

TELEGRAPH
81D1 TELETYPEWRITER SWITCHING SYSTEM
TESTING AND MAINTENANCE PROCEDURES

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1. GENERAL

1.01 This section outlines maintenance procedures applicable to the 81D1 Automatic Teletypewriter Switching System. Descriptive information pertaining to this system may be found in Section 580-101-100.

1.02 The operating and testing procedures should be closely followed in order that interruptions to service will be kept at a minimum. Facility and equipment releases should be arranged in advance of any scheduled work on the system. Patches, except for trouble cases, should be made or removed only during nonservice or light load periods and then with the consent of the control office.

1.03 The information contained in this section is applicable to 81-type outlying stations even

though the conventional switching center be replaced by a computer-type processor. Some customers will choose to employ business machines already (or being) installed for other uses to handle teletypewriter traffic between circuits of the system. In such cases, the switching center equipment may be maintained by the customer or a third party. This equipment will be referred to as Customer Provided Equipment (CPE).

1.04 Generally, codes for controlling outlying stations will remain the same. There may be some slight differences, such as the addition or deletion of a character in a transmitter start pattern. If these differences exist, they will be covered in service orders and customer operating instructions.

2. DEFINITIONS

2.01 *Activate:* The condition in which a SOTUS, electronic selector, and station control unit is placed to respond to codes. It corresponds to the select, nonprint condition of a stunt box.

2.02 *Automatic Address Station:* An arrangement at a sending station for introducing into the system traffic which contains no address codes. The address codes and end-of-message codes are generated by pushbutton controlled circuits.

2.03 *Automatic Noninterfering Tape Feed-Out (ATFO):* A circuit associated with a typing reperforator to feed out tape at the end of transmission. A series of LTRS signals is generated and punched into the tape. Feed-out signals are automatically stopped if incoming traffic resumes before feed-out is completed.

2.04 *Call Directing Code (CDC):* A two-letter code punched in the tape at the sending station. This code routes the message through the switching center or processor and causes connection of a machine at the receiving station.

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- 2.05 Deactivate:** The condition in which a SOTUS, electronic selector, or station control unit is placed so that it will not respond to call directing codes.
- 2.06 Director Circuit:** A switching center circuit which acts in conjunction with a reperforator-transmitter to scan the CDC of a message and determine its routing. It sets up connections via the link circuit and releases these upon receipt of an end-of-message code.
- 2.07 Emergency Stop Pattern:** A combination of teletypewriter characters sent out by the switching center or processor to stop transmission from an outlying station. This pattern is BLANK 0.7-second pause X LTRS LTRS.
- 2.08 End-of-Address (EOA) Code:** The combination CAR RET LINE FEED LTRS also known as the deactivate or lockout code. It is transmitted immediately after the address codes (CDC) to prevent accidental selection of unwanted stations.
- 2.09 End-of-Message (EOM) Code:** The combination FIGS H LTRS sent at the end of a message. This code clears the cross-office connection in the switching center, disconnects receiving stations, and returns station control circuits to an activated condition.
- 2.10 End-of-Transmission Code:** The letter H following the last EOM code. It is used only by outlying stations on multipoint lines to signal the switching center or processor that transmission has ended and the next station may be started.
- 2.11 Flip-Flop Circuit:** An arrangement of alternate transmitters for introducing offline traffic into the system. An auxiliary transmitter is provided at the point sending offline traffic which does not contain CDCs. These tapes are placed in the auxiliary transmitter. A locally prepared tape containing one or more CDCs, EOA code, and either FIGS Z LTRS or FIGS X LTRS is placed in the regular transmitter. A TSC starts the regular transmitter which runs until FIGS Z LTRS or FIGS X LTRS is reached. This stops the regular and starts the auxiliary transmitter containing the message. FIGS H LTRS at the end-of-message restarts the regular transmitter and the process repeats until all messages have been sent.
- 2.12 Group Code:** A two letter CDC to which several stations on the system respond. This permits addressing a message to several stations with a single code.
- 2.13 Line:** A circuit connecting an outlying station with the switching center.
- 2.14 Line Release Delay Circuit:** A feature which permits the attendant at an outlying station to retain control of the automatic transmitter for 20 seconds after the tape has run out, thereby permitting the insertion of successive tapes for transmission.
- 2.15 Link Circuit:** A circuit at the switching center consisting of a group of crossbar switches through which all regular directors make their cross-office connections.
- 2.16 Local Outlet:** A receiving station provided at the switching center or at a location within the switching center local exchange area to receive terminal or offline traffic.
- 2.17 Manual Cuton Key:** An external key mounted on the station control cabinet to turn on the receiving machine manually, bypassing the station control circuit. With this key operated at a SOTUS equipped station, or turned to ALL SIGS 1 and 2 at an electronic selector equipped station, all signals on the line will be printed. The electronic selector station has a third position of this key, designated ALL MSG 1, which will cause all messages to be printed on the No. 1 machine without the transmitter start patterns being printed. This feature is not provided at simplified stunt box controlled stations.
- 2.18 Master Station:** A station that has been designated to sound an alarm and connect the receiving machine when CDCs are garbled or missing. A master station equipped with a SOTUS will respond when a nonvalid code for that line is received prior to receipt of the EOA code. A master station equipped with an electronic station selector will respond if a CDC not valid for that line is received, or if no CDC is received prior to the CR LF EOA code. Chart 5 indicates action to be taken by the customer when a master station alarm is received. The master station also reports "line open" alarms to the switching center, while other stations on the same line report the condition only to the Telephone Company.

