CONTROLLED MAINTENANCE PLAN
FOR SWITCHING SYSTEMS
GENERAL

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1. GENERAL

1.01 This section describes the general plan for the maintenance of switching systems. It applies to all switching systems and gives the general principles, definitions, descriptions, explanations, and examples of the controlled maintenance concept. The General Controlled Maintenance Plan is supplemented by an application section for each of the switching systems. The application sections expand and detail the contents of the plan and provide the essentials necessary to apply controlled maintenance to the various switching systems. Refer to the appropriate layer index of Bell System Practices for the various application sections. It is imperative that persons involved in either the maintenance of switching systems or the implementation of controlled maintenance programs be thoroughly familiar with the information contained in this section prior to the use of the specific application sections for the various switching systems. If the controlled maintenance plan for the central office is administered in conjunction with a switching control center, refer to the 190 series of Bell System Practices as required.

1.02 Whenever this section is reissued, the reason for reissue will be stated in this paragraph.

1.03 Recommendations for changes, additions, or deletions to this section or to any of the controlled maintenance documents, should be made on Form E-3973 as specified in Section 000-010-015.

2. CONTROLLED MAINTENANCE

2.01 The word ***maintenance*** as it is used in this section refers to testing, inspection, adjusting, lubrication, cleaning, repair and analysis work. Within the telephone industry this work is known as "upkeep". In the maintenance of switching systems there are two basic types of maintenance activity—***preventive*** and ***corrective.***

- Preventive Maintenance is the term applied to the activities of locating, repairing, and recording troubles (service-affecting or not) which result from scheduled routine work. It also applies to troubles which are discovered by any manually initiated diagnostic program in Stored Program Controlled Systems (SPCS).

- Corrective Maintenance consists of the activities of logging reports, locating, repairing and recording details of troubles reported by customers, operators, alarms, other offices, testboards, and other sources. In SPCS systems this includes maintenance teletypewriter printouts resulting from failures encountered during call processing or system-initiated automatic testing. A vital part of corrective maintenance is the analysis of trouble reports, trouble indications, and network administration data to locate hidden troubles or to make modifications to the preventive maintenance schedule.

2.02 Controlled Maintenance is the term applied to the general plan described in this section and the specific switching system plans (described in the various application sections) for managing upkeep maintenance in a central office. Controlled Maintenance is a series of actions or activities formulated to maintain the designed switching capability of the equipment using a realistic balance between preventive and corrective maintenance. The effective implementation and ongoing use of a controlled maintenance plan is a major contributing factor to providing customers with service excellence and minimizing operating expenses.

2.03 The series of forms described in this section have been designed to be used in the controlled maintenance effort. These forms will be used as the primary tools for scheduling and documenting the day-to-day preventive and corrective maintenance activities and the functional performance level of the central office.

2.04 The use of these forms alone will not automatically insure that an effective Controlled Maintenance Plan is in effect or that the office performance index objectives will be achieved. Primary emphasis is to be placed on the timely and satisfactory completion of all maintenance requirements. The completion of the necessary forms documenting these activities and their careful analysis will define what alterations are necessary to office maintenance practices in order to achieve the desired performance objectives. The use of these forms will be of particular importance to

offices reporting performance in Band C or D (Network Switching Performance Measurement Plan) or offices undergoing operational reviews.

2.05 In the maintenance of a switching system, the maintenance plan cannot be either totally preventive or totally corrective. A total preventive maintenance plan would be quite expensive, resulting in prohibitive service cost. In addition, the excessive amount of manual testing and repair work would likely result in work errors and possibly degrade service. However, preventive maintenance cannot be completely eliminated. There are some central office equipment areas for which it is not possible to promptly receive adequate trouble details for trouble location. This condition requires that periodically these equipment areas be tested due to:

- Lack of internal circuitry designed to detect and report failures.
- The inability of the user (customer or operator) to provide an accurate and sufficient description of observed troubles. Preventive maintenance provides an effective and economical method for locating and repairing these troubles through the use of automatic and manual testing.
- The criticality of the circuit combined with infrequent use requires that a periodic test be made to assure that the circuit will operate properly when needed.
- The need to periodically adjust, clean, and lubricate some types of switching equipment.

2.06 The balance between corrective and preventive maintenance requirements depends upon the switching system. The more sophisticated systems rely heavily on corrective maintenance because of their increased ability to detect and report most equipment failures. The more advanced systems also have the ability to remove defective units from service and minimize any impact, if any, on customer service. The less sophisticated systems do not have the same capability to detect failures and remove equipment from service. These systems must rely on periodic manual testing to locate faulty circuits.

2.07 The key to the proper use of corrective and preventive maintenance in the Controlled Maintenance Plan is the Equipment Test List (ETL). These lists contain all the test requirements for central office equipment, both preventive and corrective. Tests are classified according to the criteria described in Part 4. The ETLs are found in the various divisions of Bell System Practices and are generally numbered XXX-001-011 to XXX-001-019.

2.08 Each Controlled Maintenance Plan provides a System standard method and forms for the testing and repair of switching systems. Its objective is to maintain the designed capabilities of switching equipment. Fig. 1 depicts an overall view of the plan. Inside the dashed box are the activities associated with Controlled Maintenance—Corrective Maintenance on the left and Preventive Maintenance on the right.

2.09 It is important to note that the source of corrective maintenance activities is ***expected troubles.*** The design of a switching system allows for a certain number of expected troubles resulting from either equipment failure or human error. It would be economically unfeasible to design, build, and maintain a trouble-free switching machine.

2.10 Each central office has a practical operating level that consists of a balance between the number of troubles, cost of maintenance, performance measurements, and rate of trouble reports. This level will be different for each machine depending on the environment in which it operates.

2.11 For some troubles, the indicators received will lead maintenance personnel directly to the source of the trouble. In other cases, a single indicator of trouble is not sufficient to locate the source and the accumulation of several trouble indications may be necessary to locate the trouble and initiate corrective action.

2.12 There are two basic reasons for preventive maintenance activity. One is the need to perform routine maintenance on equipment to prevent the occurrence of trouble. The other is to detect expected troubles for which the failure indicator is either unavailable or unreliable. For these troubles, periodic routines are conducted to determine (1) if troubles exist and (2) where the troubles are located. The activities which follow are the same for either source.

2.13 In Fig. 1 (center of dashed block), the ANALYZE RESULTS and MODIFY PREVENTIVE MAINTENANCE SCHEDULE blocks represent two activities which are essential to an effective and complete Controlled Maintenance Plan. It is of utmost importance that periodically the results of the corrective and preventive maintenance activities be analyzed and the preventive maintenance schedule changed as required. Routines may be scheduled on a more frequent basis if performance indicators or maintenance records show an inordinate number of troubles or potential troubles in a given equipment area. Under no circumstances should scheduled preventive maintenance tasks be backlogged, i.e., MW routines. See 5.28 and 5.29.

2.14 There are Controlled Maintenance Plans for the various types of equipment found in a typical central office, i.e., transmission equipment, switching equipment, etc. It is the responsibility of the central office supervisor to determine equipment responsibility, locate the Controlled Maintenance Plans for this equipment, and develop one overall, integrated plan for maintenance of this equipment responsibility area.

3. TROUBLES, THEIR CAUSES, AND INFLUENCING FACTORS

3.01 A trouble occurs when switching equipment fails to function as intended. The existence of trouble is noted when a customer or test call or diagnostic program is applied to the affected equipment and results in a report, a trouble recorder card, a maintenance teletypewriter (MCC-TTY) printout, or other indication. Customer service may or may not be affected, depending upon the nature of the trouble and the system design provisions for a second trial. When customer service is affected and the customer's call did not complete due to the trouble (or an overload), an ***ineffective attempt*** occurs.

3.02 Some equipment troubles are not immediately evident. System design does not always provide for an alarm or other indication each time a trouble is encountered. When troubles occur under this condition and the fault is limited to a customer's line, it is usually adequate to rely upon customer reports to obtain adequate information for trouble locating. However, when troubles occur in common equipment and the system does not provide adequate trouble identification, the maintenance forces may either be unaware of the trouble or have insufficient data to locate it. Analysis of trouble indicators such as trouble recorder cards is required for detecting these types of troubles.

Types of Trouble

3.03 Troubles are generally categorized into three different types:

- ***Solid Troubles (Faults)***—A solid trouble permanently affects the operation of the circuit involved, causing continuous failures.

- ***Intermittent and Transient Troubles (Errors)***—Intermittent troubles are those which continue to appear and disappear until they are cleared. For example, wire clippings may cause intermittent faults and may also cause trouble indications to appear in different locations. The operation of relays causes sufficient vibration to disturb wire clippings resulting in the trouble-causing contact being opened or moved to another location. Deteriorating components may also generate intermittent noise conditions which will cause sporadic trouble indications. Transient troubles are those which appear once and disappear. For example, an order to a network controller failed, but when the order was retried with the same controller, it passed.

- ***Marginal Troubles:*** Marginal troubles are failures of equipment under marginal tests applied by diagnostic program tests or by test sets. These tests are more severe than the demands normally encountered in service connections. Marginal tests (either electrical or mechanical) are applied to apparatus to determine if the required reserve is present. If marginal test failures occur, deterioration has used up the reserve, and corrective action must be taken before a service-affecting trouble occurs.

Causes of Trouble

3.04 The majority of troubles are the result of electrical or mechanical failures which are caused by one or more of the following conditions. Maintenance forces responsible for switching equipment must be familiar with these causes.

- ***Environment***—Environmental conditions in the forms of dirt, heat, and humidity can cause equipment failure. Dirt may come from within or from outside the central office. Lint from clothing or other textiles and fibers from paper or cardboard boxes and packing material are common kinds of dirt. Dirt may also be the result of dust brought into the building by people, equipment, or air. Dirt in the form of solid particles and residue also result from contact arcing.

  Switching Systems have been designed to operate over a variable range of temperature and humidity. However, the existence of high temperature and/or high humidity tends to change margin faults to solid trouble which may lead to catastrophic failure of the office.

- ***Wear***—The continuous operation of relays, switches, motor drives, brushes etc., results in deterioration. This wear can be accelerated by increases in friction due to dirt, inadequate lubrication, or faulty workmanship or material.

- ***Defects***—Failures of apparatus or components, such as open relay windings, circuit pack failures, internal crosses or grounds in spring assemblies, are called defects.

