D, check the routing of the transmission facility.  
**Note:** Ensure that the transmission facility is not routed in a manner that could allow some sort of equipment [see 4.13 (b)] to induce noise or voltage spikes to be induced onto the line.
- (5) If the transmission facility *is not* routed in a manner that could allow some sort of equipment to induce noise onto the line, determine whether the station is equipped with a CPT or TTY. If equipped with a CPT, refer the trouble to the customer for further action.
- (6) If the transmission facility *is* routed in a manner that could allow some equipment to induce noise onto the line, reroute, replace, or shield the transmission facility.
- (7) Have the customer verify that service has been restored by exchanging data with the computer while all of the equipment suspected of inducing the noise onto the line is operating.
- (8) If the terminal equipment is a TTY, dispatch a TELCo employee to the station to determine whether the station is located where some equipment could induce noise onto the line.
- (9) If the station *is* located where some equipment could induce noise onto the line, relocate or shield the station.
- (10) Have the customer verify that service has been restored by exchanging data with the computer while the equipment suspected of inducing the noise onto the line is operating.
- (11) Verify that no other equipment which may cause voltage drops or surges is on the same ac power line as the station.
- (12) If any equipment which may cause voltage drops or surges *is* on the same ac power line as the station, relocate the station so that it may be powered by an individual ac power line.

**Note:** At installations where relocation of the station is not feasible, a voltage regulator may be required for the ac line that powers the station.

- (13) Have the customer verify that service has been restored by exchanging data with the computer while the equipment suspected of affecting the ac line is operating.

#### Local Station on Tandem Concentrator

**4.14** Local stations which are served by a tandem concentrator should be maintained in the same manner as local stations which are served by the primary concentrator (see 4.08 through 4.11).

#### Remote PL Station (Fig. 6 and 7)

**4.15** When a remote PL station reports an access trouble on all calls, it indicates a faulty station data set, transmission facility, hub data set, interconnection arrangement, or concentrator line circuit. In this case, troubleshooting should commence on Fig. 6 as follows.

**Note:** If access to a testboard is available, that testing should be performed **prior** to performing the following procedures.

- (1) Dispatch a TELCo employee to the station to test the station in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (2) If the station **meets** the test requirements, determine whether the station loop is hubbed.
- (3) If the station loop **is** hubbed, have the hub data set tested.
- (4) If the loop is not hubbed, dispatch a TELCo employee to the concentrator to test the PL interconnection arrangement in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (5) If the interconnection arrangement **meets** the test requirements, perform the Concentrator Line Circuit Test (Test B).

- (6) If the concentrator line circuit **meets** the requirements of Test B, test the associated concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).

**4.16** When a remote PL station reports transmission trouble on all calls, it indicates faulty station terminal equipment, noisy station data set, noisy transmission facility (line loop), noisy interconnection arrangement data set, or (if line loop is hubbed) noisy hub data set. In this case, troubleshooting should commence on Fig. 7 as follows.

- (1) Determine whether the station is arranged for FDX or HDX operation.
- (2) If the station is arranged for FDX operation, perform a Loop-Back Test between the STC and the station.
- (3) If the station is arranged for HDX operation or the FDX station **fails to meet** the test requirements for the STC Loop-Back Test, dispatch a TELCo employee to the station to perform an End-to-End Test with the STC.
- (4) If the station **fails to meet** the test requirements for the STC End-to-End Test, test the station in accordance with the appropriate maintenance and test BSPs (refer to 2.02).
- (5) If the station loop and station **have met** all of the previous test requirements, determine whether the line loop is hubbed.
- (6) If the line loop is hubbed, test the hub data set.
- (7) If the line loop is **not** hubbed, dispatch a TELCo employee to the associated concentrator to test the PL interconnection arrangement per the appropriate maintenance and test BSPs (see 2.02).
- (8) If the PL interconnection arrangement meets the test requirements, determine whether the loop is arranged for HDX or FDX operation.
- (9) If the loop is arranged for FDX operation, perform the FDX Station Loop-Back Test (Test C).

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- (10) If the loop *fails to meet* the test requirements for Test C or is arranged for HDX operation, dispatch a TELCo employee to the station to perform the Station-to-Concentrator Test (Test D).
- (11) If the loop *fails to meet* the test requirements for Test D test the station and concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (12) If the loop *meets* the test requirements for Test D, determine whether the station uses a CPT or TTY.
- (13) If the station uses a CPT, refer trouble to the customer for further action.
- (14) If the station uses a TTY, test the terminal equipment in accordance with the appropriate 574-layer TTY BSP.
- (15) If the faulty unit cannot be located or has been repaired or replaced and service is still not restored, perform the Computer Port-to-Station Loop-Back Test (Test L) for FDX stations or the Computer Port-to-Station End-to-End Test (Test M) for HDX stations.
- (16) If the loop *meets* the requirements for Test L or M, refer the trouble to the customer. If not, request help from immediate supervisor.

**4.17** When a remote PL station reports access trouble on occasional calls, it should be handled in the same manner as a local station-reported trouble (see 4.10 and Fig. 4).

**4.18** When a remote PL station reports transmission trouble on occasional calls, it should be handled in the same manner as a local station-reported trouble (see 4.11 and Fig. 5).

### Remote PL Station on Tandem Concentrator

**4.19** Remote PL stations which are served by a tandem concentrator should be maintained in the same manner as those served by a primary concentrator (see 4.13 through 4.16).

### DDD-In Station

**4.20** When only one DATA-PHONE station using the DDD network reports access or transmission trouble on all calls, it indicates a DATA-PHONE service problem with the station. In this case, perform tests in accordance with the appropriate DATA-PHONE station maintenance and test BSPs.

**4.21** When a DATA-PHONE station reports access or transmission trouble on occasional calls, it indicates a faulty transmission facility in the DDD network. In this case, have the CO TELCo employees at the central office(s) involved test the various routing paths available to the station reporting the trouble. It is recommended that the CSTC maintain control of coordinating the efforts of the CO personnel.

### Remote Station Which Accesses a Concentrator via a 1A Data Station Link (Fig. 8)

**4.22** When a remote station which accesses a concentrator via a 1A Data Station link reports access trouble on all calls, it indicates a faulty 1A Data Station channel, concentrator line circuit, or station terminal equipment. In this case, troubleshooting should commence on Fig. 8 as follows.

- (1) Determine whether the station terminal equipment is a CPT or Bell System-provided TTY.
- (2) If the terminal equipment is a *TTY*, dispatch a TELCo employee to the station to test the TTY in accordance with the appropriate 574-layer TTY BSP.
- (3) If the terminal equipment is a CPT or a TTY which meets the test requirements of the 574-layer TTY BSP, dispatch a TELCo employee to the concentrator to test the 1A Data Station channel in accordance with the appropriate maintenance and test BSPs (see 2.02).

**Note:** If Step (3) was arrived at directly from Step (1), it will be necessary to dispatch a TELCo employee to the station location also.

- (4) If 1A Data Station *meets* the test requirements, perform Test B on the concentrator line circuit associated with the station in trouble.

**Note:** The TELCo employee dispatched at the station may now be recalled.

- (5) If the line circuit *meets* the requirements of Test B, test the concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).

**4.23** When a station which accesses a concentrator via a 1A Data Station link reports transmission trouble on all calls, it indicates a faulty 1A Data Station channel. In this case, troubleshooting should be in accordance with the appropriate maintenance and test BSPs (see 2.02).

**4.24** When a station which accesses a concentrator via a 1A Data Station link reports access trouble on occasional calls, it indicates a faulty ferreed switch contact in the concentrator. In this case, troubleshooting is the same as for a local station (see 4.10 and Fig. 4).

**4.25** When a station which accesses a concentrator via a 1A Data Station link reports transmission trouble on occasional calls, it indicates that the 3002 transmission facility, station-end 1A Data Station, concentrator-end 1A Data Station, or station terminal equipment is located near some equipment which may be inducing noise onto the circuit. In this case, commence troubleshooting on Fig. 9 as follows.

**Note:** It is also possible that the station-end 1A Data Station, station terminal equipment, and/or concentrator-end 1A Data Station are powered from the same customer-provided ac power line as some other equipment (ie, elevator, motor generator, etc). This could make the ac line voltage vary, thereby causing the station to garble data.



***A single station-reported transmission trouble on occasional calls (especially during nonbusy hours) may be the first call of a multiple station-reported trouble.***

- (1) Dispatch a TELCo employee to the serving concentrator to determine whether the concentrator-end 1A Data Station is located near any noise-inducing equipment.

- (2) If the concentrator-end 1A Data Station *is* located near noise-inducing equipment, relocate or shield the 1A Data Station.

- (3) If concentrator-end 1A Data Station is not located near any noise-inducing equipment or service is not restored after it has been relocated or shielded, verify that no other equipment which may cause voltage drops or surges is on the same ac power line as the concentrator-end 1A Data Station.

- (4) If other equipment *is* on the same ac power line as the concentrator-end 1A Data Station, relocate the 1A Data Station so that it may be powered by an individual ac power line.

**Note:** At installations where relocation of the concentrator-end 1A Data Station is not feasible, a voltage regulator may be required on the line which powers the 1A Data Station.

- (5) If no other equipment is on the same line as the concentrator-end 1A Data Station or service is not restored after it is provided with an individual ac power line, dispatch a TELCo employee to the station to determine whether the 1A Data Station at that end is located close to any noise-inducing equipment.

- (6) If the station-end 1A Data Station *is* located near noise-inducing equipment, relocate or shield the 1A Data Station.

- (7) If the station-end 1A Data Station is not near any noise-inducing equipment, verify that no other equipment which may cause voltage drops or surges is on the same ac power line as the station-end 1A Data Station.

- (8) If the station-end 1A Data Station *is* on the same ac power line as any equipment that may be causing voltage drops or surges, relocate the 1A Data Station so that it may be powered by an individual ac power line.

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**Note:** At installations where relocation of the 1A Data Station is not feasible, a voltage regulator may be required for the ac line which powers these units.

- (9) If no other equipment is on the same ac line as the station-end 1A Data Station, determine whether the station terminal equipment is a CPT or a TTY.
- (10) If the terminal equipment is a CPT, refer the trouble to the customer for further action.
- (11) If the terminal equipment is a TTY, verify that the TTY is not located near any equipment that could induce noise onto the circuit.
- (12) If the TTY *is* located near any noise-inducing equipment, relocate or shield the TTY.
- (13) If TTY is not located near noise-inducing equipment or service is not restored when TTY is relocated or shielded, verify that no equipment which could cause voltage drops or surges is on the same ac power line as the TTY.
- (14) If other equipment *is* on the same line, relocate the TTY so that it may be powered by an individual power line.

**Note:** At installations where relocation of the TTY is not feasible, a voltage regulator may be required for the ac line which powers the TTY.

### C. Multiple Station-Reported Access Troubles

**4.26** When more than one station has reported the same type of trouble, compare the trouble reports to determine whether:

- (a) It is access or transmission trouble.
- (b) The trouble occurs on all calls or only on occasional calls.
- (c) All the stations are of the same type (eg, local stations, remote PL stations, etc).

- (d) All of the stations are served by the primary concentrator, some stations are served by the primary concentrator and some are served by a tandem concentrator, or all of the stations are served by a tandem concentrator.

### All Reports From Stations Served by Primary Concentrator (Fig. 10)

**4.27** When all of the stations are being served by the primary concentrator, it indicates the following.

- (a) Trouble on all calls—A faulty trunk-side multiple data set arrangement, 1A Data Station, or interconnection arrangement.

**Note:** If all of the reporting stations are of the same type (eg, remote PL, multiplexed, or DATA-PHONE stations), a faulty line-side interconnection arrangement or 1A Data Station is indicated.

- (b) Trouble on occasional calls—A faulty concentrator trunk circuit, data set, or circuit pack in trunk loop, or trunk-side 1A Data Station channel.

In this case, commence troubleshooting on Fig. 10 as follows.

- (1) Determine whether trouble occurs on all calls or only occasional calls.
- (2) Dispatch a TELCo employee to the primary concentrator.
- (3) If the trouble is on all calls and all of the station *are* of the same type, test the associated interconnection arrangement in accordance with the appropriate maintenance and test BSPs (see 2.02).

**Note:** If all of the stations associated with an interconnection arrangement or 1A Data Station have reported trouble, the problem is probably caused by an ac power failure.

- (4) If the concentrator is arranged for dual access, determine if either trunk group can be accessed.

- (5) If the concentrator is a single access concentrator (10A) or dual access concentrator (10B) through which the customer *cannot* access either trunk group and the concentrator has not already been checked, test the concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (6) If the trouble only occurs on occasional calls or one trunk group of a 10B concentrator can be accessed, perform the Concentrator Trunk Circuit Test (Test K) on all trunk circuits of trunk group(s) suspected of being in trouble.
- (7) If the trunk circuits and concentrator both meet the test requirements and the trunk loops (1A Data Station, multiple data set arrangements, or DATA-PHONE interconnection arrangements) have not been checked, test the trunk loops in accordance with the appropriate maintenance and test BSPs (see 2.02).

**Some Reports From Stations Served by Primary Concentrator and Some From Stations Served by Tandem Concentrator (Fig. 11)**

**4.28** When some of the stations reporting trouble are served by the primary concentrator and some are served by a tandem concentrator, it indicates a faulty primary concentrator or trunk loop. In this case, troubleshooting should commence on Fig. 11 as follows.

**Note:** It is possible that two separate faulty units (one in the primary concentrator or trunk loop and one in the tandem concentrator or interconcentrator trunk) may be causing this type of trouble report.

- (1) Dispatch a TELCo employee to the primary concentrator.
- (2) Test the primary concentrator in accordance with the appropriate maintenance and test BSPs (listed in 2.02).
- (3) If the concentrator *meets* the test requirements, test the trunk loop in accordance with the appropriate maintenance and test BSPs (listed in 2.02).

(4) Since it is possible that the trouble is being caused by two separate faulty units, it is necessary to verify that both the stations served by the primary concentrator and the stations served by the tandem concentrator have been restored to service.

(5) If both the primary concentrator and trunk loops pass the initial test or the stations served by the primary concentrator *can* access the computer but the stations served by the tandem concentrator cannot, continue troubleshooting as described in 4.29 and Fig. 12.

**All Reports From Stations Served by a Tandem Concentrator (Fig. 12)**

**4.29** When all of the stations reporting trouble are served by a tandem concentrator, it indicates a faulty tandem concentrator, interconcentrator trunk, and/or, if all of the stations are of the same type, a faulty interconnection arrangement. In this case, commence troubleshooting on Fig. 12 as follows.

- (1) Dispatch TELCo employee to tandem concentrator.
- (2) If all of the reporting stations are of the same type (ie, remote PL, DATA-PHONE, etc), test the associated interconnection arrangement in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (3) If all reporting stations are not of the same type, test the tandem concentrator in accordance with the appropriate maintenance and test BSPs (see 2.02).
- (4) If the tandem concentrator meets the test requirements or service is not restored after replacing a faulty unit, test the interconcentrator trunks (1A Data Station) in accordance with the appropriate maintenance and test BSPs (see 2.02).

**D. Multiple Station-Reported Transmission Troubles**

**4.30** When more than one station has reported transmission trouble, compare the trouble reports in the same manner as for multiple station-reported access trouble (see 4.26). In addition,

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determine whether the trunk loops are arranged for FDX or HDX operation.



***If any station has reported transmission trouble on all calls, treat that report as a single station-reported trouble and troubleshoot in accordance with the type station as described in Part 4B.***

### All Reports From Stations Served by Primary Concentrator

**4.31** When all of the stations of a multiple station-reported transmission trouble are served by the primary concentrator, it indicates one or more faulty trunk loops. In this case, commence troubleshooting on Fig. 13A for single access (10A) concentrators or Fig. 13B for dual access (10B) concentrators as follows.

- (1) Dispatch a TELCo employee to the primary concentrator.

#### **10A Concentrator (Fig. 13A)**

- (2) If the trunk loops are arranged for FDX operation, perform the Computer Port Trunk Loop-Back Test (Test G) on all trunk loops.
- (3) If the trunk loops are arranged for HDX operation or the faulty FDX trunk loops **are not** located in Step (2), perform the Computer Port Trunk Distortion Test (Test H) on all of the trunk loops. This test requires the dispatch of a TELCo employee to the computer location.
- (4) If all of the trunk loops **meet** the requirements for Test H, refer the trouble to the customer. If not, test the faulty trunk loop(s) in accordance with the appropriate trunk loop maintenance and test BSPs (see 2.02).
- (5) If the trouble is located and cleared, return the stations to service. If not, request help from the immediate supervisor.