- 2.19 *Miscellaneous Intercept:*** An arrangement provided in the switching center equipment for the interception of any message whose code does not correspond to that of some station on the system.
- 2.20 *Multimachine Local Outlet:*** A local outlet consisting of two or more machines which receive traffic on an overflow basis. Messages are automatically routed to the lowest numbered machine which is not busy.
- 2.21 *Multiple Address Circuit:*** A switching center circuit which receives a multiple address message from the incoming line and retransmits it to all outgoing line circuits to which it is destined.
- 2.22 *Supplementary Multiple Address Circuit:***
A switching center circuit which recognizes a special multiple address code and functions similar to multiple address circuit except that the message is transmitted cross-office on a single connection basis.
- 2.23 *Multiple Address Code:*** A two-letter code (usually BC) followed by LTRS, preceding call directing codes or group codes (or a mixture of both) to indicate to the switching center equipment that the message is directed to more than one station.
- 2.24 *Multiple Address Intercept:*** An arrangement provided in the switching center equipment which combines means for both intentional and miscellaneous interception of multiple address messages.
- 2.25 *Network Control Office:*** The switching center STC to which is assigned the responsibility for the overall operation of the entire network comprising the 81-type system.
- 2.26 *No Traffic Condition:*** After each station has received both the priority and regular start pattern and none of them has transmitted a message, the start pattern equipment at the switching center will rest for two minutes if the A side of the circuit is busy or one minute if the A side is idle. It will resume polling with the station following the one which sent the last transmission. An option is available to reduce the rest period to one minute.
- 2.27 *No Traffic Response:*** The letter H sent from 81D1 outlying stations in response to a TSC when no tape is available.
- 2.28 *Offline Traffic:*** Traffic originating at, or destined for, a point located off the system which is relayed by a station on the system.
- 2.29 *Originating Station:*** A transmitting position provided at the switching center or at a location within the switching center local exchange area to introduce traffic into the system.
- 2.30 *Outgoing Line Circuit:*** Equipment and circuitry at the switching center arranged to receive messages cross-office for all stations on a given line from any incoming line or the multiple address position. Each outgoing line is provided with either two or three reperforator-transmitters depending on whether it is equipped to handle urgent messages on an expedited basis and the extent of the traffic load on the line. With no urgent messages or with both regular and urgent messages and light loads, only two reperforator-transmitters are used. With heavy traffic and urgent messages, the third reperforator-transmitter is used to handle urgent messages only.
- 2.31 *Outlying Station:*** Any station on a line served by the switching center, other than a local outlet.
- 2.32 *Processor:*** Business machine equipment, usually of the computer type, which performs all the functions of a switching center. It replaces reperforator-transmitters, directors, link circuits, transmitter start circuits, and similar teletypewriter and control equipment.
- 2.33 *Response Conditions:*** The transmitter start circuit at the switching center waits for a response after sending each TSC. If traffic is received, it sends out a LTRS LTRS signal to unblind receiving machines. The no traffic response is described in 2.27.
- 2.34 *Routing Code:*** A two-letter code which functions to call in the multiple address circuit at a switching center whenever a multiple address or group code message is received over a *trunk*. This code will indicate to the receiving center that transmission of the message to stations reached over the trunk is not required, thereby

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preventing the message from being sent back to the switching center from which it came.

2.35 Sequence Circuit: An arrangement at the switching center which prevents two regular directors from interfering with each other when they simultaneously make a bid for a cross-office connection.

2.36 SOTUS Motor Control Key: An external key mounted on the station control cabinet for controlling the power of the SOTUS. Operation of the key to the OFF position will disconnect the power, unless the SOTUS is in the deactivated condition or unless a transmitter start pattern is being sent. Power will be disconnected upon receipt of FIGS H LTRS at the end of a message or LTRS LTRS at the end of a transmitter start sequence.

2.37 Station Control Unit: A unit for controlling the starting of the station transmitter and for connecting and disconnecting the receiving machine. This control unit may be one of three types: one type employs a mechanical selecting device known as a SOTUS (Sequentially Operated Teletypewriter Universal Selector); another employs a transistorized unit known as the Electronic Receiving Selector Circuit; the third is a simplified circuit using stunt box control in 28-type teletypewriter equipment.

2.38 Switching Center: The station at which is located automatic relay switching equipment that guides messages to their destination. This equipment may be either Customer-Provided or Telephone Company-Owned, and may be conventional teletypewriter or business machine apparatus.

2.39 Switching Center Code: Special two-character code to direct a service message to a switching center. This code may be assigned to a local outlet in the switching center, or it may be arranged deliberately as a nonvalid code so that it will appear in miscellaneous intercept and cause an alarm.

2.40 Switching Center STC: This is a testroom which serves the switching center.

2.41 Transmitter Start Pattern: A group of teletypewriter characters sent in proper sequence on a line which causes the station control unit to start an outlying station transmitter. The third character in the pattern is called the Transmitter

Start Code (TSC). In the 81D1 system, priority traffic is picked up using different codes from those for regular traffic.

2.42 Transmitter Start Test Circuit: A central office test transmitter for sending test tapes to the station. It is arranged for remote control from the telegraph test position.

2.43 Trunk: A circuit connecting two switching centers. There are no intermediate stations on a trunk.

2.44 Urgent Message or Priority Pickup: An arrangement in 81D1 systems to give certain messages from outlying points priority in being picked up by the switching center. Urgent messages are inserted in the transmitter with an urgent message code and the priority key is operated. Such traffic may be given preferred handling in the switching center to route it ahead of regular traffic by provision of optional equipment. (See 2.43.)

2.45 Intentional Intercept: An arrangement provided in the switching center equipment which permits the center to intercept deliberately all messages destined for a particular station.

3. OFFICE RESPONSIBILITIES

3.01 The responsibilities of network control, circuit control, and STC offices are as outlined in Section 660-202-010. In addition, the control office at a switching center will have additional duties as covered below.

3.02 On some networks there may be intra-exchange lines and stations controlled by forces other than the switching center STC. The switching center STC does not test or maintain these lines and stations. In these cases, arrangements should be made to have the forces involved furnish the STC information concerning interruption, service matters needing supervision, status of circuit and service orders, and other pertinent matters that should be handled with either the customer or the network control office.

3.03 A switching center STC shall also maintain an up-to-date circuit layout record card file for all circuits operating into the center. It shall ascertain that layout cards include all valid codes and station equipment for each point on each circuit.

3.04 It is the responsibility of a switching center STC to obtain and examine all service orders covering code changes at points served by its lines. It shall make certain this information is furnished those test rooms serving points equipped with master stations. When code changes occur, they must be coordinated with these stations, the point involved, and the switching center.

3.05 Circuit layout record cards should contain information as to the network control office, location of switching centers, details of stations; equipment, etc. The information needed in the preparation of a layout record card is contained in the service order and plant and engineering supplements. It shall be the duty of the control office to submit a correction to any circuit layout record card not containing sufficient detail for the efficient supervision of the performance of the overall system.

4. HANDLING TROUBLE REPORTS

4.01 Due to the design of these switching systems some types of trouble may result in lost or misdirected messages. It is therefore essential that a complete and accurate description of each trouble be obtained from the customer. Significant information should be passed at once to the control office. The switching center can then be advised and take the necessary steps to either stop traffic or employ special operating procedures.

4.02 Telegraph service men at a switching center STC should be thoroughly familiar with the network. They should be able to identify lines or trunks involved in a particular transmission by reading monitor copy. To do this it is essential that they have a working knowledge of the switching center and the outlying station equipments as well as the customer's operating instructions.