3.05 Central office troubles can also be caused by human errors which result due to:

- ***Work Errors***—Work errors are the result of carelessness, faulty workmanship, or improper procedures on the part of the central office maintenance force, other forces working in the office, or forces outside the office. These errors can be found in central office record information, service orders, transfer orders, circuit layout cards, etc., as a result of work errors by employees in other organizations. Deviation from established documented maintenance methods may also result in work errors.

- ***Design Errors***—In some cases, troubles are the result of errors or miscalculations that occur in the design process. These troubles appear only under a specific set of conditions and are extremely difficult to locate in a non-working, testing environment. They may appear as either hardware or software troubles.

Trouble Influencing Factors

3.06 Maintenance forces must be made aware of the central office maintenance practices which reduce dirt accumulation and work errors. The consistent use of these practices will reduce the number of troubles caused as a result of wear. These maintenance practices are described below:

- ***Installation Activity***—Installation activity is one of the controllable factors influencing central office trouble rates. It is essential that central office personnel and installation forces by thoroughly familiar with proposed work before it is started. Because of the complete integration of the units of an electronic switching system, the detailed knowledge of planned changes and their coordination is more critical than with electromechanical switching systems. The maintenance force must be totally familiar with instructions relating to central office equipment installation which are found in Section 201-112-001. These instructions explain in detail the procedures for protecting service and equipment during installation activity.

- ***Central Office Procedures***—Central Office personnel activities may cause troubles when proper procedures are not followed in the operation of the system. These procedures involve the use of manual system controls, maintenance programs, and the removal of equipment from service. The maintenance force may also cause failures by disturbing dirt already present in the system or by introducing additional foreign matter.

- ***Housekeeping***—Good housekeeping practices accomplish two important objectives in a central office. It minimizes the dirt, safety hazards, and other potential problems associated with unkept areas. Second, it assists in the establishment of an organized, smooth operating atmosphere which is an important part of central office maintenance. Material is not to be stored, unpacked, or crated in equipment areas. Tools, test equipment, drawings, and supplies should not be allowed to become dirt collectors.

Except when work is in progress, all equipment covers should be in place.

- ***Contractor/Visitor Activity***—Contractor (building/equipment alterations) and visitor activity can cause large amounts of dirt to be brought into equipment areas. Special protection, i.e., temporary dust proof partitions and special control of windows, doors, and ventilating equipment may all be required. Central office personnel should be on the alert for service or safety hazards and inform the contractor or the Building Engineer of the need for preventive requirements. Coordination with other departments and control of visitors during "Open House" and other such functions will also help to reduce many problems associated with dirt. Special caution should be taken when using electrical or electronic equipment in Stored Program Control System (SPCS) central offices. Equipment having electrical motors, such as floor buffers, should not be plugged into the frame base outlets. These outlets are provided for use with test sets and similar items. Some types of electronic flash attachments for cameras are capable of inducing voltages in the bus system and should not be used near frames and cable racks containing parts of the bus system.

- ***Other Forces***—Due to the ability of other departments (plant, network management, etc.) to directly access and/or change the office data of SPCS offices, there is an ever present opportunity for other forces to cause service-affecting troubles. All forces associated with the operation and administration of a central office must maintain close coordination in their procedures, records, and the design and implementation of changes to ensure trouble-free customer service. In addition, when other forces are required to work in the central office, the central office force is responsible for seeing that work is performed in a manner such that customer service is not jeopardized.

- ***Environmental Control***—Central offices are provided with equipment for filtering air and regulating humidity and temperature. The effective use of this equipment, combined with the controlled use of windows, outside doors, and openings between building areas will reduce the introduction and circulation of dirt. Care should be taken to prevent drastic changes in the environmental conditions of an office. Failure of environmental control systems may cause the conditions to change significantly from normal but remain within the limits of the equipment operating parameters. In such a situation, when the environmental control system is restored, it should be allowed to gradually return the condition to normal to avoid equipment reaction due to sudden changes in environmental conditions.

- ***Bell System Practices Application***—Bell System Practices prescribe the proper procedures for testing, inspecting, cleaning, removing from service, adjusting, and repairing of equipment. Work performed in accordance with these instructions will result in effective repairs without service reaction. Non-standard adjustments or repairs will be avoided.

Controlling Trouble

3.07 The control of central office equipment troubles is comprised of the following activities:

- ***Handling Trouble Reports and Trouble Indications***—The proper handling of troubles requires the completion of trouble reports with the relevant facts pertaining to the trouble indicated and the coordination and follow-up of troubles referred to or referred from the maintenance forces. This activity also includes keeping current status logs and historical data for future records or analysis. Prompt response and fast restoral of service through the use of trouble reports is a key part of the central office trouble control function.

- ***Detection of Obscure Troubles***—There is always the possibility that some service-affecting equipment troubles exist which are not clearly indicated by the system. Scheduled analytical trouble-seeking procedures to locate these troubles must be an integral part of the total maintenance plan.

- ***Arresting Trouble-Causing Factors—*** Control of dirt, limitation of wear, protection of equipment, prevention of work errors, and the minimizing of outages are the essence of the maintenance job. Maintenance personnel should thoroughly understand the operation of the equipment, the use of the maintenance program, the use of the test gear, and the significance of trouble reports.

4. PREVENTIVE MAINTENANCE

4.01 The basis for preventive maintenance activity is the Equipment Test List (ETL), Form E-5450. (See Fig. 2.) The ETL indicates which tests are required. The tests are scheduled in order to locate troubles for which indicators are obscure or to affirm the correct operation of selected critical equipment items for which in-service failures cannot be tolerated. Lubrication, inspection, cleaning, or adjustment routines are scheduled for some equipment in order to prevent failures. Fig. 2 also illustrates the use of the results of the analysis of maintenance records for evidence of increasing troubles. If that evidence exists, the management of the office must decide what modification can be made to the preventive maintenance schedule to correct the situation. In making the decision, management must be aware of all influencing factors, such as amount of deferred work, availability of manpower, etc.

> ***Note:*** For information concerning the Central Office Maintenance Management System (COMMS) and the automated administration of preventive maintenance programs, see 4.33 and 4.34.

A. Identification of Routines

4.02 The first step in creating a preventive maintenance program is the identification of all equipment found in a particular central office. A central office inventory will accomplish two things:

- Identify all of the equipment which may require scheduled manual or test frame tests.

- Develop work units for plant upkeep.

The second step is the identification and scheduling of all required routines. To assist in the identification process, ETLs have been created (Fig 3). The ETLs, which are companions to the test and inspection practices, are system standards for the application of maintenance instructions contained in the Bell System Practices. ETLs are numbered in the same series as the tests they cover. They are generally numbered from XXX-001-011 up to XXX-001-019.

4.03 Each ETL lists all tests, inspections, and other instructions prescribed for the switching system or equipment covered by the ETL. An action classification is assigned to each instruction, indicating the manner in which the instruction must be applied. For certain action classifications, the ETL assigns minimum frequencies of application.

4.04 These test intervals are specified to meet the needs of most central offices and are consistent with reasonable costs. The tests must be performed at the interval listed in the ETL or more frequently if conditions in the office dictate a shorter interval. The purpose of performing recurring work at the ETL frequency is to prevent accumulated equipment deterioration which may lead to customer service interruptions or expensive repairs. More detailed information on ETLs can be found in Section 010-300-011.

B. Classification of Routines

4.05 All tests, inspections, or other requirements in the ETL are given one of four classifications. The use of these classifications is described below. For simplification, the word ***test*** is used to mean a test, inspection, or other work requirement.

4.06 ***Mandatory Work (MW):*** MW tests are used to detect actual or potential failures, which could result in a severe service penalty, for which indications of a failure are missing or obscure.

- MW tests must be performed at a frequency equal to or more frequently than that specified in the ETL.

- Some equipment, such as test equipment, is shown as MW because of its important to the efficient operation of an office.

4.07 ***Mandatory Review (MR):*** MR tests are used to detect actual or potential failures, which do not result in a severe service penalty,

for which indications of a failure are missing or obscure.

- The test frequency assigned to MR routines indicates that a review must be made to determine if there is a need to perform the test.

- At the time of review, if the test (not a sample) has been performed on all units since the time of the previous review, no work is required unless a check of corrective maintenance data indicates otherwise. If the test has not been performed since the previous review, it must be performed on at least a sample of the units. If the total number of units is too small for sampling, all units must be tested. If a decision is made to pass a MR routine, a notation including the justification for the decision must be recorded on the Test and Inspection Summary, Form E-5453 and E-5454.

The MR test requirement could result in the need to only apply the test to a sample each time the test comes up for review. This application may be used if sample testing each time indicates insufficient trouble to warrant performing the test on all units. In the case of a number of units too small for sampling, the required action at review could alternate between testing all units and passing the test. Fig. 4 illustrates the MR review procedure.

4.08 ***Test Frame (TF):*** TF tests make use of automatic or semiautomatic test frames or test sets. Some TF tests require manual operations depending upon the nature of the test and the features of the test frame or test set. TF tests are mandatory tests and the frequency is determined and assigned by the maintenance supervisor. These tests shall be programed locally for each office. The frequency that is assigned to a test will depend on:

- The number of circuits to be tested

- The amount of trouble found by past tests

- The availability of the test frame for scheduled testing

(This frequency must be entered in the FREQ. column of the ETL used in the office.)

4.09 ***Trouble Test (TT):*** TTs are not performed at a specified frequency but should be used as required to verify and isolate troubles revealed by other indications or analysis.

4.10 For convenience in scheduling, MW, MR, and TF tests are grouped and the TTs are listed separately at the end of each ETL section. TTs are included in the published ETLs in order that every test and requirement has an assigned classification and to provide a ready reference for selecting tests for trouble clearing and equipment testing purposes.

4.11 In the ETL, the frequency for test scheduling is indicated by the following symbols:

Symbol	***Frequency***
D	Daily
W	Weekly
M	Monthly

Less frequent test intervals are indicated by a number prefix:

Symbol	***Frequency***
3W	Once every 3 weeks
6M	Once every 6 months
12M	Once a year
36M	Once every 3 years

The frequencies for some tests must be determined locally and are indicated by the following symbols:

Symbol	***Frequency***
#	Frequency data is contained in the ETL as a note following the test.
*	• For transmission tests, the frequency for performing this test depends upon the type of facility involved and can be determined from the appropriate Bell System Practice.

• The frequency of preventive maintenance depends upon office conditions and equipment usage. In this case, the maintenance Bell System Practice will generally specify a minimum interval and stipulate increasing the interval based on experience and application.