#### **10B Concentrator (Fig. 13B)**

- (6) If the trunk group in which the transmission trouble occurs **does not** access the DDD network, troubleshoot the system as for a 10A concentrator per Steps (2) through (5).

- (7) If the trunk group in which the transmission trouble occurs **does** access the DDD network and the trunk loops are arranged for **FDX** operation, perform the DDD-Out trunk Loop-Back Test (Test I) on all trunk loops which access the DDD network. This test requires assistance at a 904-type Data Test Center (DTC).

- (8) If the trunk group **does** access the DDD network and the trunk loops are arranged for HDX operation or the faulty FDX trunk loops **are not** located in Step (7), perform the DDD-Out Trunk Distortion Test (Test J) on all trunk loops which access the DDD network. This test requires assistance at a 904-type DTC.

- (9) If all of the trunk loops **meet** the test requirements, refer the trouble to the central office (CO).

- (10) Test the trunk loops which **do not** meet the test requirements in accordance with the appropriate maintenance and test BSPs (see 2.02). If the trouble is located and cleared, return the stations to service. If not, request help from the immediate supervisor.

### Some Reports From Stations Served by Primary Concentrator and Some From Stations Served by a Tandem Concentrator.

**4.32** When some of the stations of a multiple station-reported trouble are served by the primary concentrator and some are served by a tandem concentrator, it indicates the same type of trouble as when all reporting stations are served by the primary concentrator (4.29). However, it is also possible that two unrelated troubles may be causing the reports. In this case, troubleshooting should commence as follows.

- (1) Perform the troubleshooting procedures described in 4.31 and Fig. 13A or 13B.
- (2) If the trouble **is** cleared for the stations served by the primary concentrator but **not** cleared for those served by the tandem concentrator, perform the troubleshooting procedures described in 4.33 and Fig. 14.

### All Reports From Stations Served by a Tandem Concentrator

**4.33** When all of the stations of a multiple station-reported transmission trouble are served by a tandem concentrator, it indicates a faulty interconcentrator trunk loop. In this case, troubleshooting should commence on Fig. 14 as follows.

- (1) If the tandem concentrator has single access capabilities (10A) or dual access capabilities (10B) and the trouble *does not* occur in a trunk group which accesses the DDD network, dispatch a TELCo employee to both the primary and tandem concentrators and perform the Interconcentrator Trunks Loop-Back Test (Test E) on all interconcentrator trunks.
- (2) If the trouble *is not* located, perform the Interconcentrator Trunk Distortion Test (Test F) on all interconcentrator trunks.
- (3) If the faulty trunk is located in Steps (1) or (2), test the faulty interconcentrator trunk(s) in accordance with the appropriate maintenance and test BSPs (see 2.02). If the faulty unit is located, replace it with one that is known to be operating properly and have the customer verify that service has been restored in accordance with the above mentioned BSP.
- (4) If the tandem concentrator has dual access capabilities (10B) and the trouble *does* occur in a trunk group which accesses the DDD network, dispatch a TELCo employee to the tandem concentrator.
- (5) If the trunk loops are arranged for FDX operation, perform the DDD-Out Trunk Loop-Back Test (Test I) on all trunk loops which access the DDD network. This test requires assistance at a 904-type DTC.
- (6) If the trunk loops are arranged for HDX operation, or the faulty FDX trunk loop(s) *are not* located in Step (5), perform the DDD-Out Trunk Distortion Test (Test J) on all trunk loops which access the DDD network.
- (7) If all of the trunk loops *meet* the test requirements, refer the trouble to the CO.

- (8) Test the trunk loops which *do not* meet the test requirements in accordance with the appropriate maintenance and test BSPs (listed in 2.02). If the trouble is located and cleared, return the stations to service. If not, request help from the immediate supervisor.

## 5. SYSTEM FUNCTIONAL SEQUENCES

### A. General

**5.01** The sequence charts in this part cover the sequence of events that occur in the DLCS when a call is originated by a station and when a disconnect is initiated by a station, the computer, or the called station (10B Data Line Concentrator with DDD access in one of the trunk groups only). The charts are included here as an aid when troubleshooting the DLCS.

### B. Call Origination Sequences

#### Single Access Local Station (Fig. 15)

**5.02** In order to originate a call from a single access local station, it is necessary for the station to be in the idle mode (OFF, LINE 1, and LOCAL lamps extinguished). The station may be placed in the idle mode at any time by operation of the OFF button.

**5.03** Once the station is in the idle mode, call origination is initiated by operation of the LINE 1 button. This lights the LINE 1 lamp, starts the TTY motor, and causes the data set to place 4 volts across the line.

**5.04** The concentrator detects the 4 volts on the line and marking current flows between the concentrator and station data set.

**5.05** The concentrator sequentially scans each line for the "voltage on the loop" condition. When the concentrator detects the 4 volts on a line, it stops on that line and remains there until the line is connected to a trunk. This ensures that a station requesting service when all trunks are busy will not be denied service while another station is served twice. The concentrator now proceeds with the trunk connection sequence (5.16 through 5.19).

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### Dual Access Local Station (Fig. 16)

**5.06** In order to originate a call from a dual access local station, it is necessary for the station to be in the idle mode (OFF, LINE 1, LINE 2, and LOCAL lamps extinguished). The station may be placed in the idle mode at any time by operation of the OFF button.

**5.07** Once the station is in the idle mode, a call to trunk group A or trunk group B is initiated by operation of the LINE 1 or LINE 2 button, respectively. Operation of the LINE 1 button lights the LINE 1 lamp, starts the TTY motor, and causes the data set to place 4 volts across the line. Operation of the Line 2 button lights the LINE 2 lamp, starts the TTY motor, and also causes the data set to place 4 volts across the line. However, in this case the 4 volts will be of the opposite polarity of the voltage placed across the line when the LINE 1 button was operated.

**5.08** The concentrator detects the 4 volts on the line and marking current flows, dependent on the polarity of the voltage, in one direction or the other between the concentrator and the station data set.

**5.09** The concentrator sequentially scans each line for the voltage on the loop condition. When the concentrator detects 4 volts on a line, it stops on that line, determines from the polarity of the voltage which trunk group is being requested, and remains stopped on that line until the line is connected to a trunk in the group requested. This ensures that a station requesting service to a trunk group in which all trunks are busy will not be denied service while another station is served twice. The concentrator now proceeds with the trunk connection sequence (5.16 through 5.19).

### Remote Private Line Station (Fig. 17)

**5.10** The remote PL station must be in the idle mode before a call can be originated. In this mode the station data set sends the spacing frequency. Once the station is in the idle mode (ON, LOCAL, and OUT-OF-SERVICE lamps extinguished), call origination is initiated by operation of the ON button. When the ON lamp lights, the ON button may be released.

**5.11** This starts the TTY motor and turns on the data-terminal-ready (CD) lead to the station data set. The data set will now send marking frequency toward the PL interconnection arrangement.

**5.12** The PL interconnection arrangement detects the marking signal from the station and unsquelches the output of the concentrator line-side data set causing 4 volts to be applied across the line to the concentrator. The concentrator then proceeds as described in 5.04 and 5.05.

### DATA-PHONE Station (Fig. 18)

**5.13** Call origination is initiated at a DATA-PHONE station by placing a call, in the normal manner, to the discrete number associated with the concentrator. The DATA-PHONE interconnection arrangement line-side data set automatically answers the call and the interconnection arrangement unsquelches the output of the concentrator-side data set. The concentrator-side data set now places 4 volts across the line to the concentrator and the concentrator proceeds as described in 5.04 and 5.05.

**5.14** If for some reason there is no current flow between the concentrator and the concentrator-side data set within 2.5 seconds, the interconnection arrangement will initiate a station disconnect as described in 5.38. This would be considered a trouble condition.

### Remote Data Terminals Which Access a Concentrator via a 1A Data Station Link (Fig. 19)

**5.15** Call origination is initiated at remote data terminals which access a concentrator via a 1A Data Station link by operation of a button on the terminal equipment. This turns on the data-terminal-ready (CD) lead and the TTY motor. The terminal 1A Data Station will now send the marking frequency to the concentrator. The line-side 1A Data Station detects the marking frequency and places 4 volts across the line to the concentrator. Current now flows between the concentrator and the line-side 1A Data Station, the concentrator proceeds as described in 5.04 and 5.05, and the line-side 1A Data Station sends the marking frequency to the terminal 1A Data Station.

**Trunk Circuit Connection (Fig. 20)**

**5.16** In the single access DLCS, there is only one group of trunks to which a station requesting service may be connected and all calls will be directed to these trunks. However, in the dual access DLCS, there are two trunk groups (trunk group A and trunk group B). In this case calls from local stations equipped for dual access will be directed to either trunk group A or trunk group B in accordance with which group is requested. Calls from single access local stations, remote PL and DATA-PHONE stations, remote terminals which access the concentrator via a 1A Data Station link, and stations which access the concentrator via a tandem concentrator are always directed to the same trunk group. For the sake of simplicity in the trunk circuit connection sequence which follows, the trunks of the single access DLCS will be considered to be trunk group A.

**5.17** Once the concentrator is stopped on a line requesting service, it will attempt to connect that line to a trunk. At this time either of two conditions may exist. They are the "all trunks in-group-requested busy" condition and the "trunk in-group-requested idle" condition.

**5.18** If all trunks in the group requested are busy (or out of service), the concentrator continues to search for an idle trunk and the camp-on signal is sent to the station. The camp-on signal can be recognized at the station by the fact that the station receiver selects a delete character every 3 seconds. (TTY Stations) or the CAMP-ON lamp flashes (CPT Stations). The camp-on signal will continue to be sent to the station as long as the station remains connected to the line and the "all trunks in-group-requested busy" condition exists.

**5.19** If a trunk in the group requested is idle or as soon as one becomes idle, the concentrator stops on that trunk and then connects it to the line. The concentrator then proceeds to scan the lines and trunks in search of another service request and another idle trunk. The trunk is connected to the computer port as described in 5.22 (trunk-side multiple data set arrangement), 5.23 and 5.24 (trunk-side 1A Data Station), or 5.25 (trunk-side DATA-PHONE interconnection arrangement—dual access DLCS only).

**Tandem Concentrators: Interconcentrator Trunk Connection (Fig. 21)**

**5.20** At installations where two concentrators are connected in tandem, the 1A Data Station will be used to provide the interconcentrator trunks. The tandem concentrator may be used to serve remote PL stations, and/or remote data terminals which access the tandem concentrator via a 1A Data Station link, and/or stations which appear to the tandem concentrator as local stations. In no case can the tandem concentrator be used to serve a remote DATA-PHONE station.

**5.21** When a station which accesses the tandem concentrator places a call, the tandem concentrator connects the line to an idle interconcentrator trunk in the same manner as previously described for that type station and current flows between the tandem concentrator line-side data set and the tandem concentrator trunk 1A Data Station. The trunk 1A Data Station detects the current flow in the loop and sends the marking frequency to the primary concentrator line-side 1A Data Station. The line 1A Data Station detects the marking frequency, applies 4 volts to the primary concentrator line, and sends the marking frequency to the tandem concentrator trunk 1A Data Station. The primary concentrator detects the 4 volts and stops on that line, current flows between the concentrator and the line 1A Data Station, and the concentrator connects the interconcentrator trunk to a trunk as described in 5.16 through 5.19.

**Trunk-Side Multiple Data Set Arrangement Connection (Fig. 22)**

**5.22** When the line is connected through to the trunk, current flows between the multiple arrangement data set and the line loop data set. Approximately 15 milliseconds later the multiple arrangement data set turns on lead CC. The computer should wait approximately one second, then send an answer-back signal to the station. The system is now ready for data exchange.

**Trunk-Side 1A Data Station Connection (Fig. 23)**

**5.23** When the line is connected through to the trunk, current flows between the line loop and the concentrator-end trunk-side 1A Data Station. This causes the 1A Data Station to stop sending

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the center frequency and begin sending the mark frequency.

**5.24** The computer port 1A Data Station detects the mark frequency and, approximately 15 milliseconds later, turns on lead CC. Approximately one second later the computer sends an answer-back character. The system is now ready for data exchange.

### **Trunk-Side DATA-PHONE Interconnection Arrangement [Dual Access DLCS Only (Fig. 24)]**

**5.25** When the line is connected through to the trunk, current flows between the trunk DATA-PHONE interconnection arrangement and the line loop data set. The DATA-PHONE interconnection arrangement then seizes a line to the CO. When connection is made, the CO sends dial tone to the DLCS station. Upon reception of the dial tone, the station attendant may dial the number of the station for which he has traffic. The CO then connects the call to the called station which answers and sends a tone to the DLCS station. Reception of this tone at the DLCS station indicates that the connection sequence is complete and that the system is ready for data exchange.

## **C. Disconnect Sequences**

### **Single Access or Dual Access Local Station (Fig. 25)**

**5.26** A local station (single or dual access) disconnect can be initiated by either the station, the computer, or called DATA-PHONE station (dual access only).

**5.27** A station-initiated disconnect may be originated manually by operating the OFF button on the station TTY or CPT. This releases the LINE 1 (or LINE 2—dual access station only) button and extinguishes the LINE 1 (or LINE 2—dual access only) lamp. The data set now removes the 4 volts from the line and the loop current drops to zero. The station is now in the idle mode. The trunk disconnects as described in 5.54 and the trunk-side multiple data set arrangement, 1A Data Station, or trunk DATA-PHONE interconnection arrangement (dual access only) disconnect as described in 5.42, 5.44, or 5.48, respectively.

**5.28** A computer-initiated or called DATA-PHONE station (dual access only) disconnect is originated by the computer turning off the CD lead or called DATA-PHONE station (dual access only) turning off, respectively. In this case, the trunk-side multiple data set arrangement, 1A Data Station, or DATA-PHONE interconnection arrangement (dual access only) disconnect as described in 5.43, 5.45 through 5.47 or 5.49, respectively. The trunk disconnects as described in 5.55 and the station is denied service by the concentrator until a new request for service has been generated. This is accomplished by operation of the OFF button, which in turn releases the LINE 1 (or LINE 2—dual access only) lamp. The data set now removes the 4 volts from the line and the line loop current drops to zero. Both the station and line are now idle and a new call may be originated.

**5.29** If the local station is equipped with the optional end-of-transmission (EOT) character disconnect feature, an EOT sent by either the station, computer, or called DATA-PHONE station (dual access only) causes the OFF lamp to light. The data set now removes the 4 volts from the line and the loop current drops to zero. The trunk-side multiple data set arrangement, 1A Data Station, or trunk DATA-PHONE interconnection arrangement (dual access only) disconnect as described in 5.42, 5.44, or 5.48, respectively. In order to originate another call, it is necessary to restore the station to the idle mode. This is accomplished by operating the OFF button. Operation of the OFF button restores the LINE 1 (or LINE 2—dual access only) button, extinguishes the LINE 1 (or LINE 2—dual access only) lamp, and extinguishes the OFF lamp. The station is now in the idle mode.

### **Remote PL Station (Fig. 26)**

**5.30** As for the local station, the remote PL station disconnect may be initiated by either the station or the computer.

**5.31** A station-initiated disconnect may be originated manually by operation of the OFF button on the TTY. This extinguishes the ON lamp and turns off the CD lead to the data set. The data set now sends the space frequency to the concentrator. After approximately 1.5 seconds, the PL interconnection arrangement squelches the output of the concentrator

side data set. The concentrator-side data set removes the 4 volts from the line and the loop current drops to zero. The station is now in the idle mode. The trunk disconnects as described in 5.54 and the trunk-side multiple data set arrangement or 1A Data Station disconnect as described in 5.42 or 5.44, respectively.

**5.32** A computer-initiated disconnect is originated by the computer turning off the CD lead. In this case, the trunk-side multiple data set arrangement or 1A Data Station disconnect as described in 5.43 or 5.45 through 5.47, respectively. The trunk disconnects as described in 5.55 and the station is denied service by the concentrator until a new service request is generated. This is accomplished by operating the OFF button on the TTY. Operating the OFF button extinguishes the ON lamp and turns off the CD lead. The data set now sends the space signal and approximately 1.5 seconds later, the PL interconnection arrangement squelches the output of the concentrator-side data set. The concentrator-side data set then removes the 4 volts from the line and the loop current drops to zero. At this time the station and line are in the idle mode and a new call may be originated.

**5.33** A disconnect is also initiated when an EOT is sent by either the station or the computer. Detection of the EOT by the station causes the station to disconnect in the same manner as when manually disconnected (5.31).

#### **DATA-PHONE Station (Fig. 27)**

**5.34** As for the local and remote PL stations, a DATA-PHONE station disconnect may be initiated by either the station or the computer. The EOT disconnect is provided in the DATA-PHONE interconnection arrangement if the DATA-PHONE station is equipped with the EOT disconnect option.