4.03 Telegraph service men at every STC should have a complete understanding of the function of the directing codes and switching characters required on every transmission. They should also understand the purpose as well as the procedure for the various tests necessary for maintenance.

4.04 The testroom procedure for handling cases of trouble is outlined in Charts 1, 2, and 3. These charts were prepared because of the special handling required in connection with patching, splitting, and removing or restoring drops. They

do not cover all of the circumstances that can develop from a trouble report. They are in no sense a substitute for circuit knowledge and judgment in clearing cases of trouble. The instructions in the charts apply to circuit control, section control, and terminal offices unless otherwise stated.

4.05 When reroutes are required on multistation lines, it is not necessary that the sections remain in tandem. Side legs can be added from any point, the only requirement being that the stations must remain on the same circuit and work into the same switching center after the reroute. Care should be taken to assure that patches are made to the proper side of the duplex.

4.06 At telegraph board (TLT) offices compensating resistors should be available to replace loops or repeaters which must be removed. These are usually 153-type resistance plugs. However, where loops exceed the value of these plugs, a jack terminated resistor equal to the loop should be provided.

4.07 Loop switchboards are provided at outlying stations, except some of those equipped with the simplified control circuit, to facilitate trouble location on drops. *Station tests as covered in Part 6 should be made only after other checks indicate the trouble locates on your drop, or when it is necessary to verify a trouble report which described a condition of station trouble.*

4.08 The station arrangements at switching centers will permit patching loops. The station equipment may be isolated by opening the set jacks of the loop switchboard in the usual way. The loop switchboard does not provide for patching station equipment. When trouble is experienced with reperforator-transmitters, the units are replaced in the cabinets. Defective incoming and outgoing line relay circuits, directors, etc. are replaced by patching of individual units at the switching center patching bay. Troubles that are definitely isolated to the processor at CPE switching centers should be referred to the customer for clearing.

4.09 The MANUAL CUTON key at the customer's stations should be used judiciously. Customers may ask the advice of the telephone company before resorting to its use. It should be pointed out to the customer that all transmitter start codes and receiver connect codes will be received in addition to the normal copy. "Pile-ups" at the

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end of a line may occur due to the nonreceipt of the carriage return and line feed combinations during start patterns. However, where a serious delay in restoral of the SOTUS unit or electronic director to service will occur, these objections will usually be tolerated. The use of the MANUAL CUTON key in no way precludes the requirement that the switching center be requested to place the station on "intercept" in case the station control circuit trouble is not effectively bypassed by use of the key.

4.10 Power to the SOTUS unit motor may be turned off manually or by a time switch. However, the SOTUS motor control circuit prevents interruption of power unless the unit is in the activated condition. If the power switch is turned to the OFF position while the unit is deactivated, the motor will continue to run until FIGS H LTRS is received. The power to the rectifier in the control unit is not interrupted when the SOTUS motor is turned off. Thus the selector magnet is held operated and the activated condition retained even though the motor is stopped.

5. TEST SIGNALS

5.01 A source of signals containing the proper combination of teletypewriter characters is required for testing control circuits at both outlying stations and switching centers. Offices should utilize the test transmitter circuit per drawing 20518-SD. Test tapes containing the proper signals must be prepared locally and transmitted to the station. Use of a keyboard for testing should only be as a last resort when no other means are available.

5.02 Three basic test patterns are required for adequately testing control circuits. These are Transmitter Start Codes (TSC), Call Directing Codes (CDC), and RY signals.

5.03 The TSC pattern should contain the start and emergency stop codes for each station to be tested. In addition to valid codes, an invalid code should be included to insure that the station does not respond falsely. Some of the patterns are listed as follows.

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Transmitter Start	BLANK PAUSE SPACE LTRS LTRS
Emergency Stop	BLANK PAUSE X LTRS LTRS

ARINC COLLINS PROCESSOR

Transmitter Start	BLANK PAUSE SPACE SPACE SPACE LTRS LTRS
Emergency Stop	BLANK PAUSE X LTRS LTRS

BLANK, SPACE, LTRS, X each consist of a single character as shown on circuit layout record card. PAUSE may be either 0.4- or 0.7-second marking signal (depending upon type of switching center and outlying station provided) during which relay operation or mechanical functions take place. When using a test tape, the test transmitter has a timing circuit that halts the tape for the specified interval. The BLANK blinds the receiving teletypewriter. It is necessary to send LTRS LTRS to unblind the RO. Other systems may have different patterns as stated in 1.04.

5.04 The transmitter start patterns will be slightly different on those networks that use the stunt box control (Simplified Control Circuit) at outlying stations. The Transmitter Start Circuit at the Switching Center and the SOTUS units at all existing installations on the same line with the Simplified Control Circuit must be modified so that the last two characters of the TSC are VV and not LTRS LTRS. This change is made necessary by the circuit being under stunt box control and while the printing of control characters is suppressed, the introduction of a function such as LTRS shift could result in the receiving unit experiencing an undesirable case shift during transmission of a transmitter start sequence.

5.05 All stations equipped with the Simplified Control Circuit normally must be arranged to unshift on LTRS only. In some cases, the transmitter start circuit may be modified to send "BLANK PAUSE K" in which case the stations may be arranged to unshift on LTRS and SPACE.