• For the TF classification, the frequency must be programmed locally for each office and entered in the ETL. The frequency of a particular test will depend upon:

(a) The number of circuits to be tested

(b) The amount of trouble found by previous tests

(c) The availability of the test equipment for scheduled testing.

• For test equipment to be sent to the Western Electric Company per the ***Red Ball Plan.*** See Section 745-004-000 for details.

4.12 Form E-5450 (Fig. 3) is the format used in documenting ETL routines. Columns are provided for listing the Bell System Practice, test requirements or paragraph, work description, test classification, frequency, and locally assigned job number.

4.13 In order to provide a complete record of all tests and inspections found in the Bell System Practice, the ETLs contain tests which may not apply to some offices. Where this is the case, the pages which do not apply should be retained for later needs. Parts of other pages which do not apply are indicated by writing NA in the assigned job number column on Form E-5450.

4.14 Other tests, not included in the various ETLs which apply on a local basis, are to be entered on blank E-5450 forms. Examples are building security, safety items, and requirements for other equipment located in the office which do not have an associated ETL.

4.15 If desired, the supervisor may rearrange the tests contained in all the ETLs in a manner which will be more useful to specific needs. In this case all the applicable tests would be copied on blank E-5450 forms in the desired order, and the standard ETLs would be filed separately from the test schedule. The assigned job numbers would be entered on both sets of the ETLs.

C. Scheduling of Routines

4.16 After all required routines have been identified, the supervisor must create a schedule for completing the routines consistent with the needs of the central office and the available work force. To assist in this operation, Form E-5451, Preventive Maintenance Schedule, is provided. (See Fig. 5.)

4.17 Form E-5451 provides columns for recording most of the information contained on the ETL, if desired. Other columns are provided for indicating the number of units, the work time required per unit, class, frequency, job number, schedule, etc. Assignment schedules are to be indicated by a diagonal line (/) in the appropriate spaces. The completion of an assignment is shown by a second diagonal line (\) forming an X. Tests with daily frequencies can be assigned by simply entering the letter D on the schedule at the first applicable period and a horizontal line through the following periods.

4.18 Form E-5450 is punched in the right-hand margin for filing in standard ring binders. Form E-5451 is punched in the left-hand margin for filing in standard ring binders. This arrangement enables Form E-5450 to be filed as a left-hand facing sheet and the associated Form E-5451 to be filed as the right-hand facing sheet.

> ***Note:*** The Preventive Maintenance Schedule, Form E-5451, is perforated so that the scheduling portion can be removed and the remaining list of routines can be used in preparing the routine schedules for the following year.

D. Assignment and Results Recording of Routines

4.19 As routines become due in accordance with the Preventive Maintenance Schedule, supervisors must assign scheduled routines to the work force. As the work is completed, the results of the tests are recorded on Form E-5452, Test and Inspection Work Order and Record. (See Fig. 6.)

4.20 Form E-5452 is issued for job assignments listed on the Preventive Maintenance Schedule. Assignment and reference data are obtained from the Test and Inspection Summaries, Form E-5453 and E-5454 (see Fig. 7 and 8), for each preventive maintenance job shown on the ETL. Form E-5452 is a work order and specifies the work to be performed. Details of test failures and troubles found are to be entered in the spaces provided. Complete or partial details of a job are entered in the progress report portion of the form.

4.21 The front of Form E-5452 (Fig. 6) provides spaces at the top for recording assignment data, Bell System Practices section number, equipment, work description, units involved, and progress made. The bottom part of the form is used for recording details of trouble found and action taken. The back of the form provides additional spaces for recording trouble details. It is important that all portions of the form be completed in an accurate and concise manner.

4.22 Some tests and inspections do not ordinarily result in many found troubles and also do not require numerous separate work operations. In these cases it is not necessary to use Form E-5452. Test or inspection results may be recorded directly on Form E-5453 or E-5454.

4.23 The Test and Inspection Work Order and Record, Form E-5452, is printed on white paper on both sides. It is 8-3/8 by 10-7/8 inches and is punched for filing in standard ring binders.

E. Summary of Routine Results (Forms E-5453, E-5454, and E-5455)

4.24 An effective preventive maintenance program must provide a summarization of the results of previous testing for comparison to the current testing results and the analysis of correct maintenance records. It must also provide for a record of when the tests were performed and the amount of time required. Forms E-5453, E-5454 and E-5455, Test and Inspection Summaries are used to fulfill this requirement. (See Fig. 7, 8, and 9.)

4.25 These forms are also the source of information for preparing Form E-5452, Test and Inspection Work Order and Record. The information on Forms E-5453, E-5454 and E-5455 is obtained from the ETL and office equipment records.

4.26 Form E-5453 provides spaces on the front of the form (see Fig. 7) for recording assignment data, BSP number, equipment, work description, number of equipment units involved, estimate of work time, and results of work done. The back of the form provides additional space for results.

4.27 Form E-5454 (see Fig. 8) is a smaller card version of Form E-5453 which is more suitable where it is desired to set up a card file arrangement for test and inspection routines.

4.28 Form E-5455 (see Fig. 9) is basically the same as E-5453 and E-5454 but provides more spaces for summarizing multiple assignment work details for certain jobs in large offices. These are jobs which must be broken down into smaller assignments because the total amount of work is to great for scheduling the entire routine for completion during one work tour.

4.29 Form E-5453, E-5454, or E-5455 must be prepared for each MW, MR, or TF test or requirement specified by the ETL. For non-multiple jobs, Form E-5453 or E-5454 may be used depending upon the filing system used in the office. Form E-5455 is used where large multiple assignments are required and a considerable amount of summary information is collected. The proper use of the Controlled Maintenance Plan requires that all information be entered on these forms. Special emphasis is placed on the EQUIPMENT FROM, EQUIPMENT TO, and ESTIMATED TIME entries.

4.30 Generally, it is preferred that ETL job assignments be made so that the work may be completed within one work tour. For tests and inspections which are scheduled at longer intervals, it may be better to divide the work into several job assignments. This has the advantage of providing a constant check on equipment performance and also results in a more even distribution of the work load. For example, the equipment involved in a yearly requirement may be divided into parts with consideration given to vacation periods or other factors. When large jobs are divided into smaller job assignments, a limiting factor which must be considered is the set-up time. If the set-up time is appreciable, the minimum job assignment must be long enough so that the set-up time is only a small part of the total work time.

4.31 There are some tests for which few troubles are expected and where the work can normally be completed in one work tour. In these cases, Form E-5453 or E-5454 may be used as both the work order and the summary, and the test results may be posted directly on these forms (see Fig. 7 and 8). This procedure has the disadvantage of providing the craftperson with the work time and results of the previous tests which may influence the manner in which the present tests are conducted. The supervisor must be aware of this potential problem.

4.32 Where multiple job assignments are required, individual work orders (Form E-5452) are issued as each assignment is due. When the assignment is completed, details are taken from Form E-5452 and are posted in the appropriate spaces on Form E-5455. If desired, progress on extended routines can be noted by using a light colored pencil (yellow) to color the WORK COMPL. spaces as the completion dates are entered.

F. Automated Administration—COMMS

4.33 The Central Office Maintenance Management System (COMMS) is a shared-time computer support system for assisting in the administration of the preventive maintenance program. It is used in scheduling, monitoring, and controlling preventive maintenance operations. Refer to Section 190-305-101. Specific automated features provided by COMMS are:

(1) ***Identification of Routines:*** COMMS matches an office inventory to a cross-reference file of ETL requirements stored in a computer. (Refer to Section 190-305-301.)

(2) ***Organization of Work Load:*** COMMS organizes the required preventive maintenanace routines into manageable blocks of work called work items. Each work item contains a set of routines and a number of equipment units that can be efficiently performed together to be tested by the set. The equipment units are all of the same type and are chosen to be conveniently located with respect to one another. (Refer to Section 190-305-302.)

(3) ***Routine Scheduling:*** COMMS generates a proposed schedule for the work items according to a work profile submitted by the machine supervisor. The work profile determines how the work load is distributed, by month, across a 2-year schedule period. (Refer to Section 190-305-303.)

(4) ***Work Orders:*** COMMS supplies work orders and a monthly summary list of the scheduled work. (Refer to Section 190-305-304.)

(5) ***Preventive Maintenance History:*** COMMS assembles history files from information on completed work orders. These files provide the basis for adjusting time estimates used in scheduling and manpower forecasts and provide data for analyzing the performance of the equipment and the routines.

(6) ***Administrative Reports:*** Monthly, and on request, COMMS furnishes central office supervision with the information about results, status of uncompleted work, and the projected workload for the new month. These reports pinpoint backlogged or missed work. (Refer to Section 190-305-306.)

(7) ***Update and Modify Preventive Maintenance Records:*** COMMS ETL files are updated automatically when system-wide ETL changes are made. COMMS notifies the supervisor of any pertinent changes, and with the supervisor's concurrence, processes the ETL changes and supplies a revised schedule. (Refer to Section 190-305-307.)

4.34 Detailed explanations of COMMS operations are located in Sections 190-305-101, 190-305-102, and 190-305-301 through -307.

5. CORRECTIVE MAINTENANCE

5.01 In the Controlled Maintenance Plan, corrective maintenance procedures are used for handling trouble reports from all sources other than preventive maintenance routines. These procedures are aimed at:

- Providing an effective means for control and prompt handling of trouble reports
- Dispatching reports for trouble location and repair
- Providing for orderly and simplified recordkeeping information in an effective way for possible later use.

5.02 The corrective maintenance process (see Fig. 10) is initiated by either trouble reports or other trouble indicators and is completed by service being restored and the trouble ticket being closed out. All trouble records must be periodically analyzed to determine if any modifications are needed to the preventive maintenance program.

A. Automatic Testing

5.03 Stored Program Control System (SPCS) offices do not have automatic test frames as found in electromechanical switching systems. All automatic testing in SPCS offices is performed under the control of the generic program and utilizes the various test circuits provided in the SPCS office. The corrective and preventive portions of SPCS office maintenance plans rely heavily on the proper use of these programs. Because SPCS automatic testing is program controlled, a considerable amount of testing can be performed with an extremely small amount of effort. Maintenance force response to the results of the majority of these tests is classified as a corrective maintenance activity.

5.04 In SPCS offices three categories of automatic testing are provided:

- ***Fixed Automatic Testing***—These tests are initiated from a fixed schedule contained in the generic program and are conducted daily. They are started after midnight and are generally referred to as the ***midnight routines.***

- ***Scheduled Automatic Testing***—These tests are initiated from a schedule contained in the office's memory which is created on a per office basis. Included are operational tests for trunks, diagnostic tests for service circuits and junctor circuits, and line insulation tests (LIT).