**5.35** A station-initiated disconnect is originated by operation of the CLEAR key or receipt of EOT if the station is equipped with the EOT disconnect option. This causes the station data set to send a long space and disconnect from the line. The line-side data set in the DATA-PHONE interconnection arrangement detects the long space and also disconnects from the line. The station is now in the idle mode.

**5.36** The interconnection arrangement squelches the output of the concentrator-side data set and the loop current drops to zero. The trunk disconnects as described in 5.54 and trunk-side multiple data set arrangement or 1A Data Station disconnect as described in 5.42 or 5.44, respectively.

**5.37** A computer-initiated disconnect is originated by the computer turning off the CD lead. In this case, the trunk-side multiple data set arrangement or 1A Data Station disconnect as described in 5.43 or 5.45 through 5.47, respectively. The trunk disconnects as described in 5.55.

**5.38** The DATA-PHONE interconnection arrangement concentrator-side data set detects the loss of loop current and turns off the receive supervision (RS) lead. This causes the interconnection arrangement line-side data set to send a long space and disconnect from the line. The station detects the lone space and also disconnects from the line, thereby assuming the idle mode. In addition, the line is placed in the idle mode as described in 5.36.

#### **Line-Side 1A Data Station Disconnect (Fig. 28)**

**5.39** The disconnect of a line-side 1A Data Station serving a remote data terminal is initiated by turning off the terminal equipment. This turns off the CD lead to the terminal 1A Data Station.

**5.40** The terminal 1A Data Station stops sending the mark frequency and starts sending the center frequency. If the center frequency persists for 30 milliseconds, the primary concentrator line-side 1A Data Station removes the 4 volts from the line.

**5.41** The removal of the 4 volts from the line causes the loop current to drop to zero. The trunk disconnects as described in 5.54 and the trunk-side multiple data set arrangement or 1A Data Station disconnect as described in 5.42 or 5.44, respectively.

#### **Trunk Multiple Data Set Arrangement Disconnect (Fig. 29)**

**5.42** On a station-initiated or EOT disconnect, the data set in the trunk-side multiple data set arrangement detects the loss of loop current, turns off the CC lead to the computer and the lamp on the faceplate of the data set lights 15

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milliseconds later. The computer port should now assume the idle mode.

**5.43** On computer-initiated disconnects, the computer should turn off the CD lead to the multiple data set arrangement data set for a minimum of 100 milliseconds. The trunk circuit will disconnect as described in 5.55. The output of the multiple data set arrangement data set is squelched as soon as CD goes low. The multiple arrangement data set turns off the CC lead and the lamp on the faceplate lights 15 milliseconds later. When the computer turns the CD lead on again, the output of the multiple arrangement data set is unsquelched and the computer port should be in the idle mode and ready for the next service connection.

### Trunk-Side 1A Data Station Disconnect (Fig. 30)

**5.44** On station-initiated or EOT disconnects, removal of the 4 volts from the line causes no current to flow between the line loop and the trunk 1A Data Station. The trunk 1A Data Station now stops sending the mark frequency and starts sending the center frequency. If the center frequency persists for 30 milliseconds, the computer 1A Data Station turns off the CC lead and the computer port assumes the idle mode.

**5.45** On computer-initiated disconnects, the computer turns off the CD lead for a minimum of 115 milliseconds. This causes the computer 1A Data Station to stop sending the mark frequency and begin sending the center frequency. If the center frequency persists for 30 milliseconds, current ceases to flow between the trunk 1A Data Station and the concentrator line loop.

**5.46** The loss of current causes the trunk circuit to disconnect as described in 5.55. The trunk 1A Data Station stops sending the mark frequency and starts sending the center frequency. If the center frequency persists for 30 milliseconds, the computer 1A Data Station turns off the CC lead to the computer. The computer port should now assume the idle mode.

**5.47** When the computer turns on the CD lead again, the computer 1A Data Station stops sending the center frequency and starts sending the mark frequency. If the mark frequency persists

for 15 milliseconds, the trunk 1A Data Station places 4 volts on the trunk. The concentrator recognizes this condition as the trunk idle mode and the trunk is ready for the next service connection.

### Trunk DATA-PHONE Interconnection Arrangement Disconnect (Dual Access Only)

**5.48** On DLCS station-initiated or EOT disconnects, the current between the line loop data set and the trunk DATA-PHONE interconnection arrangement drops to zero. In 3 seconds the DATA-PHONE interconnection arrangement disconnects from the CO and removes the 4 volts from the trunk. Approximately 2 seconds later, the DATA-PHONE interconnection arrangement reapplies the 4 volts to the trunk. The trunk and DATA-PHONE interconnection arrangement are now in the idle mode and ready for a new service request.

**5.49** On called DATA-PHONE station-initiated disconnects, the called station disconnects from the line in the normal manner. In 1.5 seconds the DATA-PHONE interconnection arrangement disconnects from the CO and removes the 4 volts from the trunk. Approximately 2 seconds later the DATA-PHONE interconnection arrangement reapplies the 4 volts to the trunk. The trunk and DATA-PHONE interconnection arrangement are now in the idle mode and ready for a new service request.

### Interconcentrator Trunk Disconnect (Fig. 32)

**5.50** On station-initiated or EOT disconnects, the current between the tandem concentrator line-side data set and the trunk 1A Data Station drops to zero. The trunk 1A Data Station stops sending the marking frequency and starts sending the center frequency.

**5.51** Detection of the center frequency causes the primary concentrator line-side 1A Data Station to remove the 4 volts from the line and send the center frequency toward the tandem concentrator trunk 1A Data Station.

**5.52** The trunk 1A Data Station then removes the 4 volts from the trunk. This ensures that this interconcentrator trunk is not selected

again until the remainder of the disconnect sequence is completed. After a specific time interval, the trunk 1A Data Station again applies the 4 volts to the tandem concentrator trunk indicating that this interconcentrator trunk is idle.

**5.53** On computer-initiated disconnects, the current between the primary concentrator line 1A Data Station and the trunk data set drops to zero. Detection of this causes the line 1A Data Station to send the center frequency to the tandem concentrator trunk 1A Data Station, which in turn starts sending the center frequency to the line 1A Data Station. Reception of the center frequency causes the line 1A Data Station to remove the 4 volts from the primary concentrator line. The remainder of the disconnect sequence is the same as described in 5.52.

#### **Trunk Circuit Disconnect (Fig. 33)**

**5.54** On station-initiated or EOT disconnects, the concentrator detects the loss of line loop current and 75 milliseconds later, disconnects the trunk. Both the line and trunk are now idle.

**5.55** On computer-initiated disconnects, the concentrator detects the loss of trunk loop current and disconnects the trunk. If the line is serving a local station or remote PL station, the request for service will still be present at the line circuit and the line will be connected to a low impedance bridge. The concentrator denies that station service until a new request for service is originated as described in 5.02 through 5.05 for single access local stations, 5.06 through 5.09 for dual access local stations, or 5.10 through 5.12 for remote PL stations.

#### **D. Making Computer Port Appear Busy**

**5.56** When a computer port is connected to the concentrator via the multiple data set arrangement, it can be made to appear busy to the concentrator by operation of the NORMAL-BUSY switch on the 27A1 Data Unit to the BUSY position. This opens the CD lead from the computer port to the multiple arrangement data set and the data set removes the 4 volts from the trunk. The concentrator recognizes this condition as the trunk busy mode. If all trunks are made busy, the

concentrator will generate and send camp-on signals toward any station(s) requesting service while this condition exists.

**5.57** The trunk and port are restored to the idle mode by returning the NORMAL-BUSY switch to the NORMAL position. This closes the CD lead from the computer port to the multiple arrangement data set and the data set again places 4 volts across the trunk. This condition indicates to the concentrator that the trunk is idle and available for service.

**5.58** When a computer port is connected to the concentrator via a 1A Data Station, it can be made to appear busy to the concentrator by operation of CHANNEL MODE switch associated with that port (on the Data Auxiliary Set 811G-type of the computer 1A Data Station) to the OFF position. This causes the computer 1A Data Station to send the center frequency. Detection of the center frequency causes the trunk 1A Data Station to remove the 4 volts from the trunk. The concentrator recognizes this condition as the trunk busy mode. If all channels of the 1A Data Station are made busy, the concentrator will generate and send camp-on toward any station(s) requesting service while this condition exists.

**5.59** The trunk and port are restored to the idle mode by operating the CHANNEL MODE switch to the NORM position. This causes the computer 1A Data Station to send the mark frequency. Detection of the mark frequency causes the trunk 1A Data Station to place 4 volts across the trunk. This condition indicates to the concentrator that the trunk is idle and available for service.

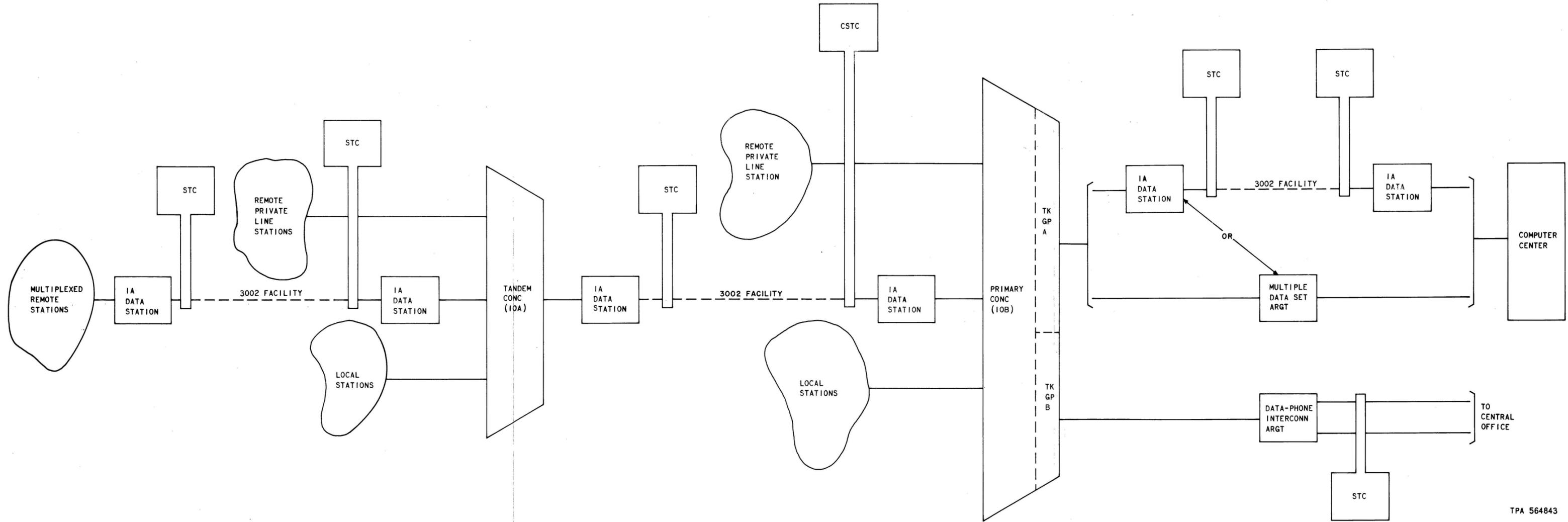
**5.60** When a concentrator trunk is connected to the DDD network via the trunk-side DATA-PHONE interconnection arrangement (dual access only), the trunk can be made to appear busy to the concentrator only when the interconnection arrangement is equipped with a key telephone set (optional). In this case, picking up the telephone set handset and operating the LINE button associated with a particular trunk will cause the interconnection arrangement to remove the 4 volts from the trunk. In addition, the line to the CO that is associated with that trunk will be seized by the telephone set. The concentrator recognizes this condition as

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the trunk busy mode and, if all trunks are busy, will send the CAMP-ON signal to any stations requesting service to that group.

interconnection arrangement to place 4 volts on the trunk. The concentrator recognizes this condition as the trunk idle mode.

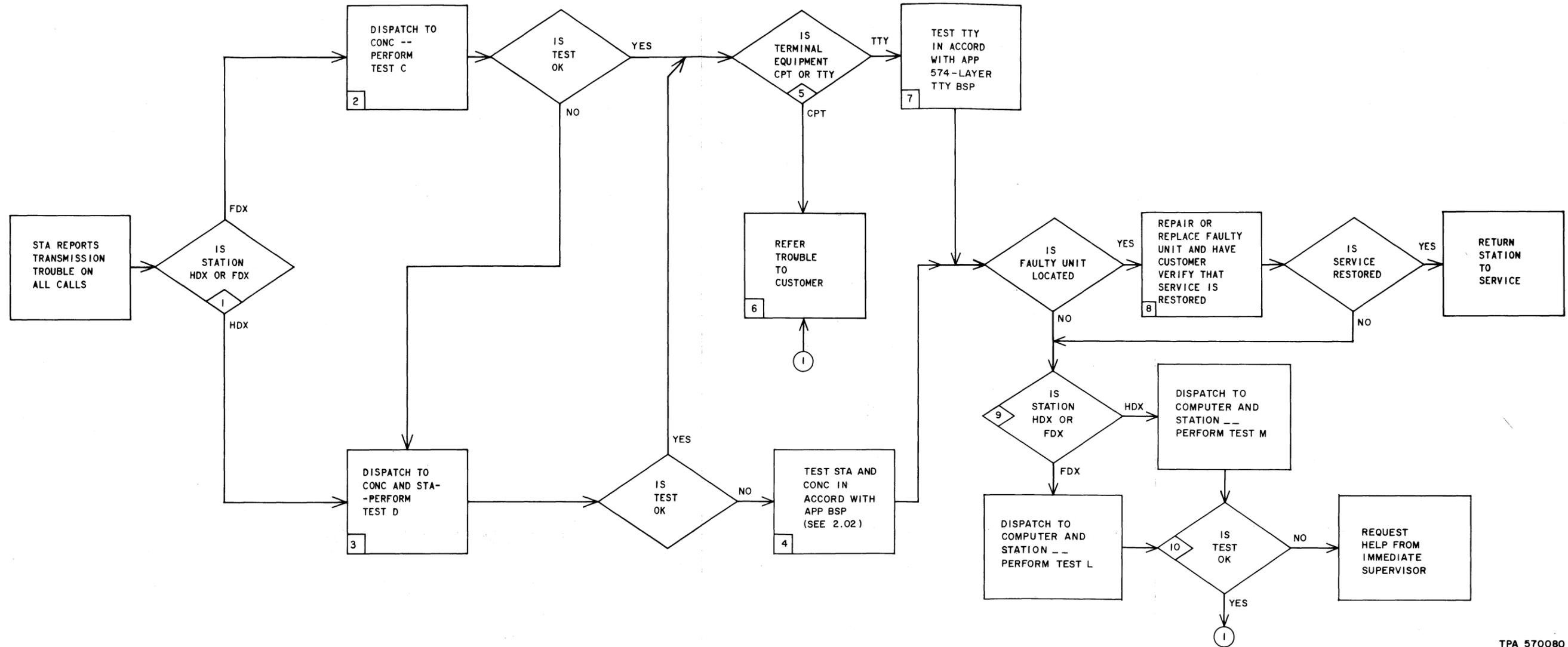
**5.61** The trunk is restored to normal by replacing the telephone set handset. This causes the



TPA 564843

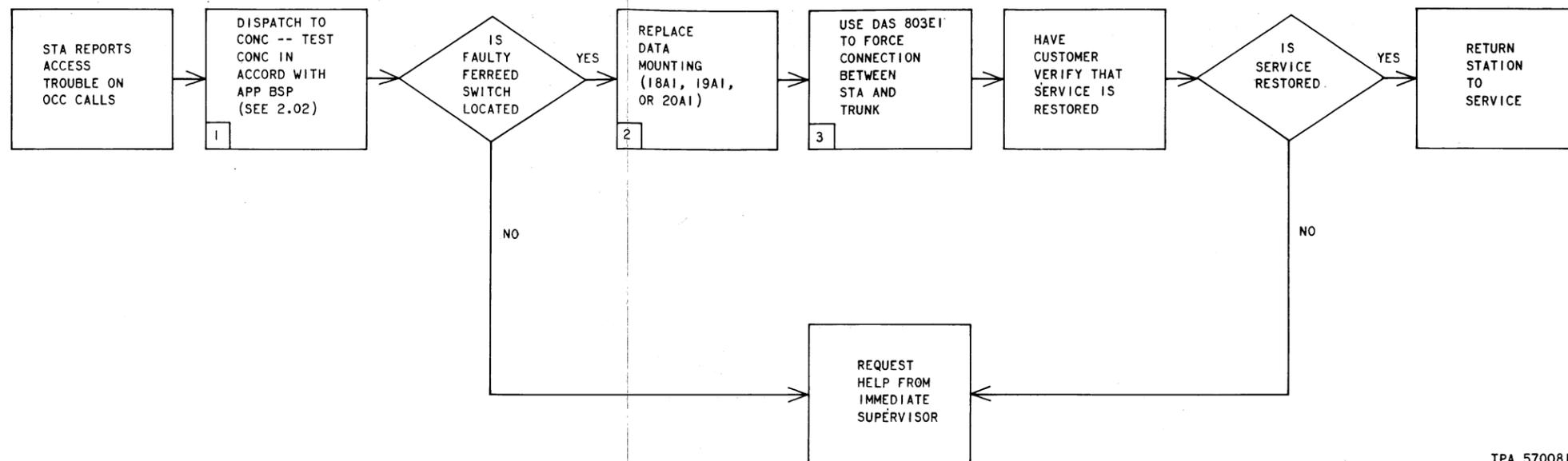
Fig. 1—Typical Arrangement of 10-Type Data Line Concentrator System