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5.06	The CDC test pattern consists of activate and deactivate combinations together with valid, non-valid, and alarm check codes. The codes should be arranged so that the operation of a regular or check station can be tested. A check station is equipped as a master station. It is arranged to intercept messages containing garbled or non-valid codes. A typical test pattern is illustrated on Chart 6.		request the control office to have transmission stopped until this is accomplished. Terminate the loops so that any test transmission will include loop repeaters, if any. On TLT circuits compensating resistors must be patched in to replace the removed loops or repeaters.
5.07	Signals consisting simply of the letters R and Y repeated alternately serve to test SOTUS units for orientation range. An activate code (FIGS H LTRS) should be transmitted from the testboard prior to sending the RY test.	6.03	<i>Transmission Troubles</i>
6.	TESTROOM PROCEDURE FOR CLEARING STATION TROUBLES		
6.01	Before any station is removed from the circuit to investigate a trouble report, all tests outlined in Charts 1, 2, and 3, as appropriate, should be made. If a station trouble is indicated, proceed as outlined below.	(a)	Obtain a release and remove the station from the circuit as covered in 6.02.
6.02	<i>Release and Removal of Station from Service</i>	(b)	Using a test tape or position monitor keyboard, send the proper CDC or TSC to select the machine to be tested.
(a)	If the nature of the trouble is such that it is interfering seriously with handling business, notify the customer that it is necessary to remove his station from the circuit. Notify the control office to have the switching center put all machines served by the affected station control unit on SKIP and/or INTERCEPT immediately. If the trouble is not seriously affecting traffic but requires removal of the station for test, notify the customer his station will be taken off the circuit as soon as convenient. Request the control office to have the switching center put all machines responding to the affected station control unit on SKIP and/or INTERCEPT as soon as traffic is cleared.	(c)	With the assistance of the customer, make transmission tests of the affected station in the usual manner. Refer to Section 312-009-100 for test limits.
(b)	When the control office advises a station may be removed from the circuit, have the customer remove any tape from the transmitter of the sending teletypewriter. If the customer's send and receive loops can be removed without interrupting the main circuit, do so and terminate them in a test circuit. If removal of the loops will cause hits or interruption on the main circuit,	(d)	If station trouble is indicated, dispatch a maintenance man, advising him of test results.
		(e)	While the repairman is enroute, if service can be furnished in a limited way or on apparatus not in trouble, notify the control office and restore the station to the circuit as covered in 6.06. When the repairman arrives and the station must be removed again, obtain a release according to 6.02.
		(f)	When repairs have been completed, make sufficient tests to verify the trouble has been cleared.
		(g)	If tests are satisfactory, have the repairman see that no tape remains in the transmitter, that all switches are normal and no alarms are indicated. Return the station to service according to 6.06.
		6.04	<i>Switching Function Troubles (Transmitting)</i>
		(a)	Obtain release and terminate as covered in 6.02.
		(b)	Have customer prepare a test tape and place it in the transmitter of the sending teletypewriter. Operate priority key if test is to include a priority start pattern.

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- (c) Patch the output of the transmitter start test circuit into the test circuit to which the customer's R leg is connected. Make certain that the station receives the same type of signals it normally receives from the circuit. With the position monitoring TTY, send FIGS H LTRS to make sure the SOTUS is left activated.
- (d) Patch a monitoring TTY to the TLT or hub to which the customer's S leg is connected.
- (e) From the transmitter start test circuit send the proper TSC test pattern to the station. Insert the proper tape so that the BLANK in the TSC is over the sensing pins. Momentary operation of the A1 key at the test position (or A key on the equipment panel) will cause one complete TSC to be transmitted. The test tape at the station should be picked up on the customer's send loop.
- (f) Remove the tape from the station transmitter. Send the proper TSC for the station and observe that the H response is received over the send loop.
- (g) If the transmitter starts and stops properly and transmission measures within limits, investigate the possibility of circuit trouble, equipment trouble at the switching center, or a came clear condition. Take appropriate action to have any found trouble condition cleared.
- (h) If the transmitter fails to start and stop properly, send a maintenance man to the station, notifying him of results of the tests.
- (i) If customer desires some degree of service while the maintenance man is enroute, notify the control office and restore as covered in 6.06.
- (j) When the maintenance man reaches the station, he will request such tests from the STC as may be required. Trouble may be caused by any of the following:
 - (1) Poor transmission. This may have been evident if test under 6.03 was made.
 - (2) Apparatus or control circuit trouble. The SOTUS unit tolerance can be checked by sending the RY test signal from a test tape.

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Be sure to send FIGS H LTRS to activate the SOTUS before sending RY.

- (k) After the trouble has been cleared, make sufficient tests to verify both the send and receive sides of the station operate properly. Restore the station to the circuit according to 6.06. Monitor both the send and receive sides until a satisfactory transmission has been observed on the circuit.

6.05 Switching Function Troubles (Receiving)

- (a) Obtain release and terminate the customer's send and receive loops as covered in 6.02.
- (b) Patch the output of the transmitter start test circuit to the R leg of the station to be tested. Make sure the station receives the same type of signals it normally receives from the circuit. Send one or more of the following tests, as required, using the proper test tape. The level of D key should be straight out so that the TD will be free-running, starting and stopping it with the 552A key at the telegraph board.
- (c) To test for failure to connect, disconnect or deactivate or for errors or extraneous characters at the beginning of a message, send a test similar to that shown on Chart 6. This contains a test for connect and disconnect on both false and valid codes. If the test on Chart 6 were used, a station in satisfactory operating condition and equipped as a master or check station would print:

A

ALARM

B

C

D

E

F

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These characters should appear along the left margin only, as shown above. If the station should connect on an invalid code, one of the numerals at the beginning of the test would appear (1, 2, 3, etc). If one of the letter test characters should fail to appear, it is evident there was failure to connect on a valid code. Tests are recommended of sufficient duration to provide reasonable assurance that the connect, disconnect, and deactivate features (and master station alarm features if applicable) are functioning satisfactorily.

(d) To test for failure to blind a receiving machine during a transmitter start pattern or for errors or extraneous characters occurring at the time, send transmitter start patterns to the station while it is connected. Nothing should print on the receiving machine. Send LTRS LTRS to the station to see that it unblinds.

(e) For tests other than above, it will be necessary to prepare special tests locally on a test tape. Supplemental tests may be sent by keyboard from a KSR monitoring TTY. However, in most cases where the foregoing tests will not suffice, it will probably be desirable to dispatch the maintenance man to the station before making special tests.

(f) If tests are satisfactory, investigate the possibility of incorrect switching characters received, circuit trouble, or a came clear condition.

(g) If station apparatus does not function properly on any one of the foregoing tests, send a maintenance man to the station, notifying him of results of the tests.

(h) Same as 6.04(i).

(i) Same as 6.04(j).

(j) When the maintenance man reports the trouble has been cleared, make tests as outlined in 6.04 and 6.05 to see that the apparatus functions properly. When tests indicate trouble is cleared, restore the station to the circuit as outlined in 6.06.

6.06 Restoring a Station to Service**SECTION****TITLE**

(a) Have the SOTUS or station control in the activate condition by transmitting FIGS H LTRS from a monitor TTY to the R loop and restore the local customer's send and receive loops to the circuit. Remove any compensating resistances used. If practicable, wait for the A side of the circuit to go idle before restoring the R loop to avoid picking up a partial message.

(b) Notify the circuit control office that the trouble has been cleared (or cleared out) or routine maintenance work (as covered in Part 7) has been completed and the station is back on the circuit. When the control office acknowledges this report, assume service to be restored.