- ***On-Demand Automatic Testing***—These tests are manually initiated through the use of a maintenance TTY input message, or they are automatically initiated by the fault recognition programs. This type of test is available for most of the equipment contained in SPCS switching machines. Some of these tests may be conducted on a routine basis as part of preventive maintenance.

Details pertaining to these tests are provided in the individual application section for each SPCS system.

Scheduling Automatic Routines

5.05 In order to provide for orderly reporting and to obtain maximum benefits from automatic testing, it is necessary for each SPCS office to establish a testing schedule. To minimize the chances of encountering busy circuits, it is recommended that all scheduled automatic testing be performed during periods of light traffic. To aid in recording the results of the testing from the maintenance TTY printouts, it is recommended that the concurrent operation of two or more test programs be held to a minimum. The daily printout of the maintenance measurements should be scheduled after the conclusion of all testing in order that it will contain the latest testing results. In extremely large SPCS offices there may not be a sufficient low-traffic period to conduct all the automatic tests. In this case, it is recommended that the service circuit tests, the circuit junctor tests, and similar tests be alternated daily on a six-day-per-week basis.

5.06 In areas with a large number of offices, blocking may occur in trunk testing as a result of several offices attempting to test trunks into one connecting office at the same time. If this occurs, trunk testing will have to be coordinated among the offices or additional test lines must be added in rotary hunting or series completing groups.

B. Monitoring and Evaluating Office Performance

5.07 The primary means of determining office performance is through the interpretation of selected service, performance, and administrative measurements. Through the use of preset objectives, significant deviations in the level of service can be readily detected. Undersirable deviations in service directly relate to a degradation in customer service and are the stimulus for a detailed analysis of trouble indicators and reports, i.e., maintenance teletypewriter printouts, trouble recorder cards, etc.

5.08 In all switching systems there are certain ***hidden*** troubles which do not result in an obvious trouble report. Due to the various retrial features of switching systems, the impact of most of these troubles on customer service is minimized;

however, if these troubles are not corrected, they will accumulate and will cause a gradual decline in service. To prevent these types of problems, it is essential that a program be established for continuously monitoring and evaluating the office. This program is based on the daily recording and reviewing of selected service and performance measurements of the office and the comparison of these measurements to an established set of objectives. See the individual application sections for determining the means for establishing objectives and monitoring and evaluating office performance for a given system.

Setting Objectives

5.09 The establishment of objectives for an office should be based on the attainment of high levels of service performance. The specific figures which are indicative of service excellence will become evident as experience is gained in the operation of an individual central office and by comparing results from other offices in the network switching performance measurement plan. In the event that performance is far below the expected level, it may be necessary to set interim objectives that can be met in a short period of time with a reasonable amount of effort. Unattainable or unreasonable objectives tend to have a detrimental effect on attempts to improve performance.

Control Record

5.10 The Control Record is designed to provide a simplified system for the monitoring and evaluation of a central office. It provides a current picture of the office's performance on a daily basis which can be compared to other days' performance and the office's objectives.

5.11 Control Records exist for each type of switching system and a description and detailed explanation of their use can be found in the Controlled Maintenance Plan application section for each switching system.

Analyzing Trouble Indicators and Reports

5.12 A successful corrective maintenance program depends upon the effective use of information received from a switching system's trouble reporting mechanism. It would be too costly to investigate every failure indication that appears in an office; therefore, present telecommunications systems are designed to function with a certain number of errors and failures. A good controlled maintenance plan is aimed at keeping these errors and failures within the designed limits instead of attempting to eliminate them completely.

5.13 The specific routine for analyzing trouble indicators and reports will differ for each switching system. In general the routine must establish groupings for various indicators and provide a means of determining an acceptable level of failures for each group. Whenever this level is exceeded, a formal analysis of that group of indicators is to be performed. Periodically, each group is to be analyzed in an attempt to improve the level of performance and to identify any hidden faults.

C. Correcting Troubles

Administering Trouble Reports

5.14 The primary sources of trouble reports are the maintenance teletypewriter or trouble records, alarms, the Repair Service Center, and other offices. Other sources are shown in Fig. 10. A well-controlled Corrective Maintenance Plan must provide for the proper administration of all trouble reports.

5.15 Trouble reports from the Repair Service Center may be by telephone or by the use of Form E-4086, Inspection and Routine of Central Office Equipment. When one of these forms is received, a Trouble Ticket should be prepared and associated with Form E-4086. Only the action taken, coding, and close out details need to be entered on the Trouble Ticket. Fig. 11 is an illustration of Form E-4086. If the trouble referral is by telephone, the entire trouble ticket must be completed.

5.16 Repair Service Centers use a code on Form E-4086 for customer reports. Similar types of customer trouble reports are grouped, i.e., Can't Call—No Dial Tone, Can't Be Called, etc. The coding system is called Group Classification. Form E-4736, Classification Codes and Definitions, illustrated in Fig. 12, depicts and explains the coding.

5.17 The back of Form E-4086 provides for the recording of the central office maintenance activity in response to the service center referral. Upon completion of the central office work on the

case(s) in question, the results should be recorded and the Form E-4086 returned to the Repair Service Center. If the referral was by telephone, a call to the Repair Service Center should be used to forward the results.

Trouble Ticket

5.18 Trouble tickets are corrective maintenance work orders and records for central office maintenance personnel. Trouble tickets are the source documents for details of trouble reports and the resulting found or not-found troubles. It is important that tickets be written for all trouble reports and that entries be complete, accurate and legible. It is the responsibility of the supervisor to instruct all craft personnel in the proper writing of trouble tickets and to assure that these instructions are being followed uniformly.

5.19 The trouble ticket is used to record details of trouble reports or related work operations. A trouble ticket will be prepared for each report from other locations and in each case where an alarm, trouble recorder card, or maintenance teletypewriter printout results in corrective maintenance activity. Trouble tickets are indicated as ***T*** (Trouble) or ***M*** (Memo) according to the following:

- T-type tickets are issued for reports from customers, other departments, other offices, alarms, trouble recorder cards, and maintenance teletypewriter printouts.

- M-type tickets are issued to cover pending work operations as a result of closed-out trouble reports (T tickets) where repairs are to be made later. When the trouble report is closed out and service is restored by removing the defective equipment from service, the associated T ticket is retained in a special file for pending work. Later, when a craftperson is assigned to clear up these items, an M ticket is issued for recording details of the repair or replacement work operation. When the equipment is restored to service, the T ticket is filed. The T ticket should be noted to indicate the issuance of the memo ticket.

5.20 Trouble tickets are not issued for recording troubles disclosed by preventive maintenance activities such as tests and inspections. Procedures for handling these troubles are discussed in Part 4 of this section.

5.21 Trouble tickets are serially numbered for identification and for relating them to reports or troubles. Ticket serial numbers are to be entered in the Central Office Log described in 5.24. It is recommended that the tickets be numbered serially beginning at the first of each month i.e., July tickets would be numbered 7-1, 7-2, etc. If desired, a separate numbering scheme may be used for different categories such as hardware, software, and trunks. The supervisor is best qualified to select the ticket numbering scheme that fits the individual office.

5.22 When several reports or indications are found to be the result of one equipment trouble, the T tickets and maintenance teletypewriter printouts for these reports or indications must be correlated to present a clear picture of the office trouble history. It is mandatory that only one count be scored on the Trouble Summary for each equipment fault. See 5.35 for a description of the Trouble Summary and how equipment trouble counts are used for maintenance administration.

5.23 Trouble Tickets exist for each type of switching system. A description and a detailed explanation of their use can be found in the Controlled Maintenance Plan application section for each system.

Central Office Log

5.24 Maintaining a Central Office Log is a vital part of the administration of trouble reports. In addition to recording trouble reports, the log records any unusual central office activity which could result in trouble reports, i.e., installation or contractor activity. The log is a convenient display of information containing items such as the volume, origin, coding, and status of trouble reports. It is also the source for determining if there is any ***unusual activity*** which may be responsible for changes in switching performance. As an administrative tool, the Central Office Log provides a quick reference of any open items in the central office. See Fig. 13 for an illustration of the Central Office Log, Form E-5457.

5.25 The Central Office Log is printed on white paper and measures 8-3/8 inches by 10-7/8

inches. The form is punched in the left margin for filing in standard ring binders.

5.26 It is recommended that the log be closed out monthly; however, some other period may be used depending upon the volume of trouble reports and other entries for a given central office. Trouble reports which are not closed out on one log should be carried over to the log for the next period.

5.27 Many offices require only one log for recording trouble reports and other activities. In large offices it may be better to use a separate log for hardware, software, trunk activities, or any other suitable categories. The creation of separate logs should be considered only if it will enhance the basic purpose, of providing a meaningful and useful display of pertinent information.

D. Analysis of Trouble Records

5.28 One of the most important activities that is a part of corrective maintenance is the periodic analysis of completed trouble records. In addition to the trouble tickets, data that should be analyzed includes the results of preventive maintenance routines. The purpose of this analysis is to categorize all troubles in terms of units of equipment, types and codes of apparatus, or causes of trouble and to initiate positive action to reduce the possibility of future troubles. Any action that is taken must be evaluated in terms of the costs that will be incurred as a result of changes in maintenance procedures. This type of management evaluation may result in a decision to take no action based on the assumption that the costs will outweigh the benefits to be derived from any maintenance procedure changes.

5.29 The analysis of trouble records may result in any number of actions. Some examples of these actions are:

- Increase or recommend a decrease in the frequency of a particular preventive maintenance routine.
- Initiate on-the-job training to reduce work errors.
- Change housekeeping and apparatus cleaning routines to reduce amount of dirt and dust in office.
- Request Engineering to add a feature or option to the office.
- Initiate an Engineering Complaint per Section 010-700-010.

Ticket File

5.30 The first step in the analysis of trouble records is the creation of a ticket file which provides for the systematic storage of trouble tickets. All tickets are to be filed in accordance with a scheme that is applicable to the particular switching system. This file should be located in the maintenance center for ready reference and study.

5.31 Fig. 14 shows the ticket file and the ordering information for obtaining the file. Each ticket file unit is equipped with two fixed and two snap-on designation strip holders, and it has 26 bin dividers. The bin sizes can be arranged in increments of 3/4 inches. This feature provides for a variety of filing arrangements. In addition, file units may be connected to provide the required size of filing system for an office.