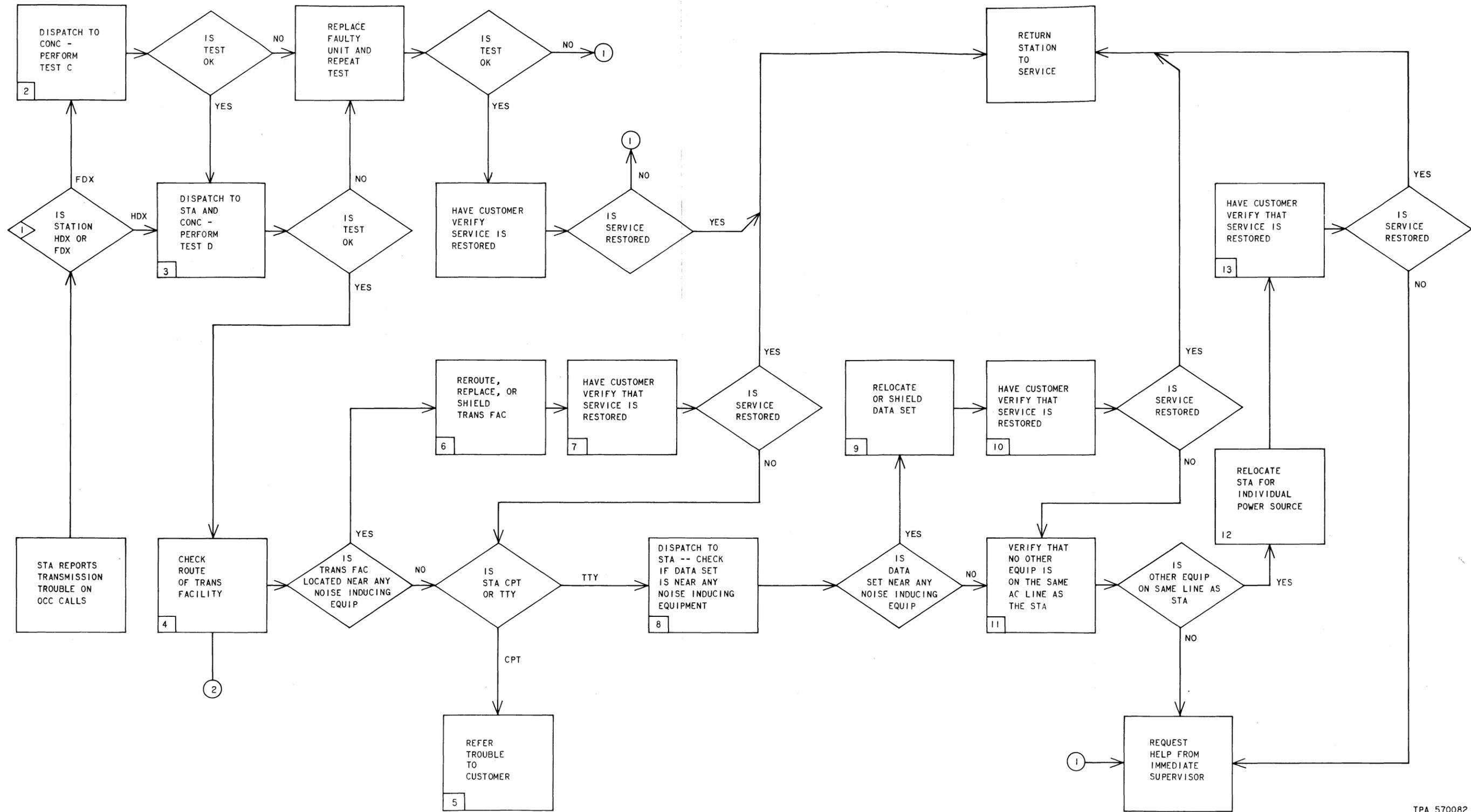
TPA 570080

Fig. 3—Local Station Troubleshooting Flowchart for Single Station-Reported Troubles (Transmission Trouble on all Calls)



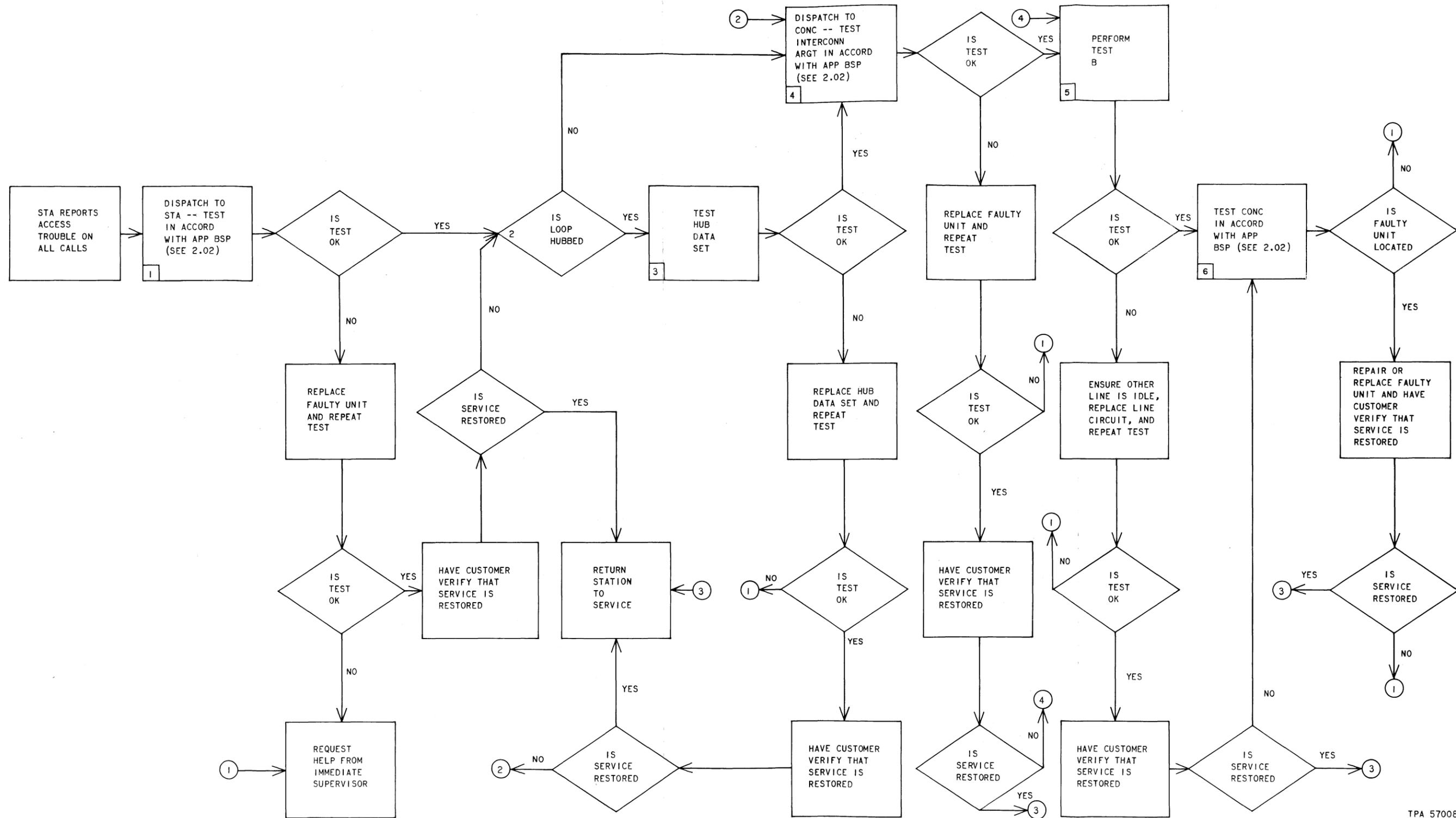
TPA 570081

Fig. 4—Local Station Troubleshooting Flowchart for Single Station-Reported Troubles (Access Trouble on Occasional Calls)



TPA 570082

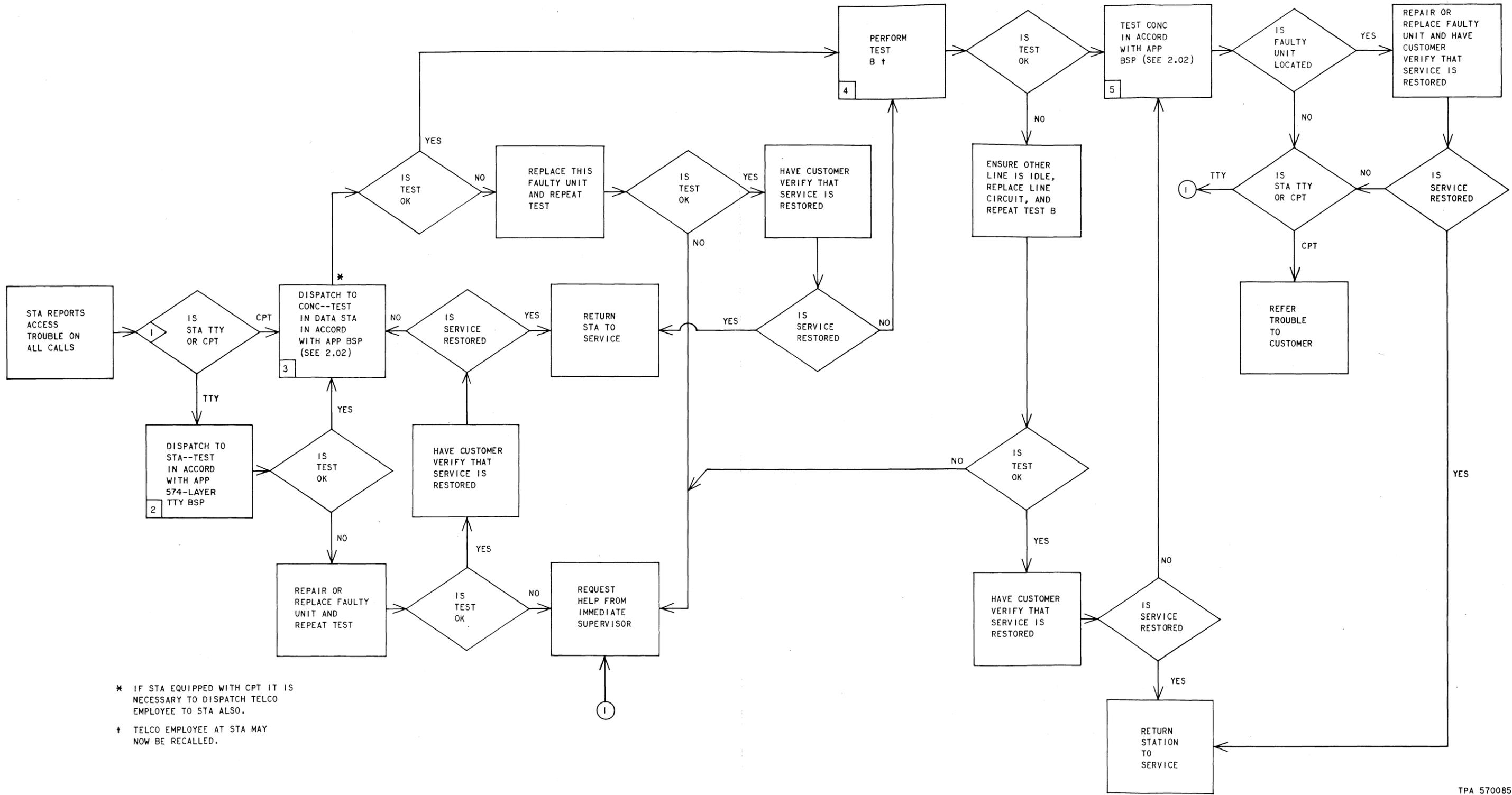
Fig. 5—Local Station Troubleshooting Flowchart for Single Station-Reported Troubles (Transmission Troubles on Occasional Calls)



TPA 570083

Fig. 6—Remote PL Station Troubleshooting Flowchart for Single Station-Reported Troubles (Access Trouble on All Calls)





\* IF STA EQUIPPED WITH CPT IT IS NECESSARY TO DISPATCH TELCO EMPLOYEE TO STA ALSO.

† TELCO EMPLOYEE AT STA MAY NOW BE RECALLED.

TPA 570085

Fig. 8—Remote Station Which Accesses Concentrator via 1A Data Station Link Troubleshooting Flowchart for Single Station-Reported Troubles (Access Trouble on all Calls)