(c) Notify the local customer that his action has been restored to normal service and to discard any extraneous copy he may have received on the RO. If the station has no tape to transmit, have the customer prepare a short test message addressed to his own station and insert it in the TD so the Telephone Company can observe the start of the transmitter.

(d) The circuit control office should immediately notify the switching center to resume service to that station and discontinue "skip" and "intercept".

(e) Monitor both sides of circuit until satisfactory operation is assured.

7. ROUTINE MAINTENANCE

7.01 Release of stations for routine maintenance will be initiated by the STC. The switching center may be notified by means of a service message from the station to be routined. Some computer type processors can be programmed to recognize a request for release and automatically place the station on "Intercept". In any case, the maintenance man will call the STC to initiate release procedures.

7.02 On some systems the customer's requirements may demand routine maintenance during nonservice periods. On other systems, requests for releases must be made in advance of the day the work is to be done. Such arrangements should be made locally if possible. Any disagreement between the customer, STC, or maintenance people

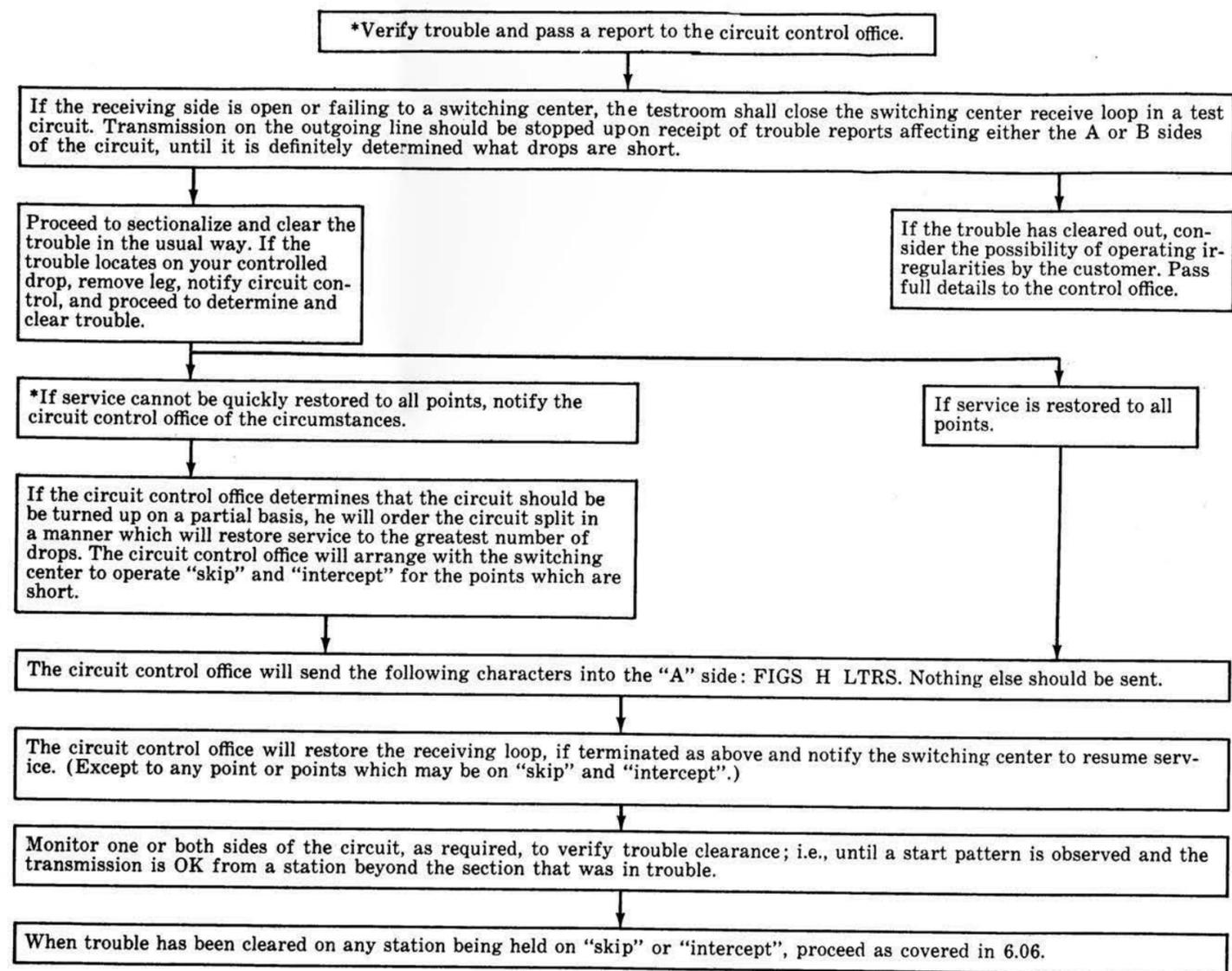
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| | should be referred to the control office for handling with the switching center. |
| 7.03 | In those cases where arrangements for release are to be made in advance, they should be made 24 hours prior to the time desired. Appointments should be made by the STC calling the local customer who will check with the switching center to determine whether the time selected is satisfactory. If the time proposed is not agreeable, the customer will suggest other periods which may be available. |
| 7.04 | If advance arrangements are not necessary, normal routine procedures will apply as outlined in 7.05. |
| 7.05 | By following the procedures outlined below, routine maintenance is done first on the sending station, then on the receiving station. In this manner, the total out-of-service time is kept to a minimum. <ul style="list-style-type: none">(a) When the maintenance man has reached the station and obtained from the customer the necessary authority for the release of the apparatus he will advise the testroom that he is ready to proceed with the routine.(b) The STC will notify the circuit control office that a release has been obtained for routine maintenance work and request that the station be placed on "skip".(c) The control office will arrange with the switching center to have the station placed on "skip" and notify the STC when this has been done.(d) The STC will remove the customer's S leg from the circuit and terminate it.(e) Notify the maintenance man that the sending leg has been removed and he can proceed with his work as covered in Section 580-100-500.(f) When requested by the maintenance man, arrange in the same manner to have the station placed on "intercept" and terminate the R leg at the STC. |