5.32 In the ticket file all T tickets should be filed together according to the equipment or software group in which the troubles are found. All NTF (No Trouble Found) tickets which cannot be associated with a particular unit of equipment should be filed in the bin designated as NTF. Separate bins should be designated for filing Memo, Hold for Repair, and Pending trouble tickets issued during the current month. Spare bins may be used for special studies.

5.33 Fig. 14 illustrates a suggested ticket filing arrangement. Trouble tickets filed in each bin should be filed sequentially by disposition code. Through this procedure, as each ticket is filed, a quick check for repeating troubles can be made.

5.34 Trouble tickets should be retained in a three-month moving file. At the end of each report period, tickets for the oldest month should be removed.

Trouble Summary

5.35 The second step in the analysis process is the monthly recording of the number of troubles associated with the designated equipment

and cause groups, comparison of troubles by months (trends), comparison of troubles with the past year's average, and a comparison of troubles with an objective level of trouble.

5.36 Form E-5463, Trouble Summary, is provided for this purpose. It is printed on white paper, measures 8-3/8 by 10-7/8 inches and is punched in the margin for filing in standard ring binders.

5.37 Fig. 15 is an illustration of Form E-5463. Columns are provided for listing major groups of equipment and causes and for recording the average number of troubles for the previous year, current objectives, and the number of troubles coded to each equipment group each month.

5.38 Fig. 16 is an illustration of the back of the Trouble Summary which provides space for entering remarks or explanatory notes referring to entries made on the front of the form.

5.39 The Trouble Summary provides space for recording monthly trouble data in order to readily identify trouble trends. The data recorded on this summary is obtained from trouble tickets which are described in 5.18 of this section. T tickets are filed in the ticket file in bins corresponding to the headings which are entered in the EQUIPMENT column on the Trouble Summary. At the end of each report month, the T tickets are counted and totals are entered opposite the equipment groups in the proper report month column. The tickets are also counted and sorted on the basis of cause. Memo tickets are not recorded on the Trouble Summary. Additional spaces are provided in the EQUIPMENT column if a further breakdown of equipment troubles is required for special studies.

5.40 Two columns, AVG PREV YEAR and CUR OBJ are provided on the Trouble Summary for comparing current trouble trends with past trouble results and also for comparison with an objective figure. As the number of troubles is entered each month for each equipment group, comparisons can be made. If the number of troubles for a particular equipment group should rise unexpectedly or if a gradual rising trend is noticed, investigation to determine the cause is required.

5.41 The AVG PREV YEAR column is provided for entering the average month's trouble figure for the previous year. It is expressed as a whole number opposite each entry listed in the EQUIPMENT column. The number entered in this column should not in all cases be the arithmetical average of last year's trouble history. If, for one or more months of the previous year, the trouble rates were abnormally high or low for known reasons, these months should not be used in the calculation of the average of the year. The average for the previous year is to be used as a bench mark, and should not be distorted by known abnormal conditions.

5.42 The CUR OBJ column is provided for entering the monthly objective figure for the current year. it is expressed as a whole number opposite each entry listed under the EQUIPMENT column on the Trouble Summary. When calculating the objective for the following year, consideration must be given to current trends of trouble rates and conditions known or expected to exist which might affect trouble rates the following year. For example, the addition of more frames, the transfer in or out of customer lines, the addition of new services or features, or the result of a reconditioning program would all have an effect on trouble rates. The objective should be set with these conditions in mind. In addition, the objective figure should be adjusted if the actual results obtained vary a great deal from the previously set current objective and the cause is known.

Review Maintenance Records

5.43 The last stage of analysis is to be a detailed review of all maintenance records including the results of the Preventive Maintenance routines, the Trouble Summary, the Central Office Log, and, if necessary, individual trouble tickets. The Trouble Summary presents trouble records in large enough segments so that developing trends can be recognized. When adverse trends are seen, investigation should be made for determining the cause. This analysis should include investigation into the type of apparatus or software in which the trouble existed and the cause of the troubles.

5.44 A review of all maintenance records should be made every six months. One period of analysis should be completed just prior to the establishment of the Preventive Maintenance schedule

for the following year in order that the results can influence the setting of the schedule.

6. MAJOR OUTAGES, DOCUMENTATION, AND RETENTION OF RECORDS

6.01 For information concerning major outages, documentation, and retention of records, see the Controlled Maintenance Plan application sections for the individual switching system.