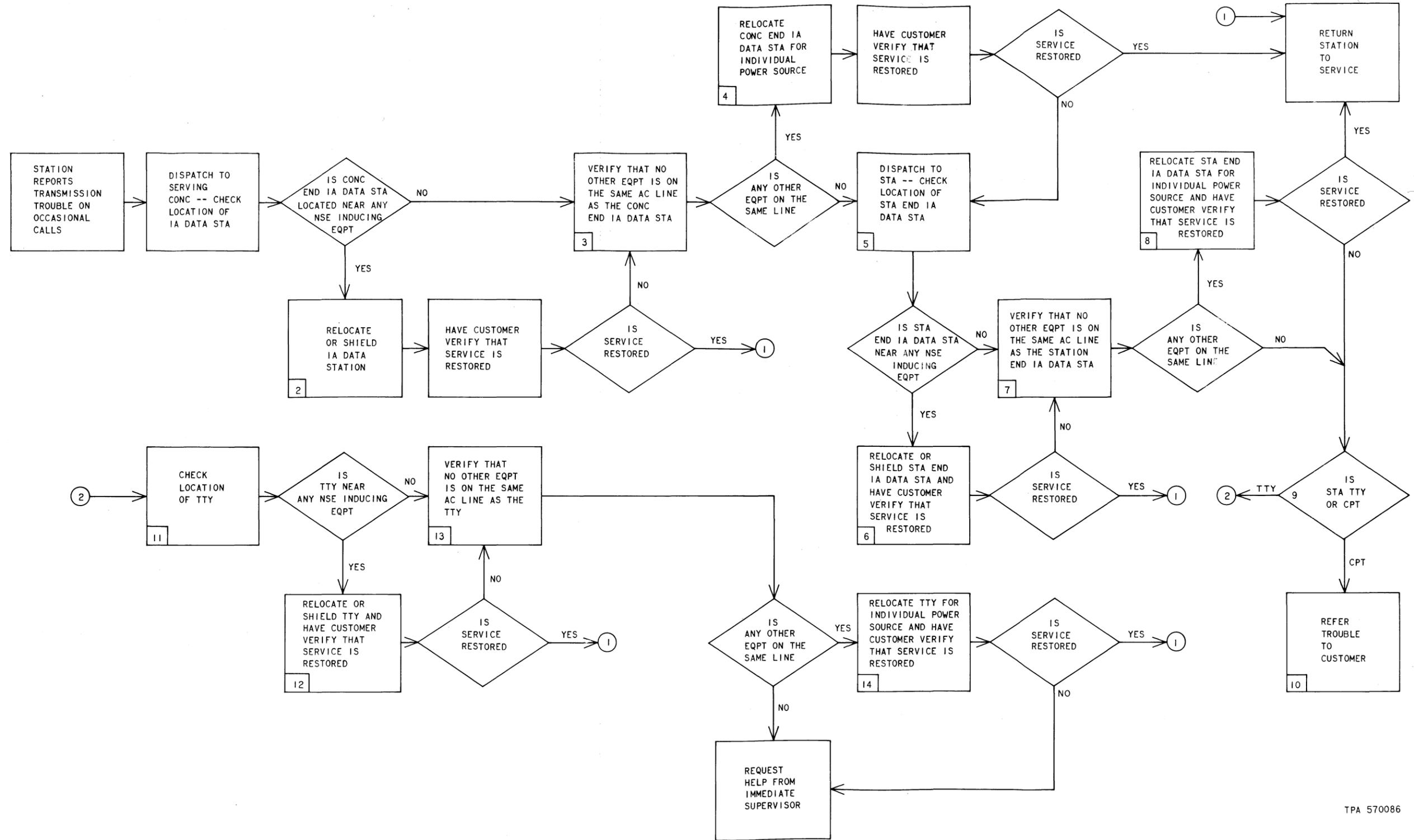
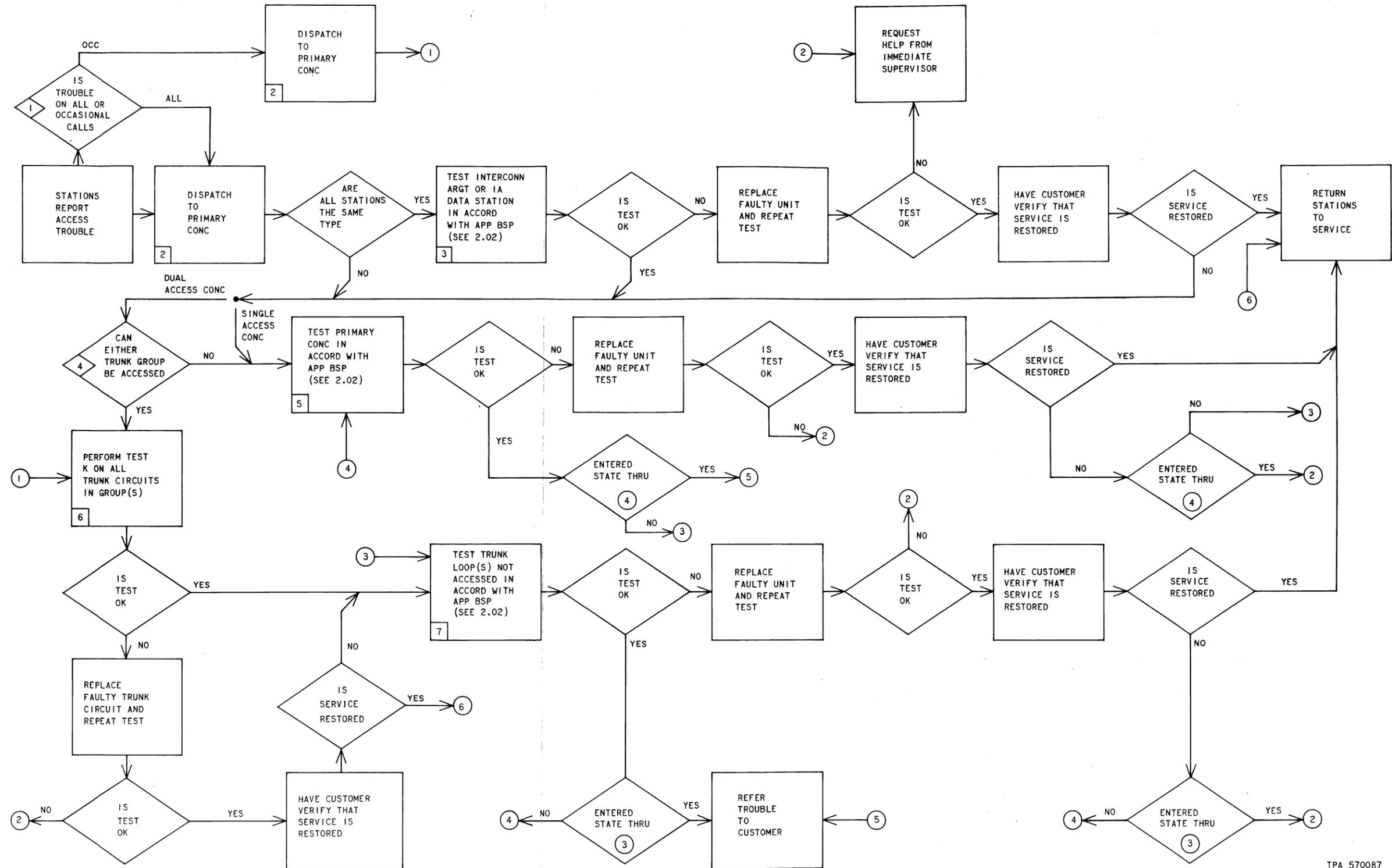


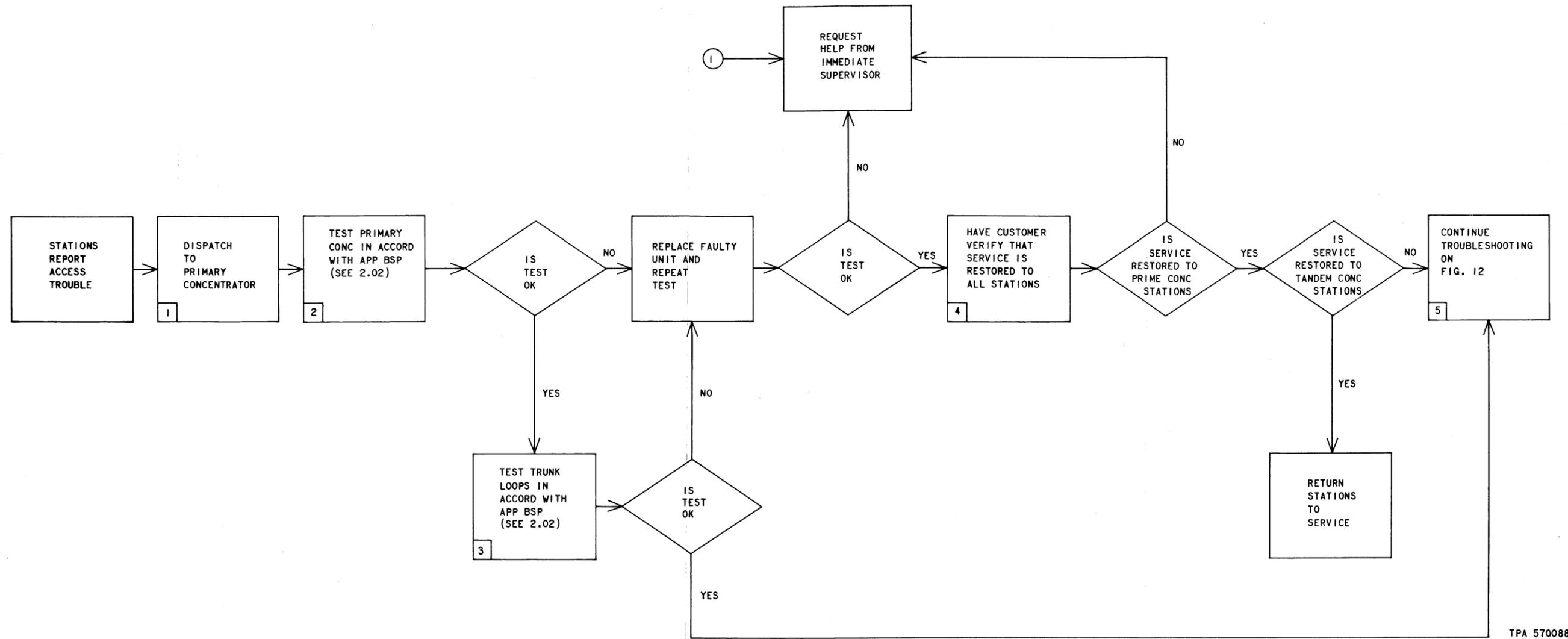
Fig. 9—Remote Station Which Accesses Concentrator via IA Data Station Link Troubleshooting Flowchart for Single Station-Reported Troubles (Transmission Trouble on Occasional Calls)

TPA 570086



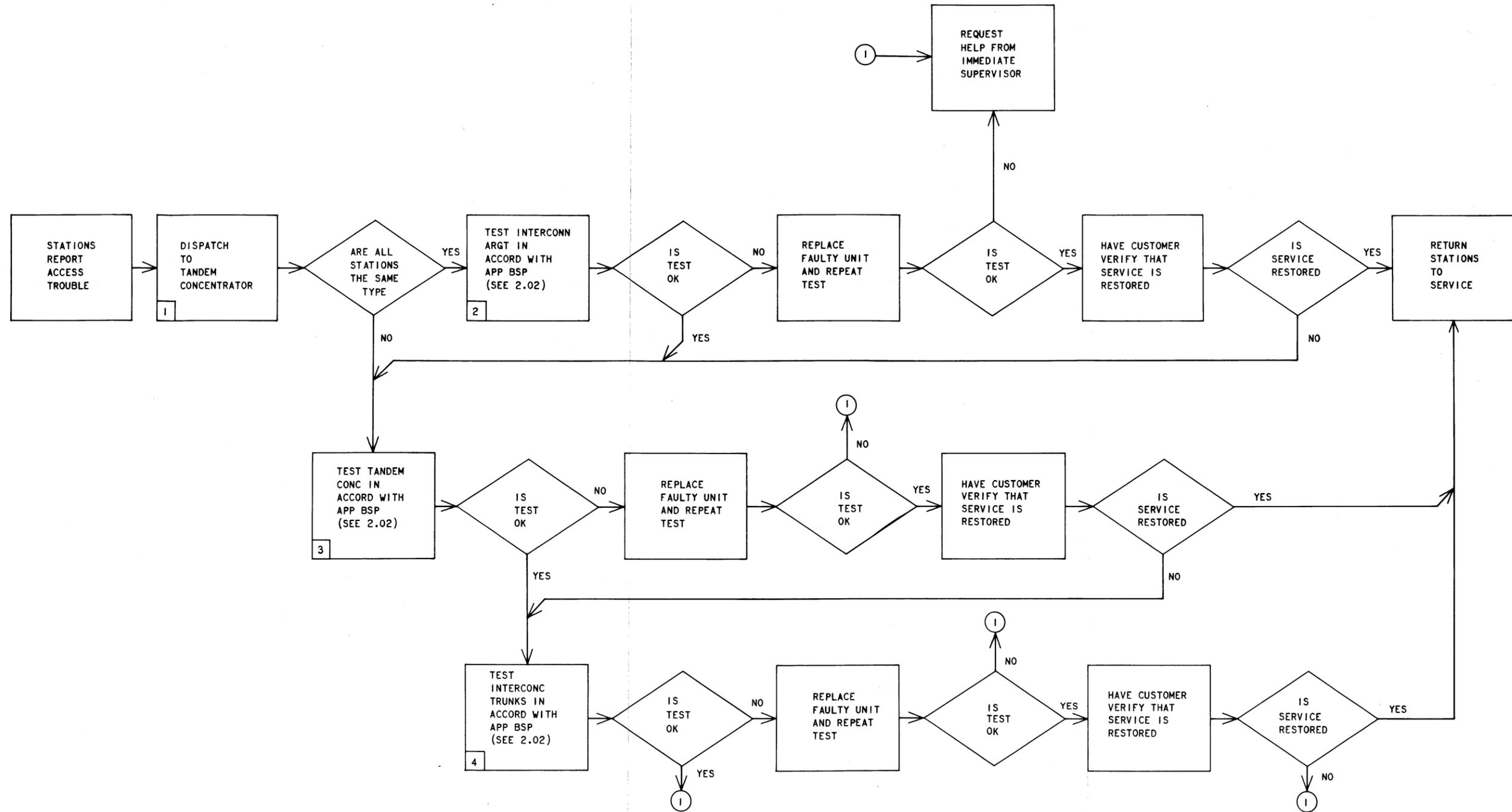
TPA 570087

**Fig. 10—Troubleshooting Flowchart for Multiple Station-Reported Access Troubles When all Reporting Stations are Served by the Primary Concentrator**



TPA 570088

**Fig. 11—Troubleshooting Flowchart for Multiple Station-Reported Access Troubles When Some of the Reporting Stations are Served by the Primary Concentrator and Some are Served by a Tandem Concentrator**



TPA 570089

**Fig. 12—Troubleshooting Flowchart for Multiple Station-Reported Access Troubles When all Reporting Stations are Served by a Tandem Concentrator**

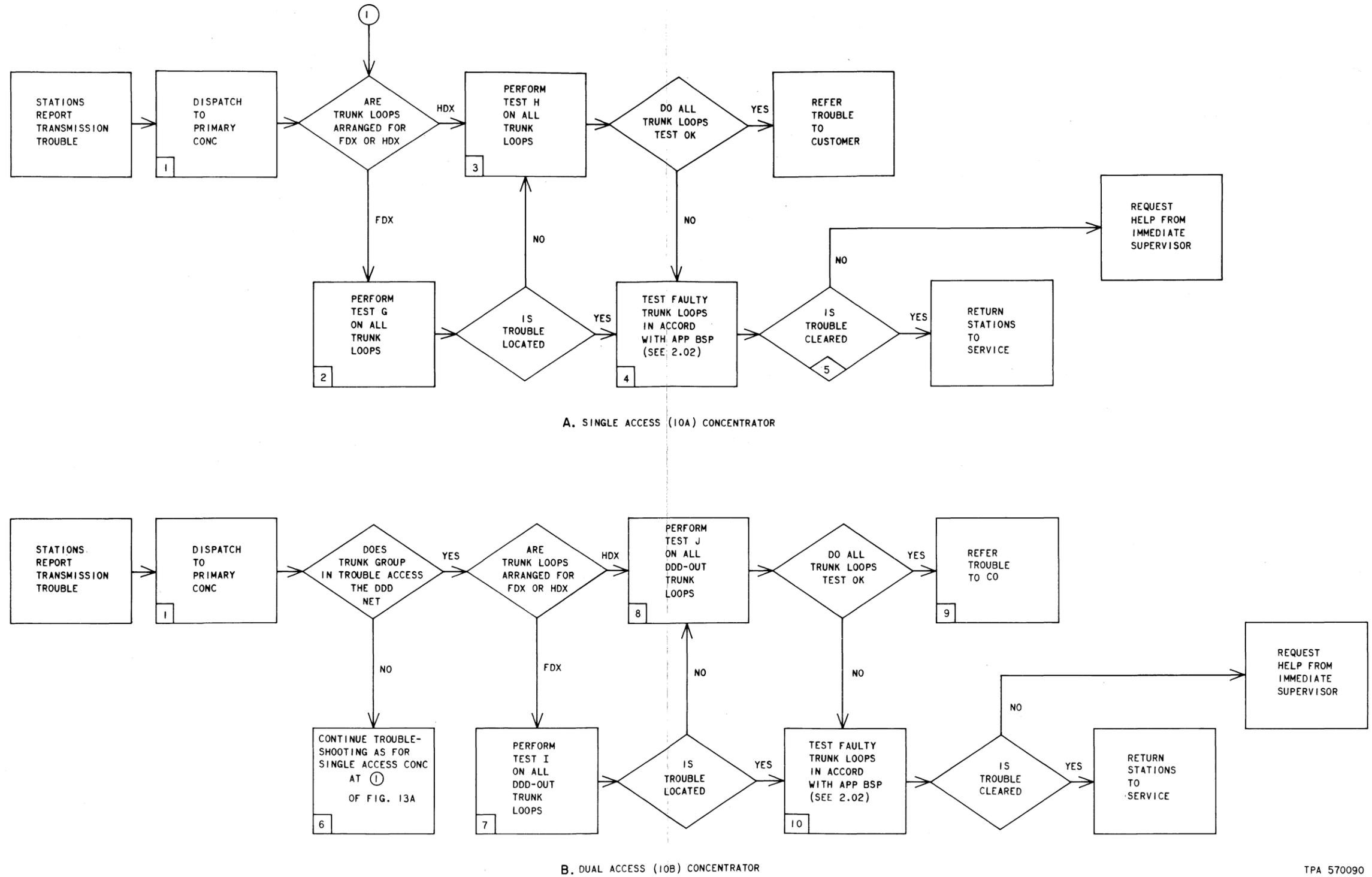
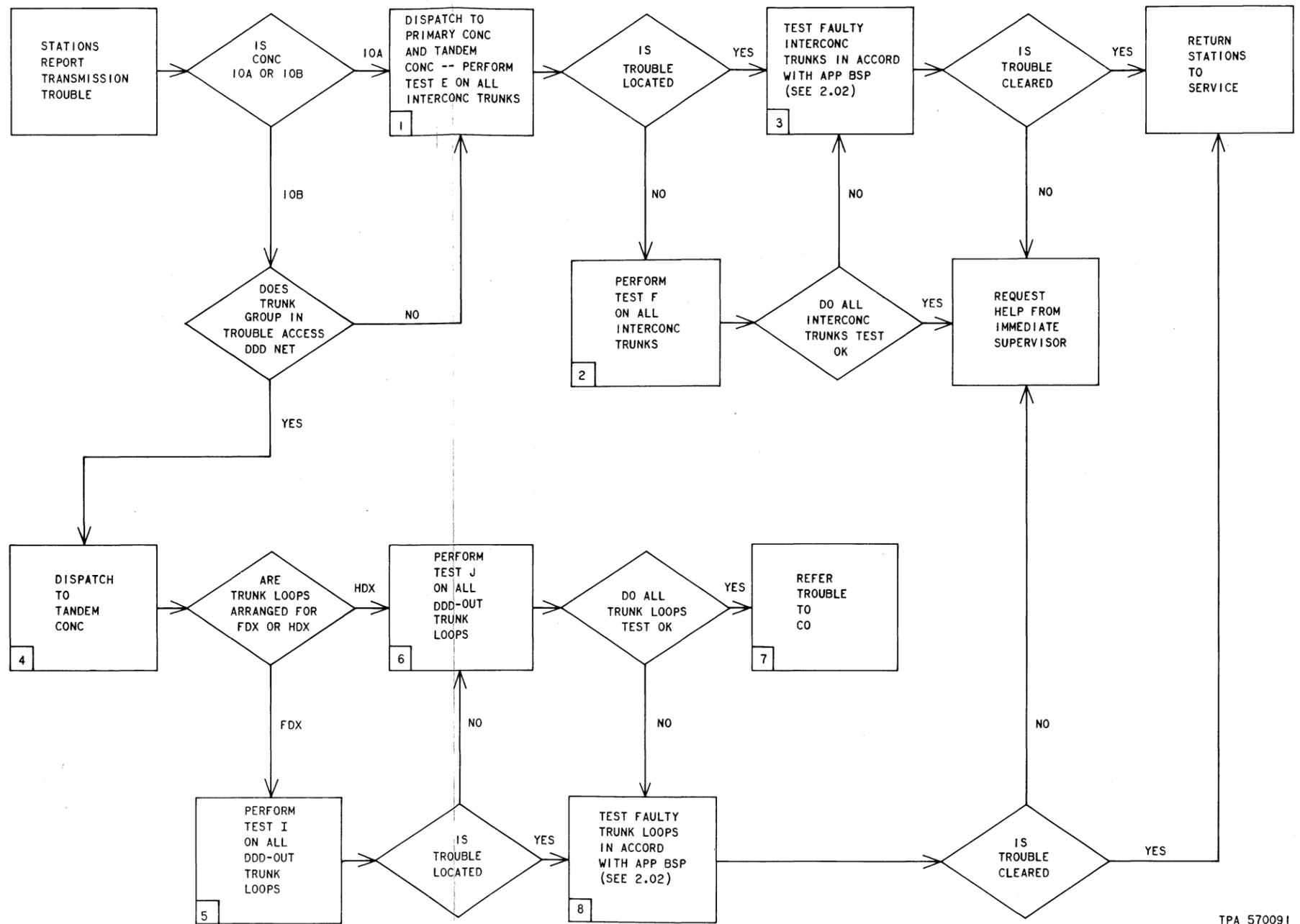