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| | (g) Upon completion of the routine, make tests in accordance with Part 8. |
| 8. | TESTS FOLLOWING ROUTINE MAINTENANCE |
| 8.01 | Make the following tests when requested by the maintenance man. <ul style="list-style-type: none">(a) Receiving tolerance of SOTUS, if station is so equipped.(b) Receiving tolerance of ASR and RO TTYs.(c) Receiving tolerance of typing reperforator, if provided.(d) Test transmitter start feature and transmission from all transmitters, including those associated with the autoaddress equipment.(e) Connect and disconnect features of station control.(f) Test to assure that receiving machine blinds on receipt of transmitter start pattern; also that it unblinds on LTRS LTRS following the transmitter start pattern.(g) Operation of auxiliary features such as line release delay, tape feed out, master station alarms, etc. |
| 8.02 | The test procedures are detailed in Part 6. |
| 8.03 | When all of the above tests have been made and all requirements met, restore the station to service in accordance with 6.06. |
| 8.04 | It is the responsibility of the outlying point STC to be sure the station is in satisfactory working condition before it is turned up for service. When routine maintenance is performed outside of service hours, it is especially important to see that all features of the station are restored to normal to avoid a failure at the start of the next service period. |
| 9. | RELEASES FOR REASONS OTHER THAN TROUBLE |
| 9.01 | As stated in 1.03, except for cases of trouble, patches on facilities carrying 81-type teletypewriter systems should be made or removed |

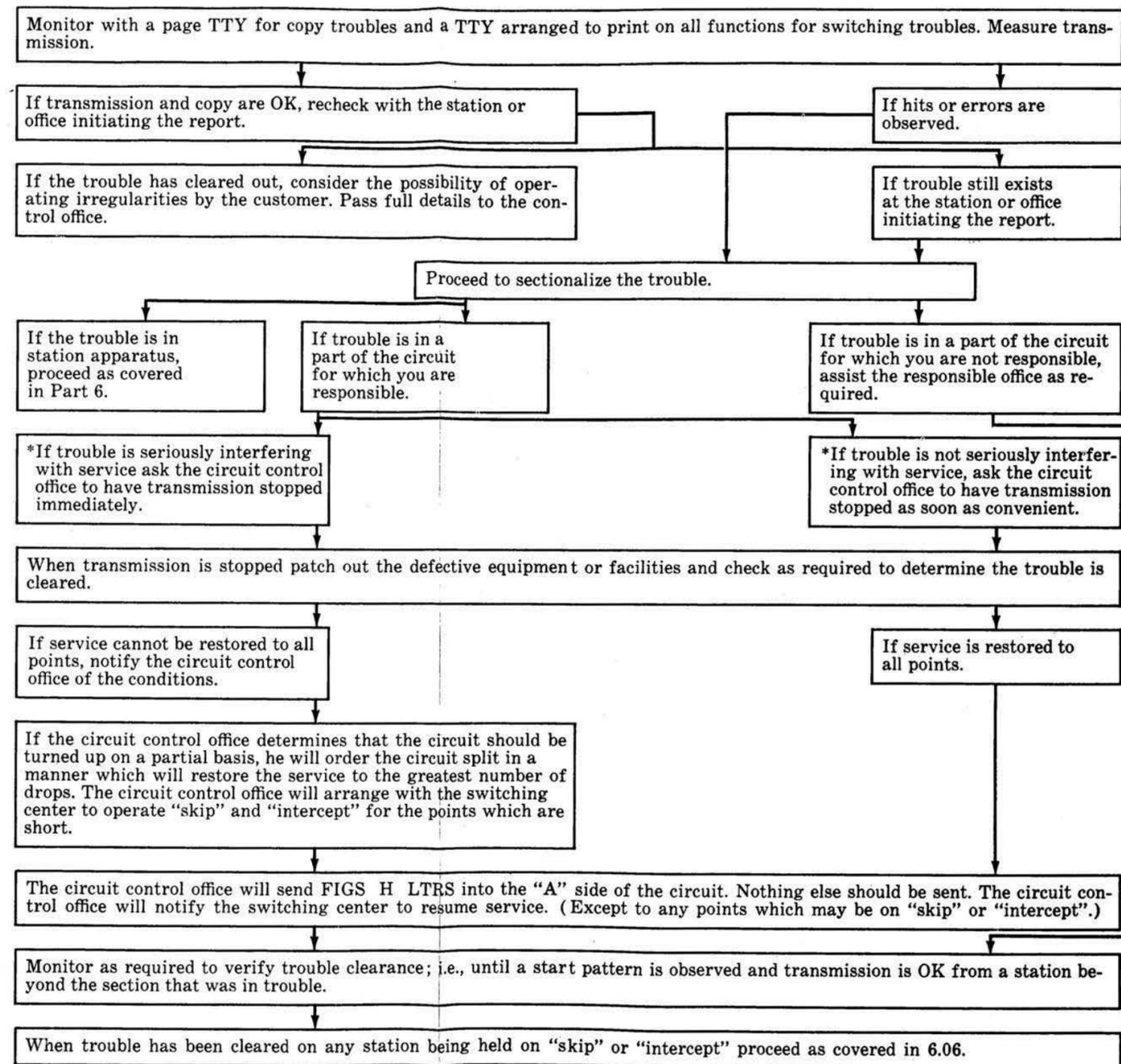
SECTION	TITLE	SECTION	TITLE
	only during nonservice or light load periods. There may be certain circumstances where it is necessary to deviate from this rule. Tests in connection with other circuits, construction work, and circuit maintenance work which cannot be conveniently deferred are examples of such circumstances. In such cases the patch should not be made without the control office obtaining a release from the customer at the switching center.	312-009-100	TTY Stations—Orientation and Distortion Tests
		580-100-500	81-Type Systems—Station Performance Tests
		570-201-100	Sequentially Operated Teletypewriter Universal Selector (SOTUS)
		570-201-101	Description and Theory of Operation of BS6 Sequential Selector
		580-101-100	81D1 Teletypewriter Switching System—Description
		580-101-101	Improvements in 81D1 Teletypewriter Switching System, Including 100 Speed Operation
		SD-70882-01	Electronic Receiving Selector Circuit
		SD-70883-01	Station Control Circuit (For Elec. Director)
		*CA-16754	Station Control Circuit—Simplified for Stuntbox Control
			* Long Lines Engineering—Central Area
9.02	If the release is granted the control office should inform the noncontrol office involved to proceed with the patch. When the patch is completed, the control office should transmit FIGS H LTRS on the "A" side and notify the switching center to resume service. All testrooms involved should monitor both sides of the circuit until a start pattern is observed and transmission is satisfactory from a station beyond the patched section.		
9.03	At the expiration of the release time, the circuit control office should activate the SOTUS units or station control circuits by transmitting FIGS H LTRS on the "A" side of the circuit. If the customer cannot arrange to grant a daily periodic release for circuit maintenance work, such releases should be obtained as prescribed in 9.01 and 9.02.		
10. OTHER BSP REFERENCES AND DRAWINGS			
10.01	The following are Bell System Practices and drawings related to this section.		