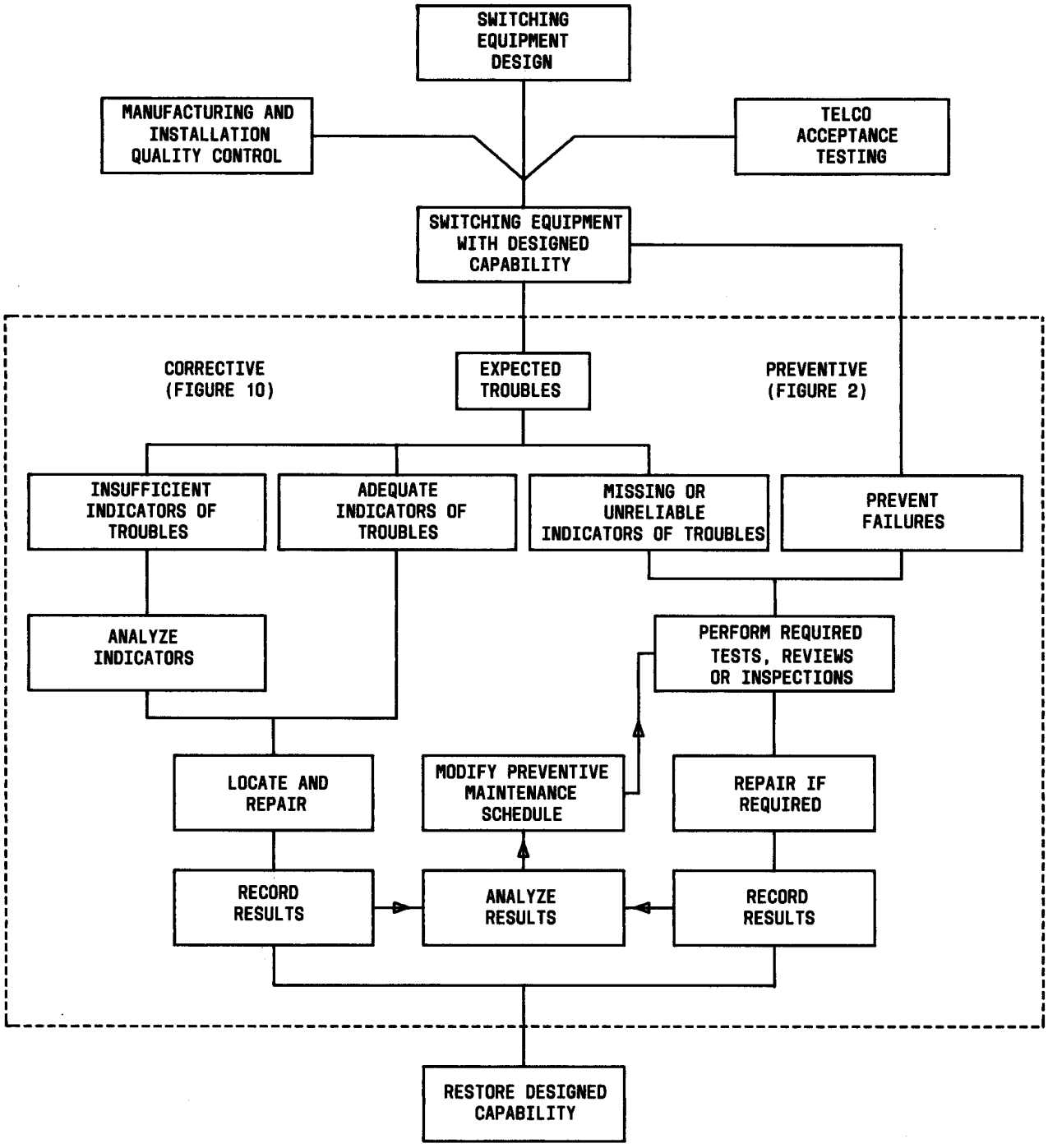

Fig. 1—Controlled Maintenance Diagram

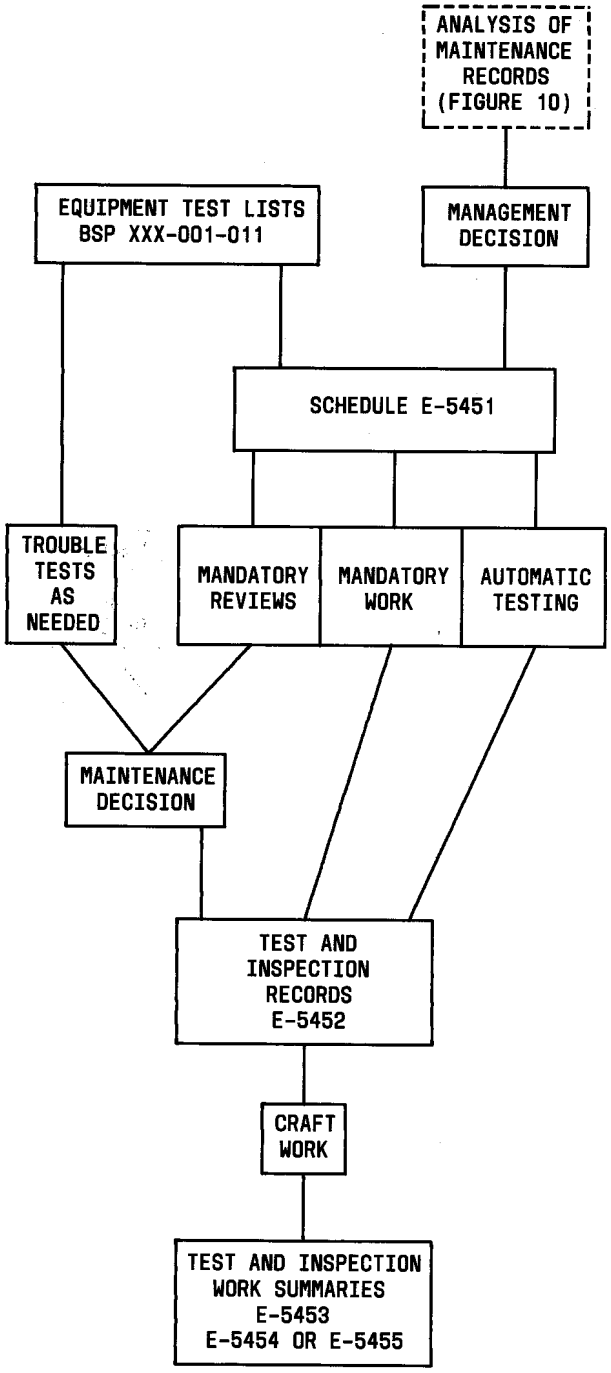

Fig. 2—Preventive Maintenance Diagram

EQUIPMENT TEST LIST						
B.S.P.	ISS	TEST OR REQT.	EQUIPMENT AND WORK DESCRIPTION	CLASS	FREQ.	JOB NO.
231-105-303	5		SYSTEM EVALUATION PROCEDURES			
		A	*Central Control Test*			
			Steps 1-6	*MW*	*M*	
			Steps 7-22	*MW*	*6M*	
		B	*Signal Processor Test*			
			Steps 1-3	*MW*	*M*	
			Steps 4-13	*MW*	*6M*	
		C	*Program Store Test*			
			Steps 1-3	*MW*	*6M*	
		D	*Call Store Test*			
			Steps 1-6	*MW*	*‡*	
			‡ After each RC Update but not more			
			than once per month			
			Steps 7-12	*MW*	*6M*	
		E	*Peripheral Equipment Test*			
			Steps 1-8	*MW*	*M*	
			Steps 9-16	*MW*	*6M*	
			Steps 17-20	*MW*	*M*	
			Steps 21-28	*MW*	*6M*	
		F	*Peripheral Controller Enable Test*	*MW*	*‡*	
			‡ Following Growth to PU Bus			
		G	*Lines, Trunks, and Service Circuit Test*	*TF*	*	
231-114-501	4		EMERGENCY MANUAL LINE CIRCUIT TEST			
		A	*Transfer Actions*	*MW*	*12M*	
		B	*Transfer of Individual Circuits*	*MW*	*12M*	
		C	*Busy Test of Associated Trunk*	*MW*	*12M*	
		D	*Customer Call to Oper & Oper Call to Customer*	*MW*	*12M*	
		E	*Dial Incoming Calls*	*MW*	*12M*	
		F	*Power Cross Detection*	*MW*	*12M*	
231-115-501	7		OFFICE ALARMS			
		A	*Miscellaneous Power Frame*	*MW*	*12M*	
		B	*Junctor Frame*	*MW*	*12M*	
		C	*Line Switching Frame*	*MW*	*12M*	
		D	*Line Junctor Switching Frame*	*MW*	*12M*	
		E	*Trunk Switching Frame*	*MW*	*12M*	
		F	*Trunk Junctor Switching Frame*	*MW*	*12M*	
		G	*Universal Trunk Frame*	*MW*	*12M*	

Fig. 3—Equipment Test List (E-5450)

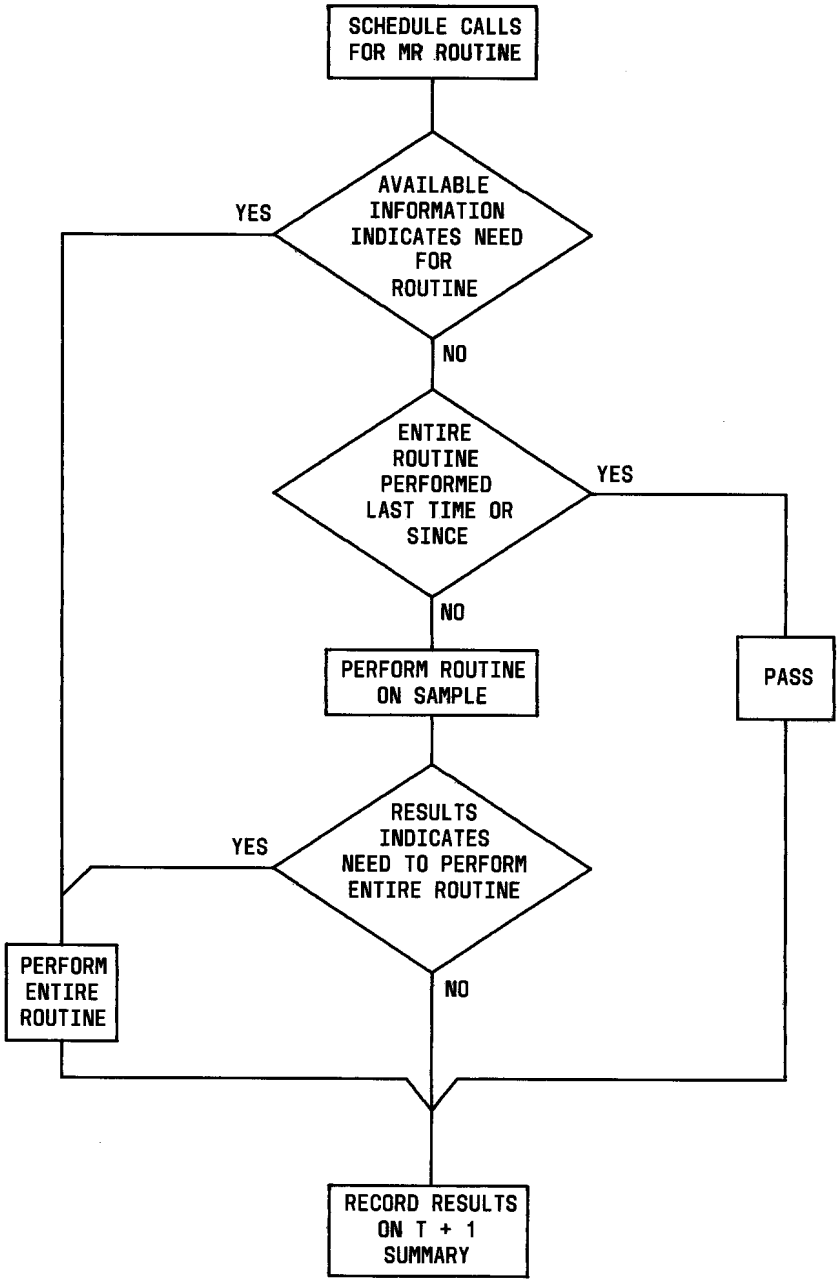

Fig. 4—Mandatory Review (MR) Procedure

OFFICE 267 NO. SHEETS ___ SHEET NO. 1

PREVENTIVE MAINTENANCE SCHEDULE

YEAR ____

OFFICE 267 NO. SHEETS ___ SHEET NO. 1

E-5451 (11-76)

JOB NO.	EQUIPMENT AND WORK DESCRIPTION	CLASS	FREQ.	NUMBER UNITS	MIN. PER ASGN.	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
						1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	BSP 218-112-501 LINE LINK, AUX. LINE LINK AND LLC FR'S NWS RELAY TYPE TESTS																
1	TEST A MARKER PREFERENCE CHAIN TRANSFER AND ALARM	MW	12M	20	3										/		
	BSP 218-160-501 OUTGOING SENDER CONNECTOR AND OUTGOING SENDER LINK CIRCUIT LINKS																
2	TEST A MARKER PREFERENCE CHAIN TRANSFER AND ALARM	MW	12M	16	3						X						
	BSP 218-764-501 PREFERENCE CONTROL AND MAKE BUSY CIRCUIT TESTS																
3	TEST A MARKER PREFERENCE CHAIN TRANSFER AND ALARM	MW	12M	42	4			X									
	BSP 218-115-501 TRUNK LINK AND CONNECTOR CKT NWS RELAY TYPE TESTS																
4	TEST E MARKER P CHAIN TRANSFER AND ALARM	MW	12M	16	3											/	

Enter test classification as specified on ETL

Interval at which the work item is scheduled for performance

Locally assigned job number

Number of units scheduled for test at the interval shown

Minutes required to perform the work item

TOTAL HOURS PER PERIOD

Enter total work time for period in hours

2.48" 48" 1-0" 30"

This form provides for scheduling recurring work items on a "period" basis. Each month is divided into four schedule periods. The dates for the designated periods are as follows:

Period	Dates
1	1 - 7
2	8 - 14
3	15 - 21
4	22 to end of month

Entries in month columns show the period in which each item is to be performed and the period in which the work is completed. Codes used are as follows:

- ⧄ Item scheduled.
- ⧅ Item completed in period scheduled.
- → ⧅ Item completed in later period than scheduled. The arrow shaft should be drawn in at the end of each period if item is still scheduled but not completed. (Arrow in reverse direction may be used to show item completed ahead of schedule.)
- ▨ Items not completed per schedule and deferred to next scheduled period.

Deviations from schedule should be explained on back of form.

Fig. 5—Preventive Maintenance Schedule (Form E-5451)

TEST AND INSPECTION WORK ORDER AND RECORD

E-5452 (6-68)

OFFICE 393 (A) ASSIGNMENT OR JOB NO. 8 (B)

ASSIGNMENT DATA

B.S.P. NO. TEST LETTER OR PAR. 232-115-501 P, B, C, K, L (C)

EQUIPMENT MP-0, MS-00 to 03, MT-00 To 15, UTJ-00 to 08, TT (D)

WORK DESCRIPTION: OFFICE ALARM TESTS (E)

FROM EQPT. UNIT (F)		TO EQPT. UNIT (F)		TOTAL UNITS (G)	SHIFT (H)
MP	0	TT	-	31	DAY

ASSIGNED TO (I)	TO BE STARTED (J)	TO BE COMPLETED (J)
JRG	7-14-75	7-18-75

PROGRESS REPORT

DATE	FROM EQPT. UNIT		TO EQPT. UNIT		TIME SPENT (MINUTES) TEST	TIME SPENT (MINUTES) REPAIR	BY
7-14	MP	0			20		JH
7-15	MS	00	MJ	03	80		JH
7-15	MT	00	MT	10	190		JH
7-16	MT	11	MT	15	90		RB
7-17	UTJ	00	UTJ	08	160		JH
7-17	TT	-			25	5	JH

WORK RECORD

EQPT. UNIT (K)		TROUBLE APPEARANCE (L)	ACTION TAKEN (M)	REPAIR TIME (N)	BY (N)
TT	-	FA LAMP DID NOT LIGHT	REPLACED LAMP	5	JRG

NOTE	EXPLANATION
A	Central Office identification.
B	Locally assigned number and/or letter to identify assignment or job by type of work, shift, equipment, etc.
C	Reference information.
D	Identification of equipment.
E	Description of work to be performed. If limited trouble might be expected on this test, use of this form on this test would be optional.
F	For designating the first and last circuit or equipment assigned by work order.
G	Total units this assignment.
H	"Shift" work to be performed (day, evening, night).
I	Show trick designation or initials of employee work assigned to.
J	Show date and/or time work is scheduled to be started and completed.
K	Equipment unit on which trouble is indicated.
L	Details of trouble appearance.
M	Details of action taken to clear trouble, timed consumed, workman's initials.
N	Show workmans' initials and summary of time spent testing and repairing by date and equipment involved.
O	For totaling trouble appearances this page.