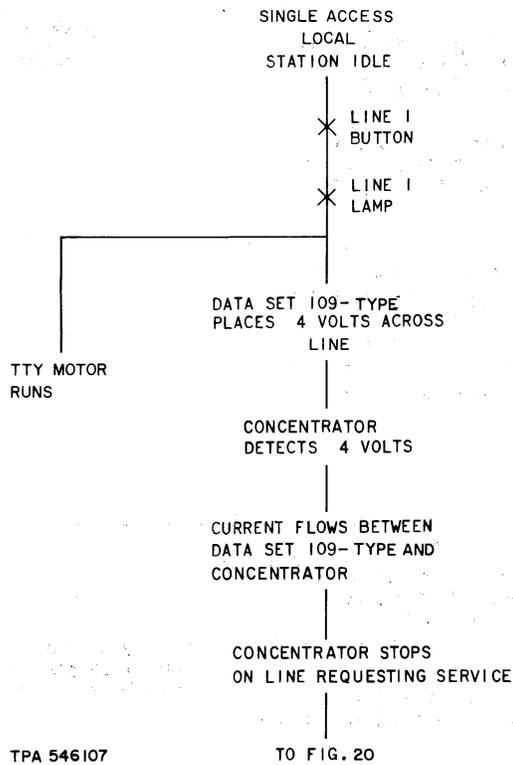
Fig. 13—Troubleshooting Flowchart for Multiple Station-Reported Transmission Troubles When all Reporting Stations are Served by the Primary Concentrator

TPA 570090

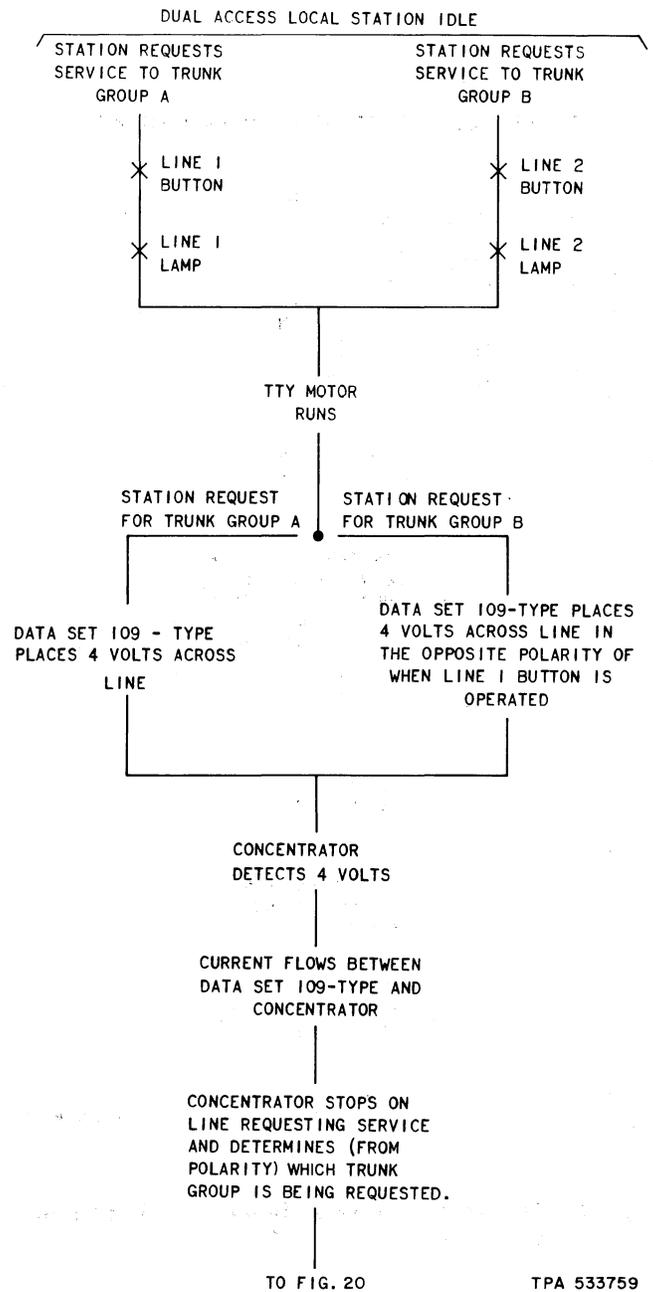


TPA 570091

**Fig. 14—Troubleshooting Flowchart for Multiple Station-Reported Transmission Troubles When all Reporting Stations are Served by a Tandem Concentrator.**



**Fig. 15—Single Access Local Station Call Origination Sequence**



**Fig. 16—Dual Access Local Station Call Origination Sequence**

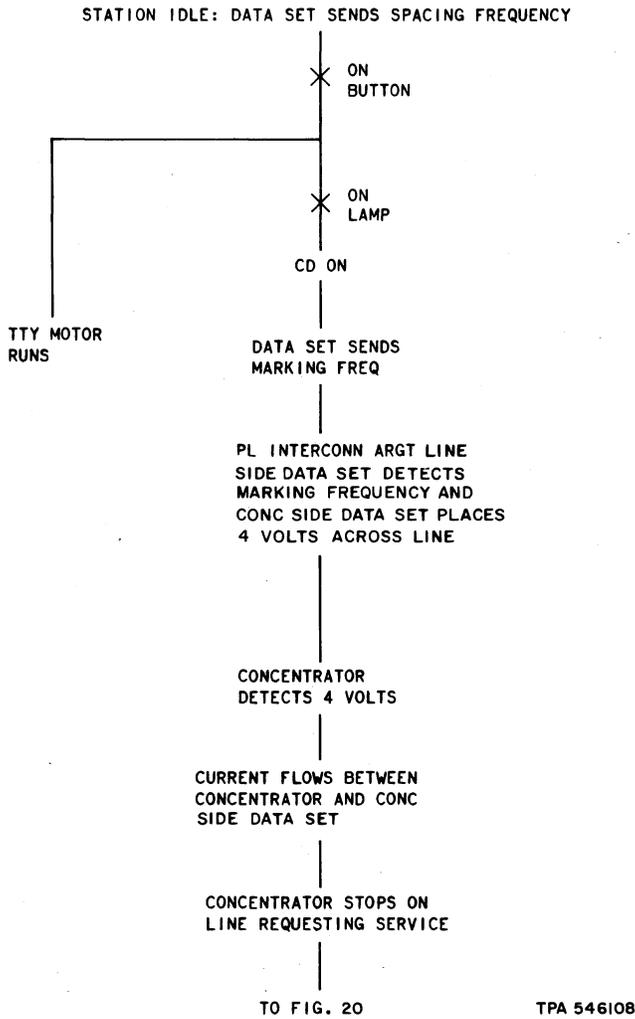


Fig. 17—Remote Private Line Station Call Origination Sequence

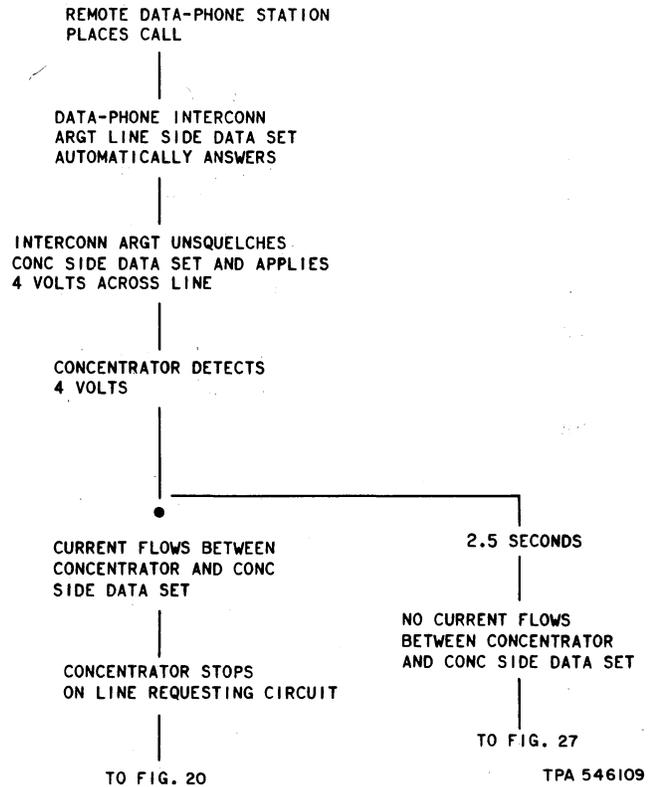
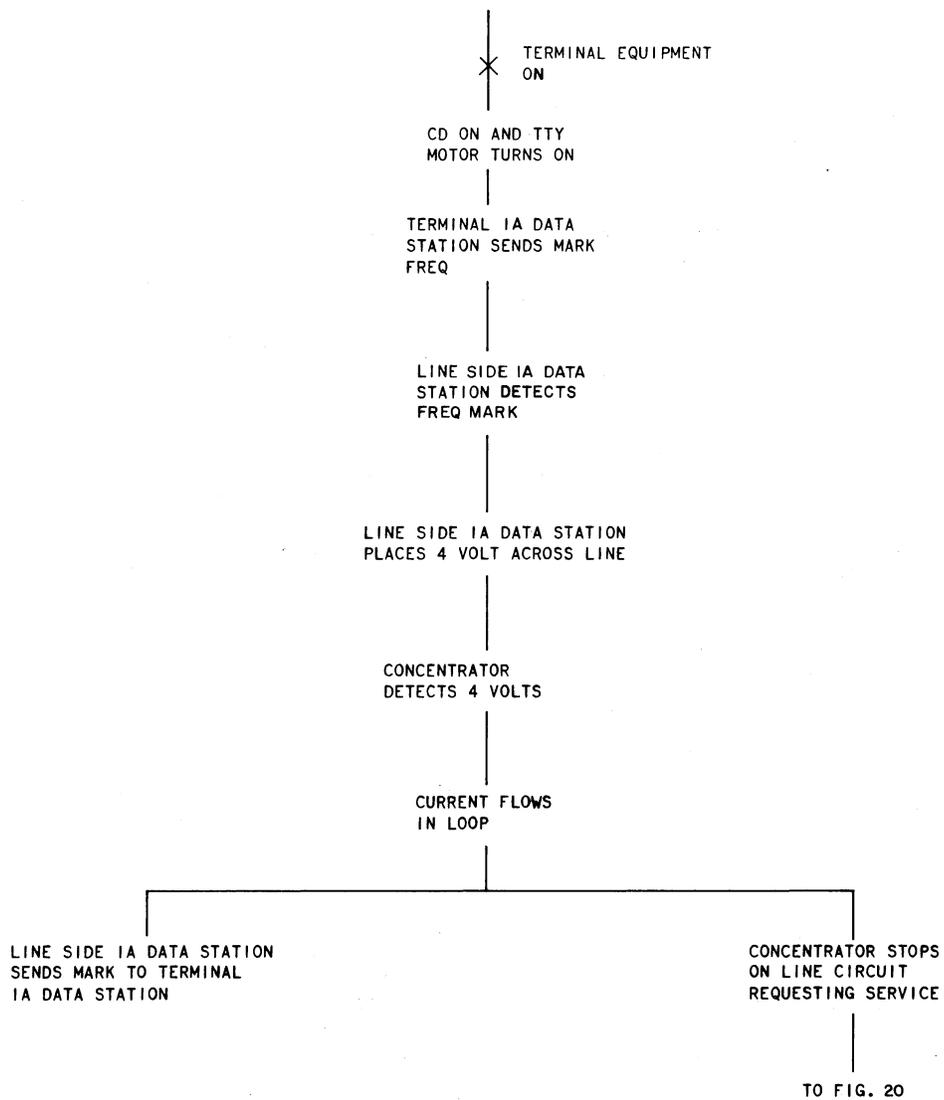