CHART 1 — REPORTS OF OPEN CIRCUIT, FAILING, UNUSABLE COPY, ETC.



*The circuit control office will pass these reports to the switching center. The customer's operating instructions for switching centers do not prescribe that message transmission on an outgoing line or trunk be stopped when a "line trouble" signal is received at the control board following an open of one-half second or more on the associated incoming line or trunk. This situation may result in a number of messages being lost in transmission when the trouble affects both sides of the circuit. The testroom should request the switching center to stop transmission immediately on an open line or trunk circuit, except when it is known that the trouble does not affect the transmitting side.

CHART 2 — REPORTS OF HITS OR ERRORS

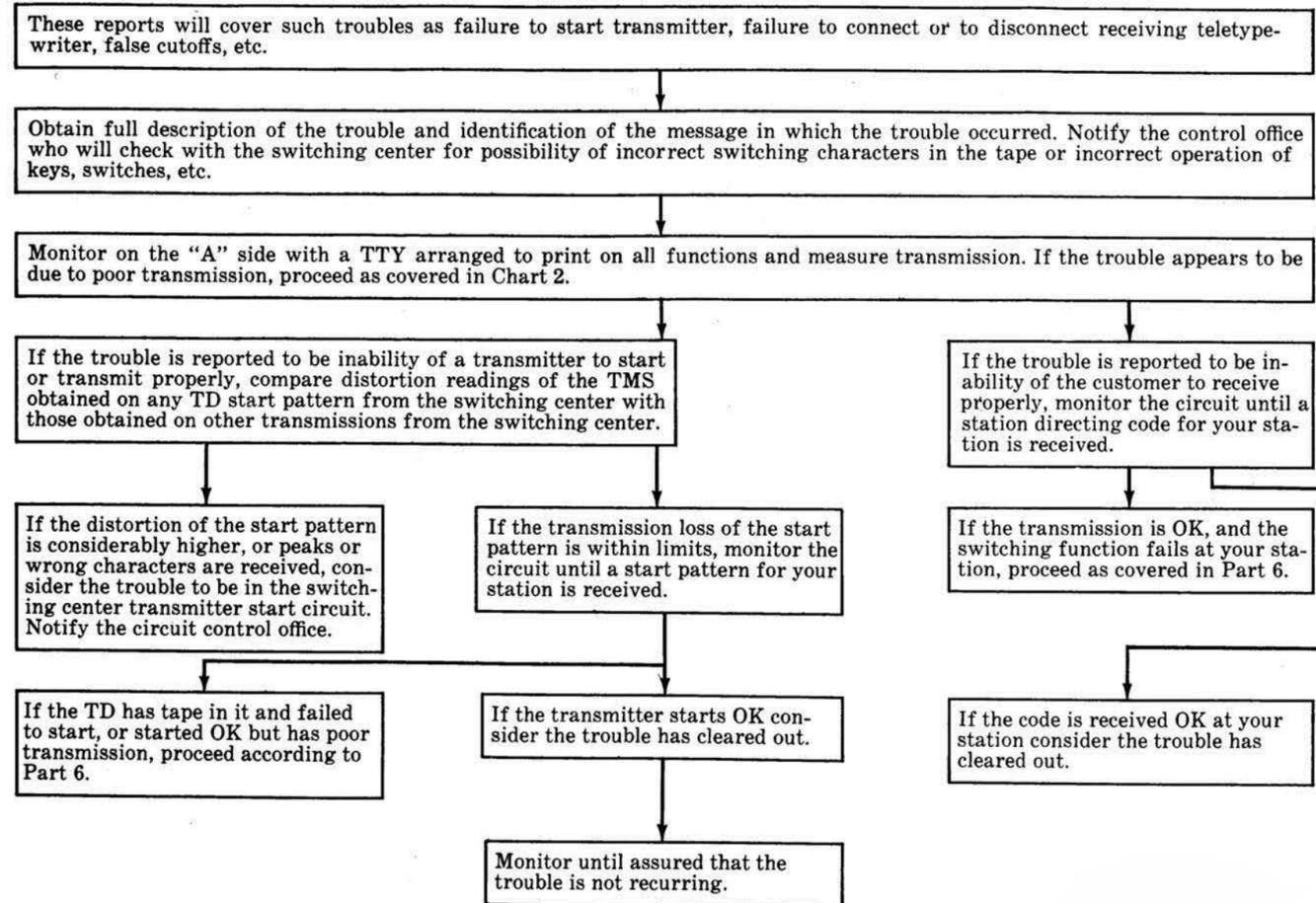


*The circuit control office will pass these reports to the switching center.

CHARTS 1 AND 2

CHART 4 - AUTOMATIC ADDRESS EQUIPMENT ALARM INDICATIONS, CONDITIONS AND CORRECTIVE ACTIONS AS COVERED IN CUSTOMER'S OPERATING INSTRUCTIONS