TOTAL TROUBLE APPEARANCES 1 (O) NO. SHEETS 1 SHEET NO. 1

Fig. 6—Test and Inspection Work Order and Record (Form E-5452)

E-5453 (6-67)

TEST AND INSPECTION SUMMARY

OFFICE 393 (A) ASSIGNMENT OR JOB NO. 21 (B)

BSP NO. AND TEST LETTER OR PAR. (C)	WORK DESCRIPTION (G)
232-135-501 A, B	A. CHANNEL DETECTOR PASS BAND T.+A. B. SENSITIVITY T. + A.
EQUIPMENT (D) T.T. STA. TST CKT. TRK GRP 046	

FROM (E)	TO (E)	TOTAL UNITS (F)	TEST (H)		ESTIMATED TIME (I)	
000	—	1	CLS MW	6M FREQ	PER UNIT 60	60 PER ASGN.

DATE (J) E-5452 ISSUED	DATE (J) WORK COMPL.	(K) BY	(L) TROUBLES	TIME SPENT (M) TEST	TIME SPENT (M) REPAIR	SUMMARY OF TESTS, INSPECTIONS, SAMPLES, REVIEWS (N)
1/6/75	1/8/75	JG	1	75	20	697 Hz. CHAN. LOWER BAND READJ.
7/14/75	7/15/75	JG		65	-	NTF

NOTE	EXPLANATION
A	Designation of Central Office.
B	Locally assigned — Cross-referenced to Equipment Test List.
C	Test reference information.
D	Description of equipment.
E	Show first and last unit of equipment on this assignment.
F	Total circuits covered by this assignment.
G	Description of test or inspection.
H	Test or Inspection class and frequency — From Equipment Test List.
I	Estimated test time per unit and assignment.
J	Date Form E-5452 issued and date this assignment completed.
K	Workman's initials.
L	Total trouble appearances — Taken from Form E-5452.
M	Total test and repair time — Taken from Form E-5452.
N	Space for summarizing trouble details — Shown on Form E-5452 when used.

Fig. 7—Test and Inspection Summary (Form E-5453)

FORM E-5454 (6-67)

TEST AND INSPECTION SUMMARY

OFFICE 278 ASSIGNMENT OR JOB NO. 10

BSP NO. AND TEST LETTER OR PAR.	EQUIPMENT	WORK DESCRIPTION
232-005-701 2.01, 2.02	3A CARD WRITER	CLEANING CARD WRITER LUBRICATING CARD WRITER

FROM	TO	TOTAL UNITS	TEST		ESTIMATED TIME	
			CLS. MW	M FREQ.	PER UNIT / HR	PER 1 HR ASGN.
ALL		1				

DATE		BY	TROU-BLES	TIME SPENT		SUMMARY OF TESTS, INSPECTIONS, SAMPLES, REVIEWS
E-5452 ISSUED	WORK COMPL.			TEST	REPAIR	
–	10/11/67	JR	0	–	50 MIN	
–	11/9/67	JT	0	–	1 HR	
–	12/12/67	JR	0	–	1 HR	

Fig. 8—Test and Inspection Summary (Form E-5454)

OFFICE _____ ASSIGNMENT OR JOB NO. _____

TEST AND INSPECTION SUMMARY
MULTIPLE JOB ASSIGNMENTS

E-5455 (6-67)

EST. TIME PER ASGN. / PER UNIT	TEST FREQ. / CLASS	EQUIPMENT WORK DESCRIPTION	BSP NO. AND TEST LETTER OR PAR.	JOB NO.	MO. DUE	FROM EQPT./UNIT	TO EQPT./UNIT	NO. UNITS	DATE E-5452 ISS.	DATE WORK COMPL.	BY	NO. OF TBL.	TIME SPENT TEST	TIME SPENT RE-PAIR	DATE E-5452 ISS.	DATE WORK COMPL.	BY	NO. OF TBL.	TIME SPENT TEST	TIME SPENT RE-PAIR	DATE E-5452 ISS.	DATE WORK COMPL.	BY	NO. OF TBL.	TIME SPENT TEST	TIME SPENT RE-PAIR	DATE E-5452 ISS.	DATE WORK COMPL.	BY	NO. OF TBL.	TIME SPENT TEST	TIME SPENT RE-PAIR
				1																												
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Note	Explanation
A	Designation of Central Office
B	Locally Assigned and Cross-Referenced to Equipment Test List
C	Test Reference Information
D	Description of Equipment
E	Description of Tests or Inspections
F	Test or Inspection Class and Frequency – From Equipment Test List
G	Estimated Test Time per Unit and Assignment
H	Number Suffixed to Assignment or Job No. to Identify Individual Assignments
I	Month Work Assignment is Scheduled for Review, Sample or Completion
J	Show First and Last Unit of Equipment for Each Assignment
K	Enter Number of Units Per Assignment
L	Enter Date Form E-5452 was Issued and Date the Assignment was Completed, Reviewed or Sampled
M	Workman's Initials
N	Total Trouble Appearances – Taken From Form E-5452
O	Total Test and Repair Time – Taken From Form E-5452

Fig. 9—Test and Inspection Summary—Multiple Assignments (Form E-5455)

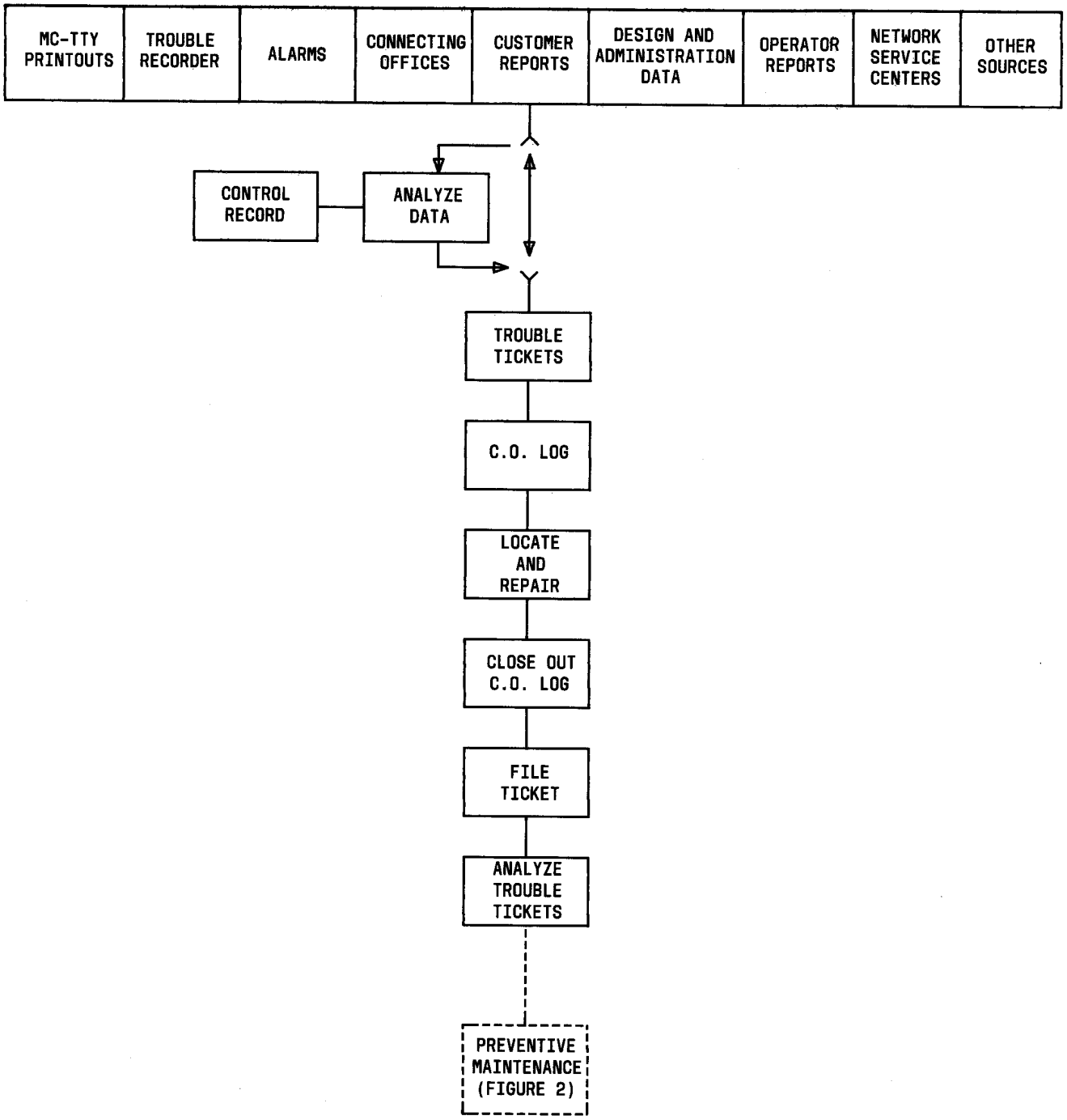

Fig. 10—Corrective Maintenance Diagram

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FORM E-4086
(4-66)

INSPECTION AND ROUTINE OF CENTRAL OFFICE EQUIPMENT

TICKET NO._____

DATE	TIME	RPT'D BY	C.O. TRBL CODE
C.O. DESIGNATION		CABLE & PR	

DATE	TIME	LINE OR EQUIPMENT	TYPE REPORT CODE	DATE	TIME	LINE OR EQUIPMENT	TYPE REPORT CODE

REMARKS:

(FRONT)

ORIG. EQUIP. (INSP. & ROUT.)		TERM EQUIP. (INSP. & ROUT.)	
CLEARED BY TIME DATE	TIME SPENT LOCATING & CLEARING	CLEARED BY TIME DATE	TIME SPENT LOCATING & CLEARING
MDF (INSP.)		IDF OR LDF (INSP.)	
CLEARED BY TIME DATE	TIME SPENT LOCATING & CLEARING	CLEARED BY TIME DATE	TIME SPENT LOCATING & CLEARING
RTN TO	DATE	TIME	TOTAL TIME LOC. & CLEARING