Fig. 18—DATA-PHONE Station Call Origination Sequence



NOTE:  
 TERMINAL EQUIPMENT IDLE: TERMINAL 1A DATA STATION SENDS CENTER FREQ

TPA 546111

Fig. 19—1A Data Station Call Origination Sequence

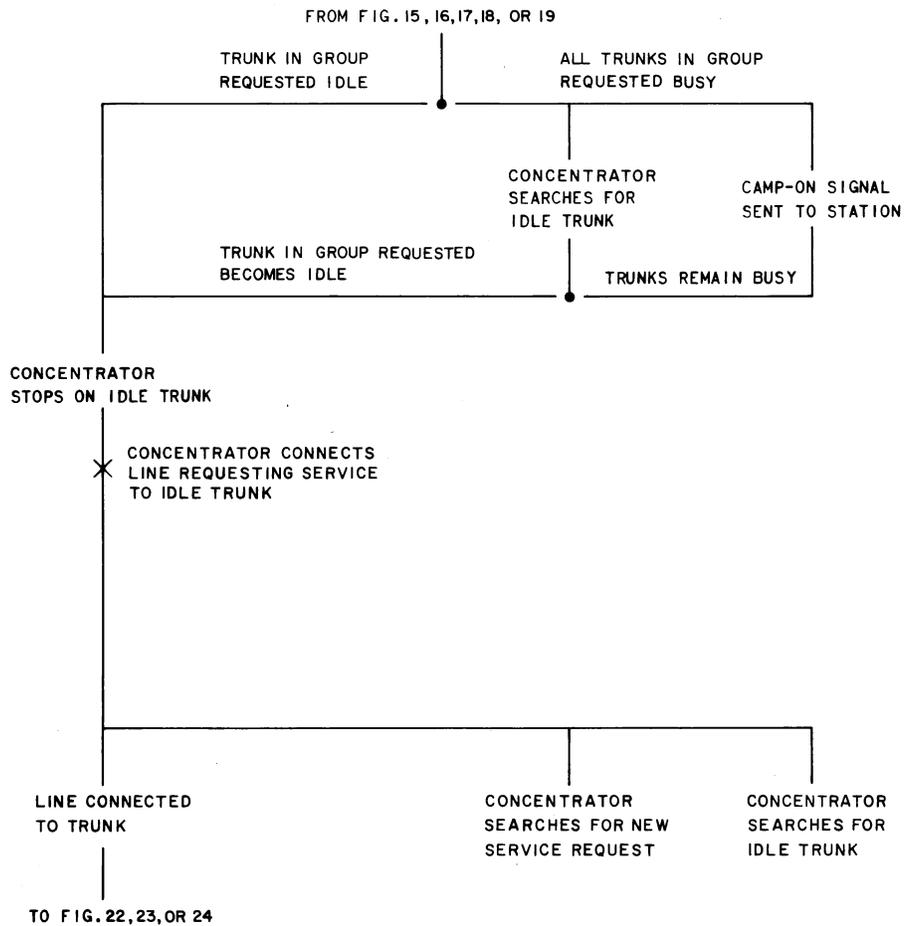
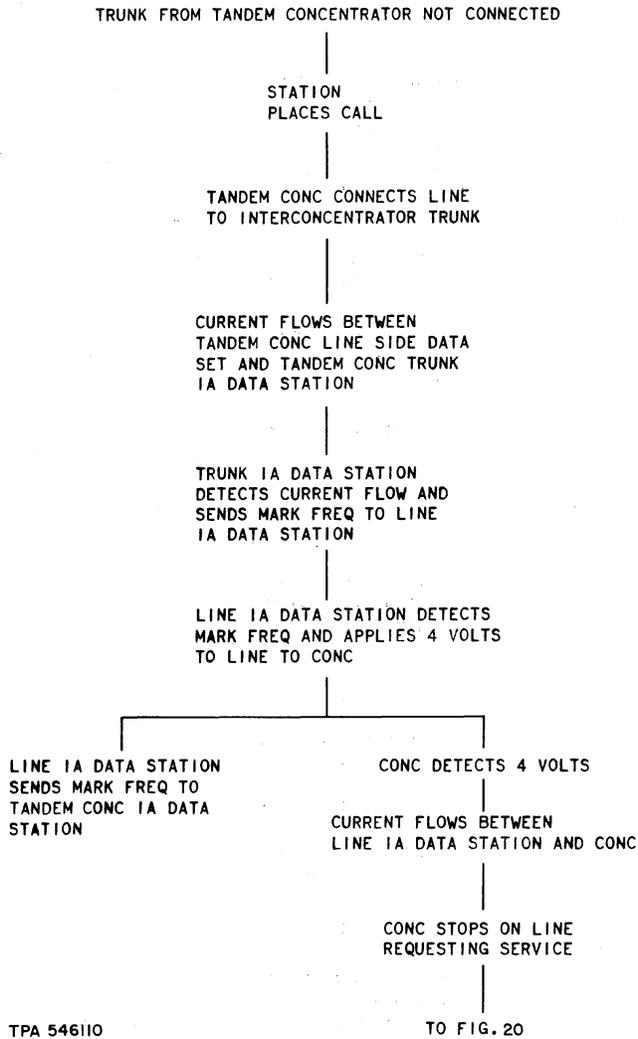
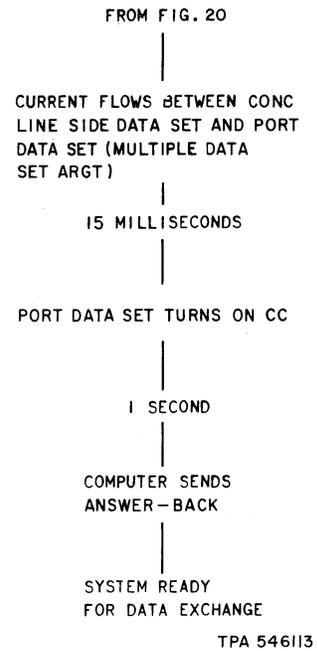


Fig. 20—Trunk Connection Sequence

NOTE:  
 INTERCONCENTRATOR TRUNK IDLE: LINE IA DATA STATION  
 SENDS CENTER FREQ TO TANDEM CONC TRUNK IA DATA STATION  
 AND TANDEM CONC TRUNK IA DATA STATION SENDS CENTER FREQ  
 TO LINE IA DATA STATION.

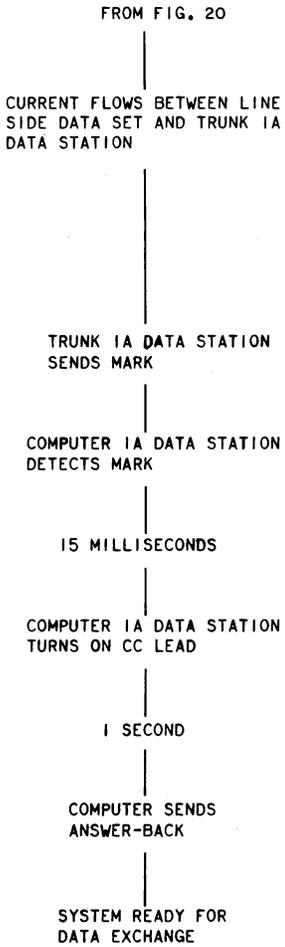


**Fig. 21—Tandem Concentrators: Interconcentrator Trunk Connection Sequence**



**Fig. 22—Trunk Multiple Data Set Arrangement Connection Sequence**

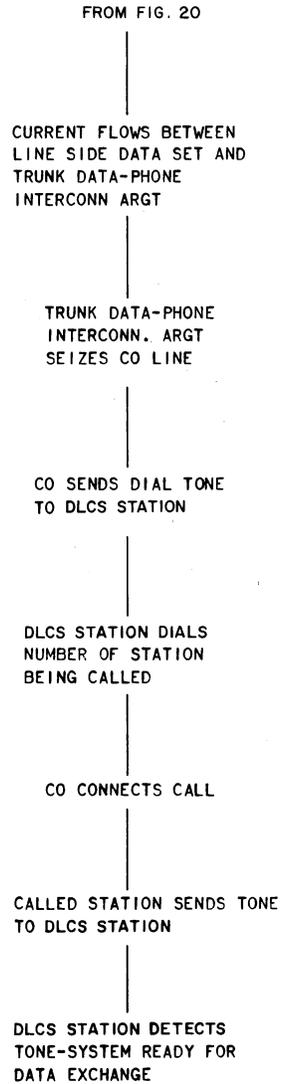
TRUNK IDLE: TRUNK 1A STATION SENDS CENTER FREQ TO COMPUTER  
 1A DATA STATION AND COMPUTER 1A DATA STATION SENDS MARK FREQ  
 TO TRUNK 1A DATA STATION



TPA 546114

Fig. 23—Trunk 1A Data Station Connection Sequence

TRUNK IDLE: TRUNK SIDE DATA-PHONE INTERCONNECTION  
 ARRANGEMENT APPLIES 4 VOLTS TO CONCENTRATOR  
 TRUNK AND IS DISCONNECTED FROM LINE TO CO



TPA 553758

Fig. 24—Trunk-Side DATA-PHONE Interconnection  
 Arrangement Connection Sequence (Dual  
 Access Only)

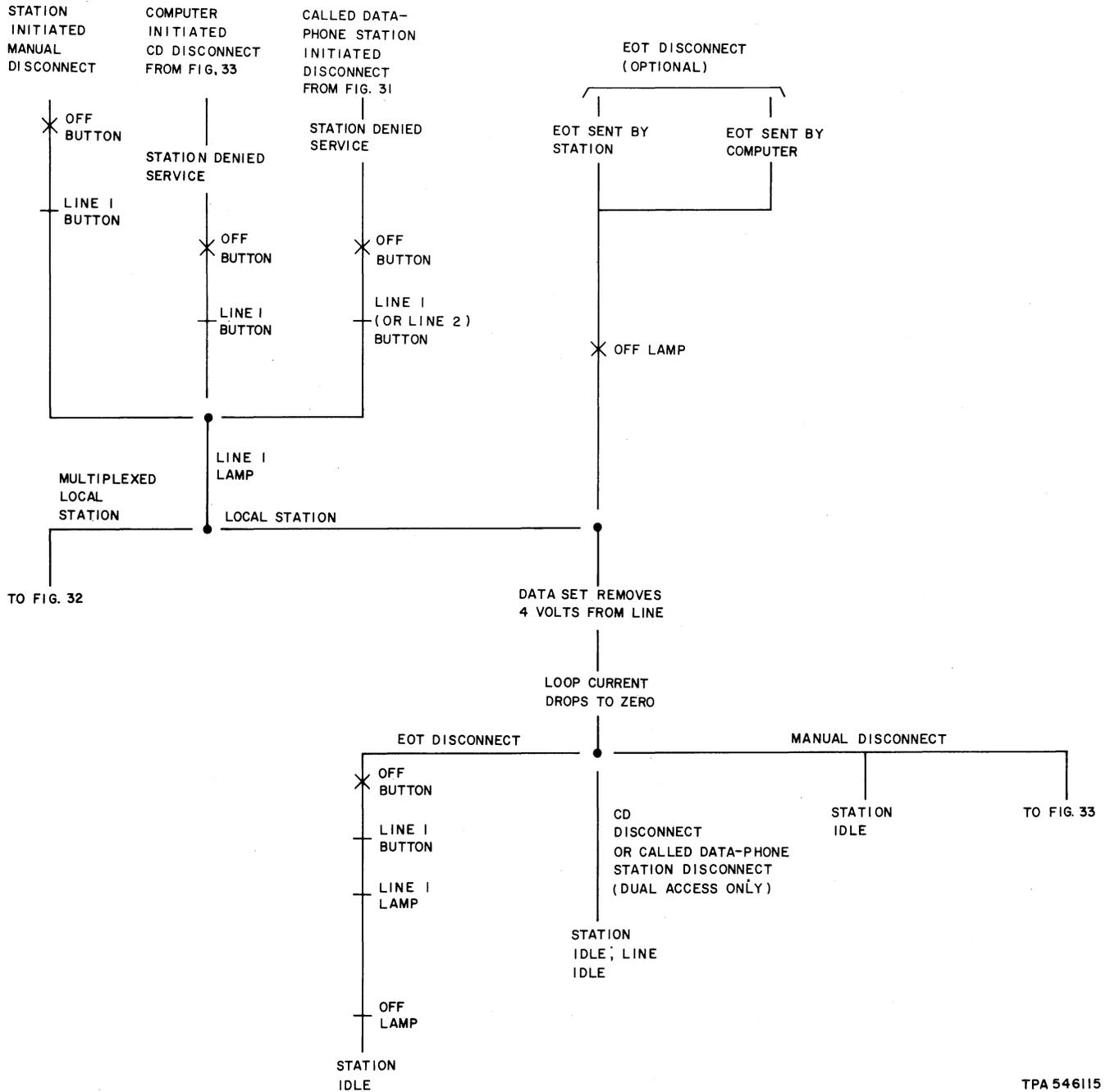


Fig. 25—Local Station Disconnect Sequence

TPA 546115

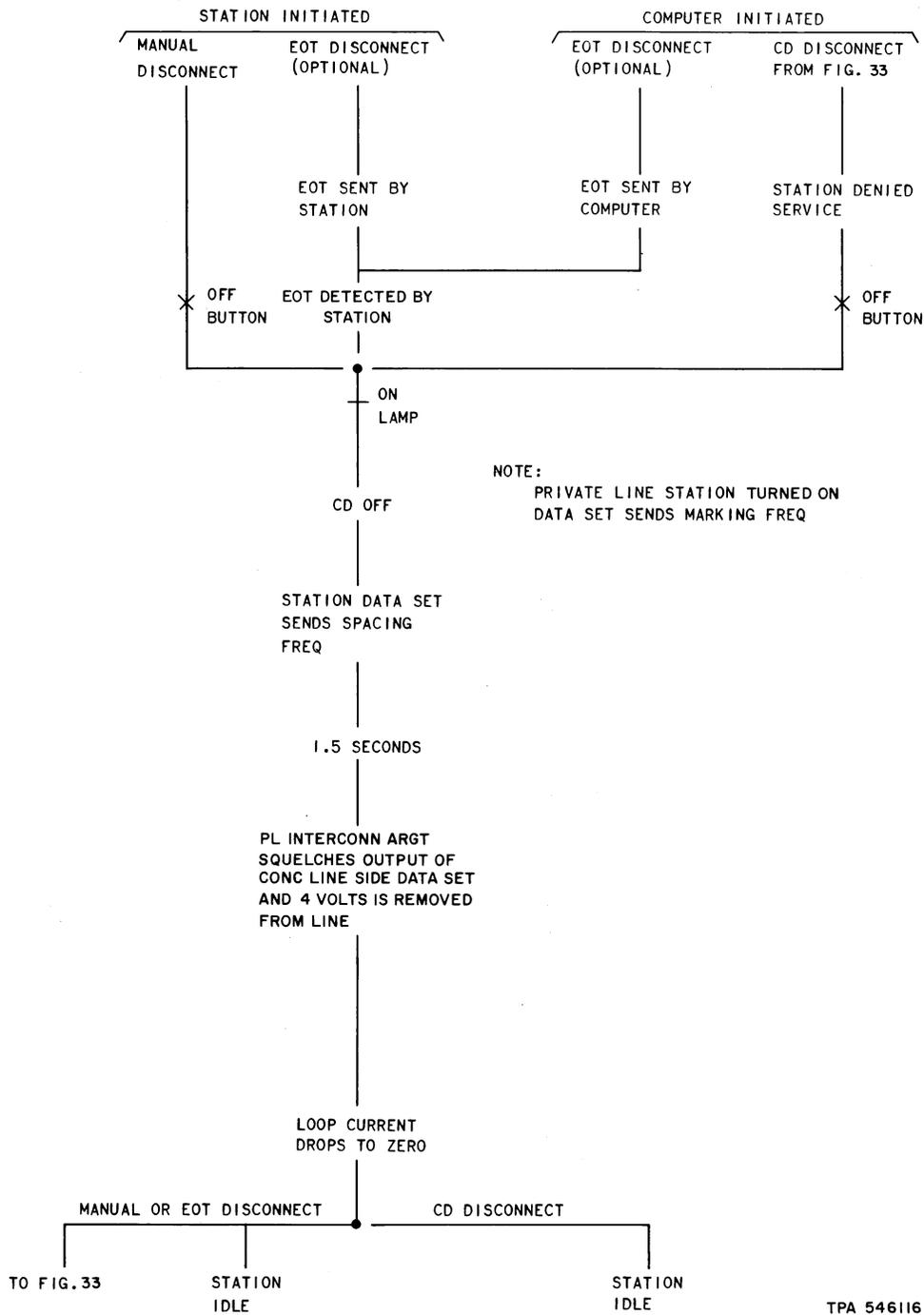
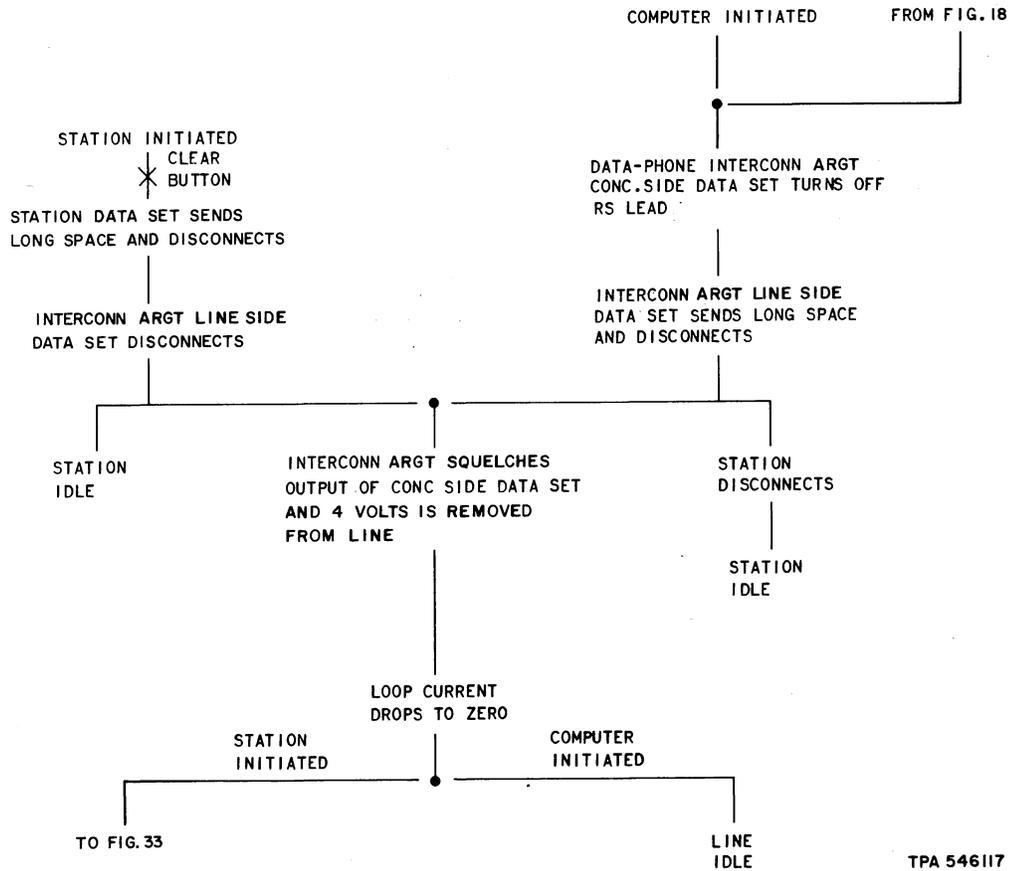
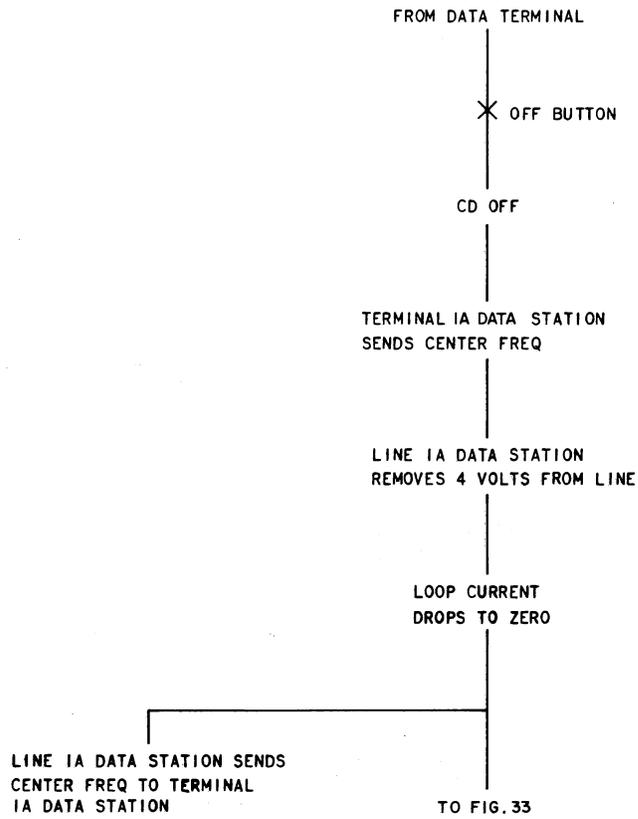