CHART 3 - REPORT OF SWITCHING FUNCTION TROUBLES



ALARM INDICATION			CORRECTIVE ACTIONS	
KEYBOARD AND OPERATOR CONTROL PANEL	REPERFORATOR-TRANSMITTER CABINET	CONDITION	KEYBOARD AND CONTROL PANEL	REPERFORATOR-TRANSMITTER CABINET
Red BSY lamp, keyboard disabled immediately.	Audible alarm, MCH, ALM, red lamp No. 1 or No. 2 depending on machine affected.	Machine trouble, reperforator-transmitter unit not responding to signals sent from keyboard.	<ol style="list-style-type: none"> 1. If recording message operate COPY key to release keyboard, continue typing message. Operation of COPY key lights C lamp. 4. If trouble period extended, continue at KSR under "copy" condition. Arrange for messages to be transmitted from ASR. 6. When BSY lamp restored indicating normal conditions, operate COPY key which will restore C lamp. 7. Resend messages typed while COPY key was operated, if not handled per Step 4. 	<ol style="list-style-type: none"> 2. Press ALM SUP to silence buzzer. 3. Examine tape <ol style="list-style-type: none"> (a) If taut or bunched, correct condition, reset for repeat of interrupted message. (b) If damaged, advance and resend lost portion. (c) If mechanical trouble, report to Tel. Co. 5. After trouble cleared, operate ALM RELS key to restore lamps.
Red BSY lamp, keyboard disabled immediately.	Audible alarm, TAPE OUT alarm, red lamp No. 3 or No. 4 depending on reperforator-transmitter stopped.	Torn tape—operation of tape out pin stopping transmitter.	<ol style="list-style-type: none"> 1. If recording message operate COPY key to release keyboard, continue typing message. Operation of COPY key lights C lamp. 5. If trouble period extended continue at No. 15 under "copy" condition. Arrange for messages to be transmitted from No. 19. 8. When BSY lamp restored indicating normal conditions, operate COPY key which will restore C lamp. 9. Resend messages typed while COPY key was operated, if not handled per Step 5. 	<ol style="list-style-type: none"> 2. Press ALM SUP to silence buzzer. 3. Operate appropriate TRANS STOP key No. 1 or No. 2. 4. Examine tape <ol style="list-style-type: none"> (a) If undamaged, reset and close gate. (b) If damaged, advance and resend from No. 15. (c) If mechanical trouble report to Tel. Co. 6. After trouble cleared, operate ALM RELS key to restore lamps. 7. Restore TRANS STOP key to normal.
Red BSY lamp, keyboard disabled at end-of-message.	Audible alarm, TAPE REEL OUT alarm, red lamp, No. 6.	Low tape at either reperforator-transmitter.	<ol style="list-style-type: none"> 1. Operate COPY key to release keyboard for recording messages. Operation of COPY key lights C lamp. 5. If tape supply cannot be replenished for extended period, continue at No. 15 under "copy" condition. Arrange for messages to be transmitted from No. 19. 8. When BSY lamp restored indicating normal conditions, operate COPY key to restore C lamp. 9. Resend messages typed while COPY key was operated, if not handled per Step 5. 	<ol style="list-style-type: none"> 2. Press ALM SUP to silence buzzer. 3. Operate appropriate TRANS STOP key No. 1 or No. 2. 4. Replenish tape supply. 6. Restore TRANS STOP key to normal. 7. Operate ALM RELS to restore lamps.
Red BSY lamp and keyboard disabled immediately.	Audible alarm, FUSE ALM, red lamp, No. 6.	Blown fuse in automatic address cabinet. (dc power)	<ol style="list-style-type: none"> 1. If recording message operate COPY key to release keyboard, continue typing message. Operation of COPY key lights C lamp. 6. If trouble period extended, continue at No. 15 under "copy" condition. Arrange for messages to be transmitted from TD. 10. When BSY lamp restored indicating normal conditions, operate COPY key which will restore C lamp. 11. Resend messages typed while COPY key was operated, if not handled per Step 6. 	<ol style="list-style-type: none"> 2. Press ALM SUP to silence buzzer. 3. Operate TRANS STOP key No. 2. 4. Operate BUSY key. 5. Report to Tel. Co. 7. When fuse replaced, FUSE ALM restored. 8. Reset tape, restore BUSY key. 9. Restore TRANS STOP No. 2.

CHART 5 – OUTLYING STATION ALARMS AND CORRECTIVE ACTION AS COVERED IN CUSTOMER'S OPERATING INSTRUCTIONS

ALARM INDICATIONS		CONDITIONS	CORRECTIVE ACTIONS
AUDIBLE AND VISIBLE	TELETYPEWRITER MACHINE CONDITION		
Condition 1 All Stations Audible alarm White lamp No. 1	(a) If connected, RO will run open. (b) If not connected, alarm cannot be restored until line closes.	Open receiving line or loop.	1. Press AUD SUP to silence buzzer. 2. Report condition immediately to Tel. Co. 3. MASTER STATIONS ONLY Report to switching center giving time of open line alarm. 4. Press ALM RELS to restore lamps.
Condition 2 MASTER STATION ONLY Audible alarm White lamp No. 1	RO printing, unable to restore alarm until end of message.	Message with NO assigned directing code for the circuit.	1. Press AUD SUP to silence buzzer. 2. Report to station originating message for correction. 3. Report to Tel. Co. 4. Press ALM RELS to restore lamps.
Audible alarm (No lamp)	Audible signal with NO lamp operated.	Blown fuse in station control unit.	1. Press AUD SUP to silence buzzer. 2. Report to Tel. Co. 3. Report to switching center identifying last three messages and time trouble occurred.
Audible alarm White lamp No. 1 and red lamp	(a) Transmission interrupted. (b) Transmission just completed (no other station started).	Emergency stop operated by the switching center affecting first sending position.	1. Press AUD SUP to silence buzzer. 4. Press ALM RELS to restore lamps.
At first SEND POSN Audible alarm White lamps No. 1 and No. 2		Note: Occurs when emergency stop operated by the switching center affects second sending position.	2. Reset tape in transmitting reperforator-transmitter. 3. Notify sending station No. 1 that tape has been reset.
Second sending position Red lamp (No audible)	(a) Transmission to line interrupted. (b) Transmission to line just completed no other station started.	Emergency stop operated by the switching center.	

CHART 6 – RECEIVER TEST TAPE

Sample of characters perforated in a test tape for a master or check station having an individual connect code of BP, group codes GE, GF, GK, GX, and XC. There are other stations on the same line, having the following codes: BN, GC, XR, BA, GD, DJ, DX, DY, and CE.

↓↓↓↓↓↑↑#↓BP↓<≡↓A↑#↓BN↓<≡↓↑↓<≡↓↑#↓GC↓<≡↓↑2<≡↓↑#↓
 XR↓<≡↓↑3<≡↓↑#↓BA↓<≡↓↑4<≡↓↑#↓GD↓<≡↓↑5<≡↓↑#↓
 DJ↓<≡↓↑6<≡↓↑#↓DX↓<≡↓↑7<≡↓↑#↓DY↓<≡↓↑8<≡↓↑#↓
 CE↓<≡↓↑9<≡↓↑#↓YY↓<≡↓ALARM↑#↓
 GE↓<≡↓B↑#↓
 GF↓<≡↓C↑#↓
 GK↓<≡↓D↑#↓
 GX↓<≡↓E↑#↓
 XC↓<≡↓F↑#↓

Only the characters shown above should be perforated in the test tape. If the tape is spliced so that it is circular, mark the LTRS characters at the beginning of the test. The proper starting point for a test is with any one of these LTRS above the sensing pins of the test transmitter. Each test tape should contain the CDCs of the station it is to be used to test, plus codes for other stations on the same line. Numerals appear after the CDCs for other stations, letters after CDCs for this station. If a numeral is printed on machine being tested it indicates trouble. (See 6.05.)