Fig. 26—Remote Private Line Station Disconnect Sequence



TPA 546117

Fig. 27—DATA-PHONE Station Disconnect Sequence



NOTE:  
TERMINAL EQUIPMENT TURNED ON:  
TERMINAL 1A DATA STATION  
SENDS MARKING FREQ.

TPA 546118

**Fig. 28—Line-Side 1A Data Station Disconnect Sequence**

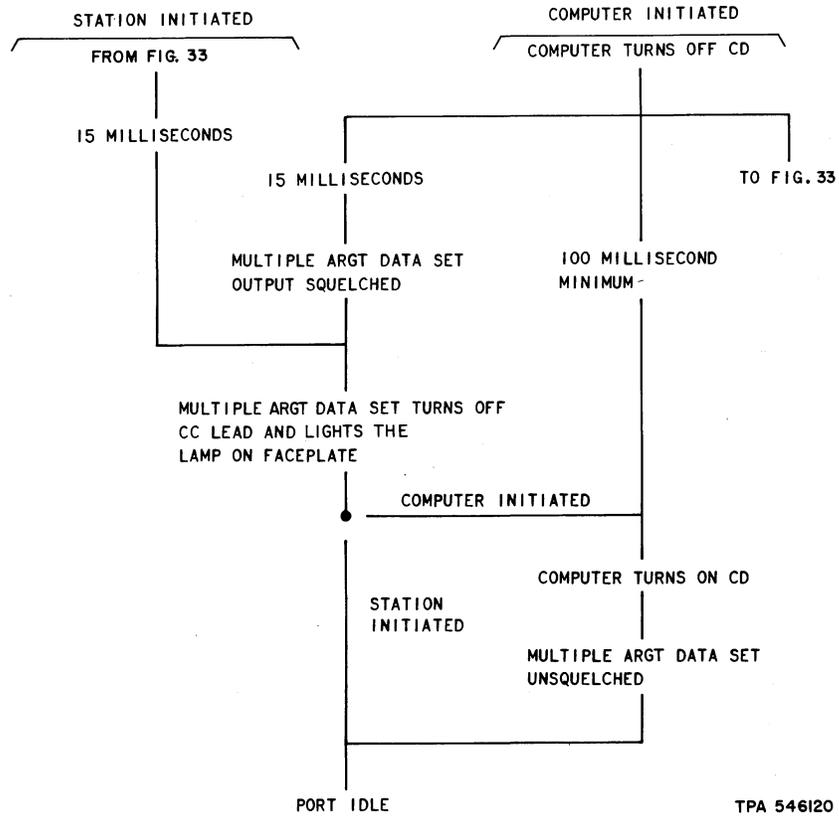


Fig. 29—Trunk Multiple Data Set Arrangement Disconnect Sequence

NOTE:  
TRUNK CONNECTED: CONC END IA DATA STATION  
SENDS MARKING FREQ

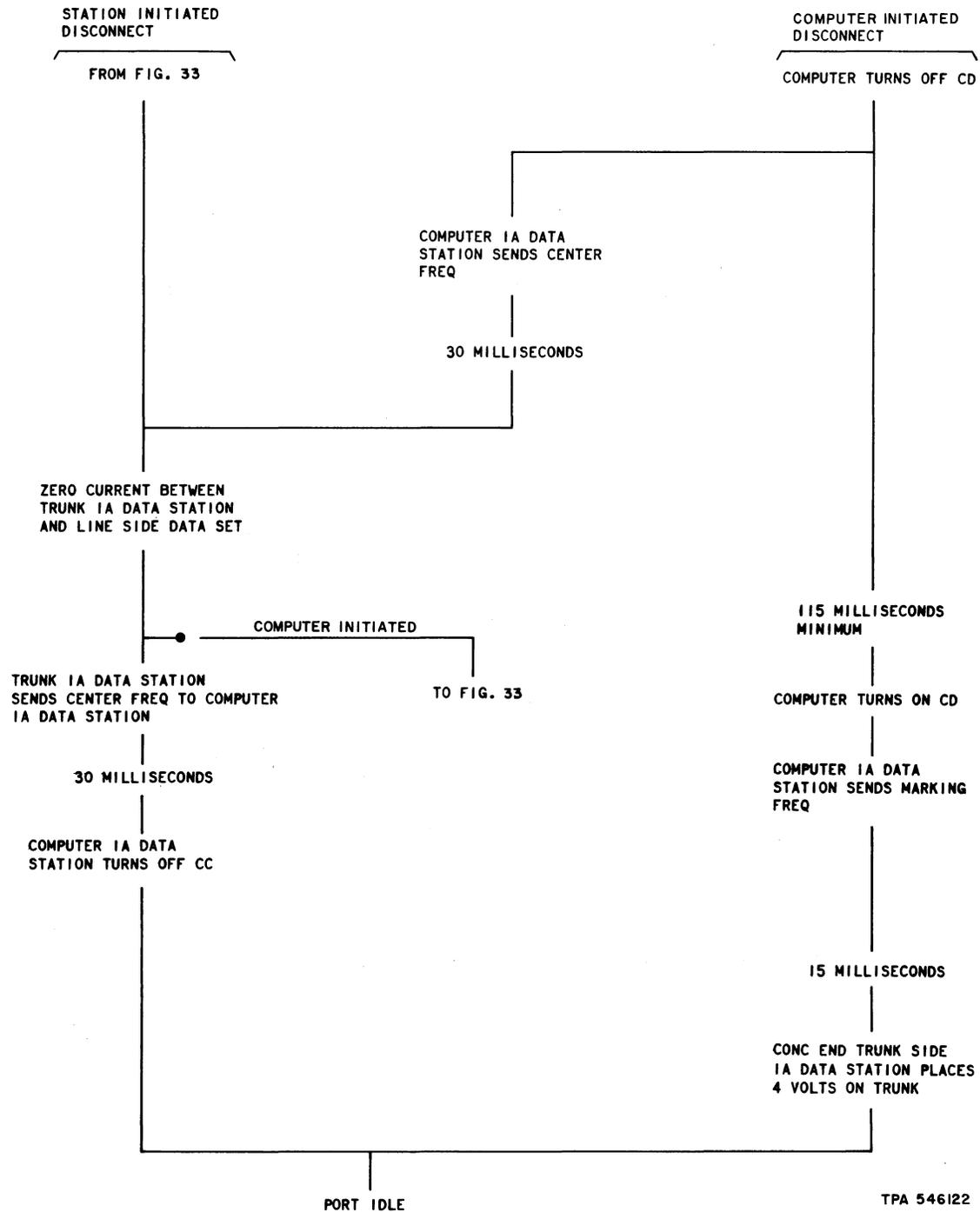
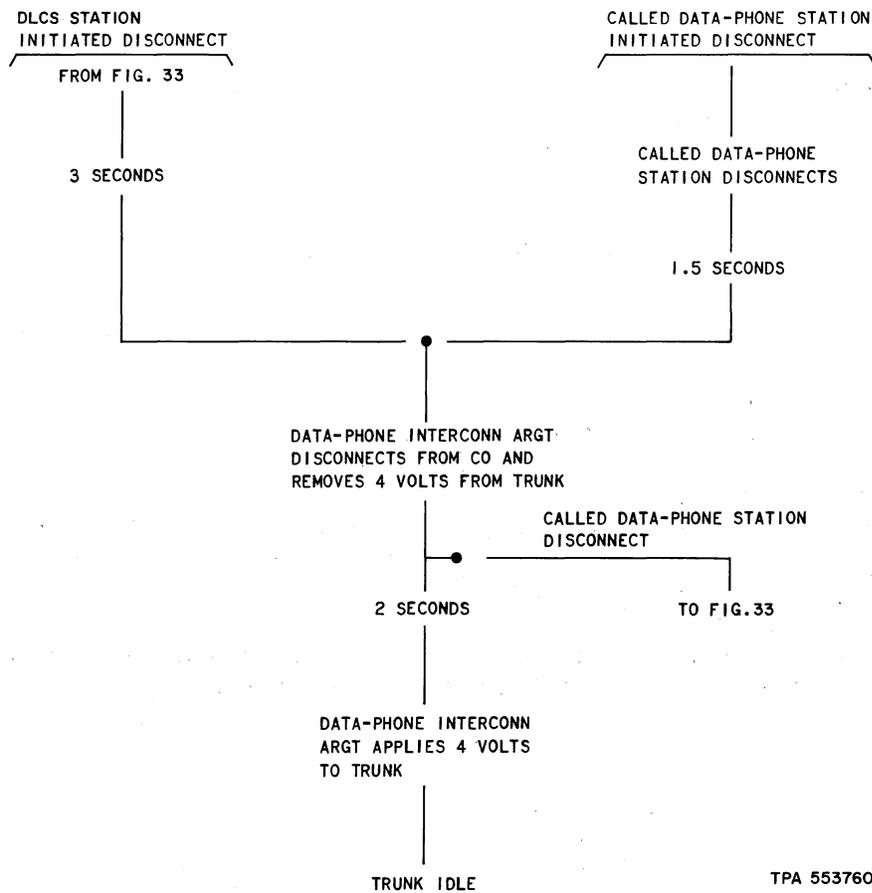


Fig. 30—Trunk-Side 1A Data Station Disconnect Sequence



**Fig. 31—Trunk-Side DATA-PHONE Interconnection Arrangement Disconnect Sequence (Dual Access Only)**

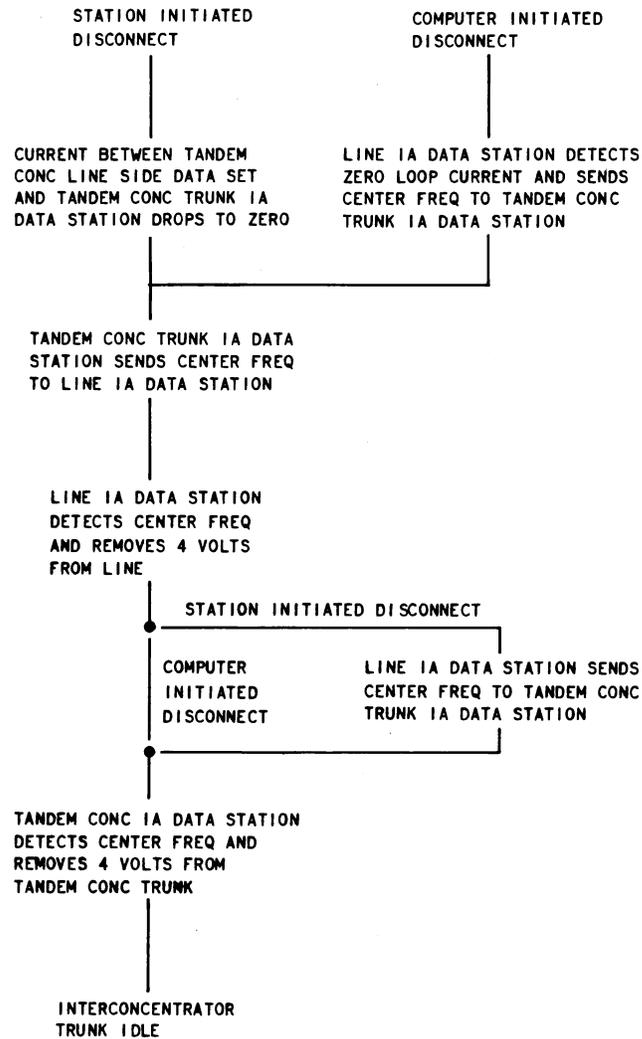


Fig. 32—Interconcentrator Trunk Disconnect Sequence

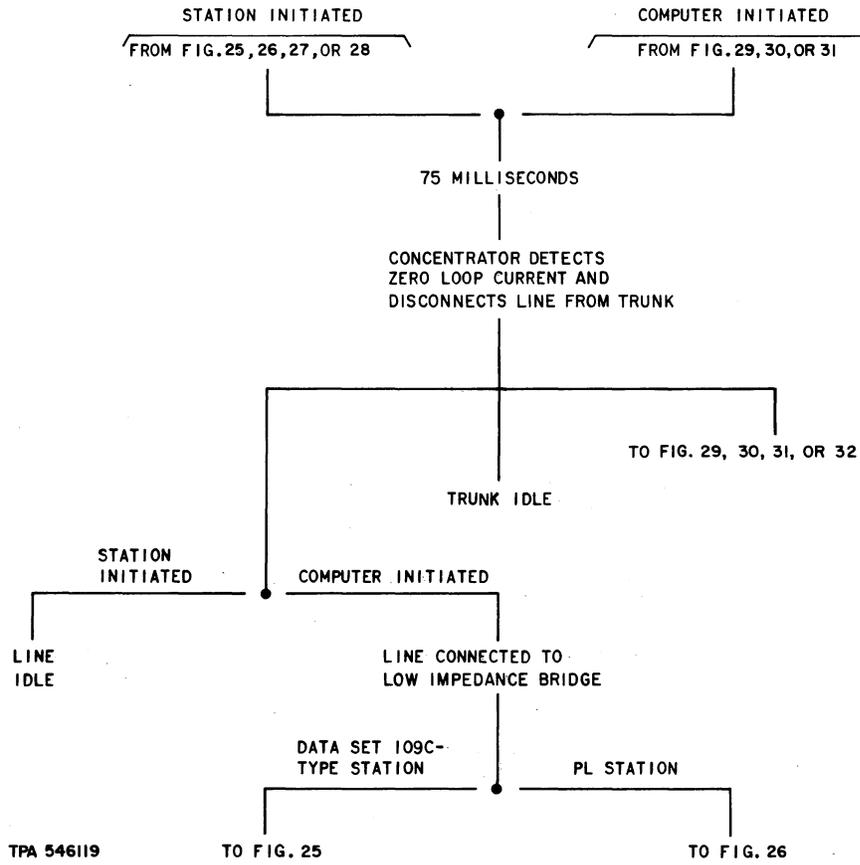


Fig. 33—Trunk Circuit Disconnect Sequence