(BACK)

Fig. 11—Inspection and Routine of Central Office Equipment (Form E-4086)

CLASSIFICATION CODES AND DEFINITIONS FOR THE MANUAL HANDLING OF TROUBLE REPORTS

	CODE	TYPES OF REPORTS
Originating Call	1 CC — NOT CAN'T CALL NO DIAL TONE	Does not hear Central Office Dial Tone. Can't Raise the Operator, or receives Slow Dial Tone.
Originating Call	2 CC — OTH CAN'T CALL OTHER	Hears Central Office Dial Tone but Cannot Originate or Complete a Call. Includes reports of Cannot Call on circuits that do not furnish dial tone.
Originating or Terminating Call	3 TRAN-NOISE TRANSMISSION NOISE	Reports Poor Transmission, Noise, or Interference.
Terminating Call	4 CBC CAN'T BE CALLED	Reports Can't Be Called, e.g., Bell Doesn't Ring, Bell Rings and Can't Answer. Bell Rings No Answer, Bell Rings After Answer, Bell Rings and Can't Trip Ring, Called For Wrong Number, or Gets Busy Incoming.
	5 MEM SVCS FAIL. MEMORY SERVICES FAILURE	Reports trouble with Customer Calling Services features, such as Speed Calling, Call Transfer, Three-way Calling, Call Waiting, Dial Pickup, Dial Hold, or Camp-On Busy of an Automatic Switching System.
	6 DATA FAIL. DATA FAILURE	Reports Can't Send Data or Can't Receive Data. Includes reports on Automatic Call Unit failures.
	7 PHY COND PHYSICAL CONDITION	Reports Worn, Damaged, Loose, or Missing Equipment, etc.
	8 MISC MISCELLANEOUS	Any type trouble report not included in the other codes.

DISPOSITION CODES

1 STATION SET
All troubles in the station set used for *any* class of service. It includes Teletypewriter station sets, Call Directors, station sets associated with Speakerphones, PICTUREPHONES,® PBXs, or Order Turrets, and Mobile Telephones. The subset of the two-piece telephone set is considered a part of the station set. Troubles on that portion of a coin telephone involving coin apparatus are included in Other Station Equipment.

2 OTHER STATION EQUIPMENT
All troubles in station equipment other than the station set such as Data Sets, BELLBOY® Receiver Units, Auxiliary Signaling Equipment, Key Telephone Units, Key Cabinets or Turrets, Supplementary Station Equipment, Switchboards, Switching Equipment, Booths, and Coin Apparatus.

3 STATION WIRING
All troubles in Drop and Block Wire, Station Protectors, Inside Wire, Inside Wiring Cable used in lieu of Inside Wire, and Ground Wires.

4 OUTSIDE PLANT
All troubles in Cable. Cable Terminals, Amplifiers, Line Wire, Load Coils and their protection; Concentrators, Carrier Equipment. Base and Coast Stations in General Mobile Service and BELLBOY Personal Signaling Service located in places other than central offices.

5 CENTRAL OFFICE
All troubles in central office equipment. Includes troubles in central office equipment permanently associated with customer lines, and troubles in equipment common to customer lines.

6 CUSTOMER ACTION
All troubles caused by customer action or error affecting Company-owned and customer-owned equipment or attachments. Also includes trouble on customer-owned equipment or attachments.

60 RECEIVER OFF HOOK
All troubles caused by customers leaving the receiver off the hook.

7 TEST OK
Trouble reports are closed as Test OK when the trouble-causing condition cannot be determined and the report is not referred to the central office or outside forces for further investigation. Includes central office and concentrator overload conditions.

8 FOUND OK-IN
All trouble reports Found OK by central office forces, and not dispatched to outside forces. Reports where there is substantial evidence that the report was caused by lockup conditions, equipment off normal, etc., are classified to the central office.

9 FOUND OK-OUT
All trouble reports Found OK by outside forces. Reports that were Found OK by central office forces before dispatching are included.

0 REFERRED-OUT
All trouble reports referred to other forces or agencies for further handling. This does not apply to trouble reports on TWX and WATS Classes of Service when the trouble locates in *near-end* plant (Station Apparatus, Access lines, and Serving Central Office).

CAUSE CODES

1 MAN MADE-TELEPHONE EMPLOYEE
Trouble was caused by a Telephone Company employee or overlooked by an employee on a previous report.

2 MAN MADE-OTHER
Trouble was caused by other than Telephone Company employees—intentionally or unintentionally. Includes troubles caused by Western Electric employees.

3 PLANT OR EQUIPMENT
Trouble was caused by overload, failure or breakdown of plant or equipment—independent of any direct human action.

4 WEATHER
Trouble was caused by weather conditions. Includes troubles caused by a tree being blown into the route of cables or wires.

5 OTHER
Covers cases not included in codes 1 thru 4.

6 UNKNOWN
Covers cases where it is impossible to determine the cause of a trouble or trouble report.

Fig. 12—Classification Codes and Definitions (Form E-4736)

E-5457 (6-67)

CENTRAL OFFICE LOG

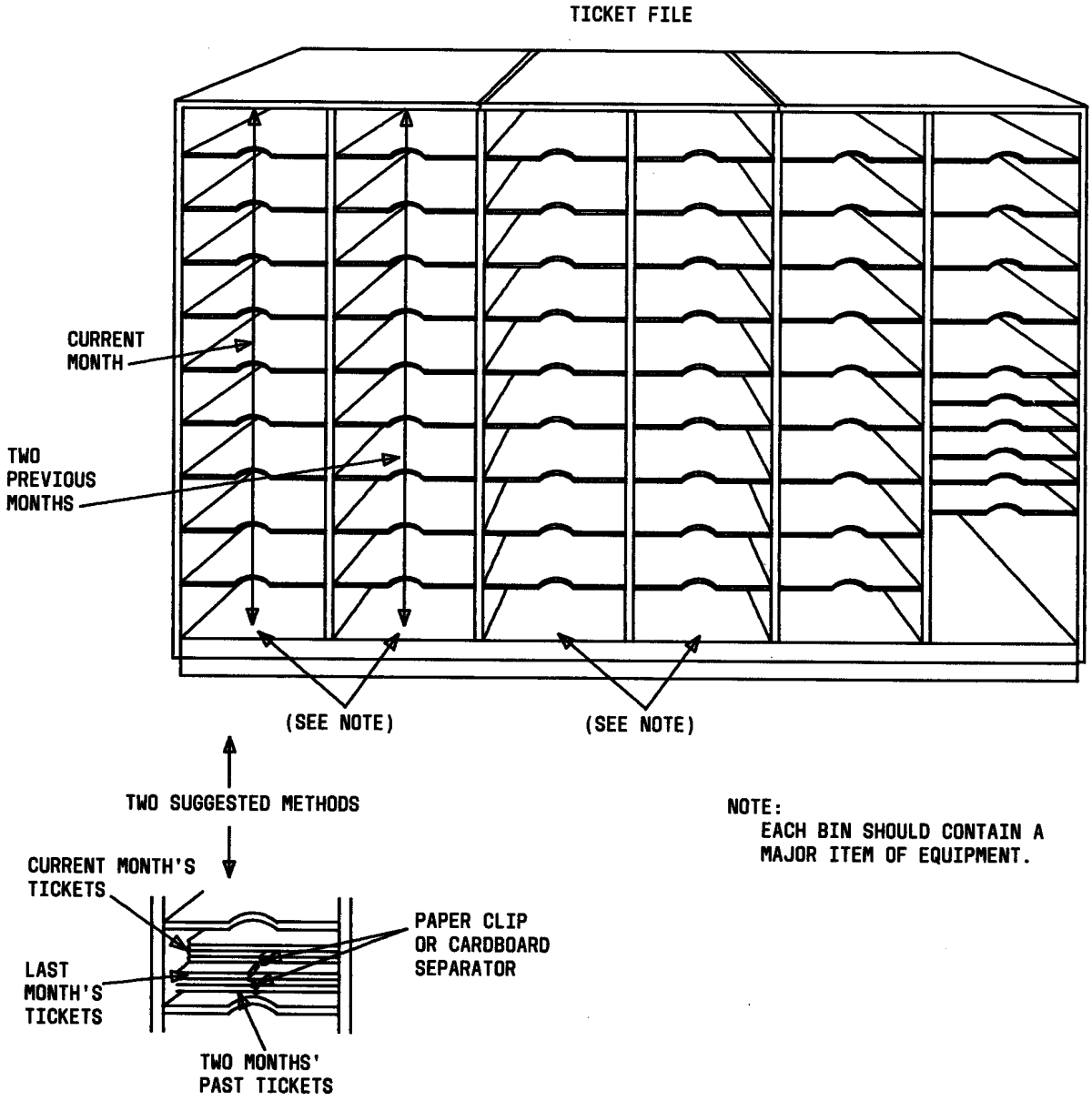
OFFICE 393 (A)

PERIOD JUNE 76 (B)

DATE	TKT. NO.	TIME RCVD.	FROM OR REPORT CLASS	NATURE OF REPORT OR ACTIVITY	DISP. TO	CLOSED OUT	EQPT. GROUP
(C)	(D)	(E)	(F)	(G)	(H)	(J)	(K)

NOTE	EXPLANATION
A	Central office name or unit designation.
B	Period covered by form.
C	Date report is received.
D	Central office trouble ticket serial number.
E	Time report received.
F	Trouble report source or report classification.
G	Brief description of report.
H	Initials of individual investigating report.
J	Indicates report closed out. Enter time or date.
K	Trouble ticket filing information. Enter equipment group.

Fig. 13—Central Office Log (E-5457)



TICKET FILE ORDERING INFORMATION:
(QUANTITY) - TICKET ANALYSIS FILE - DRAWING 38-Y-3868
(QUANTITY) - SNAP ON 8G DESIGNATION STRIP, TICKET ANALYSIS FILE - DRAWING 38-Y-3868
(QUANTITY) - DIVIDER, TICKET ANALYSIS FILE, DRAWING 38-Y-3868

Fig. 14—Trouble Ticket File

E-5463 (6-67)

TROUBLE SUMMARY

Office _____ **Period Covered** _____

EQUIPMENT	AVG PREV. YEAR	CUR OBJ	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL

Fig. 15—Trouble Summary (E-5463—Front)

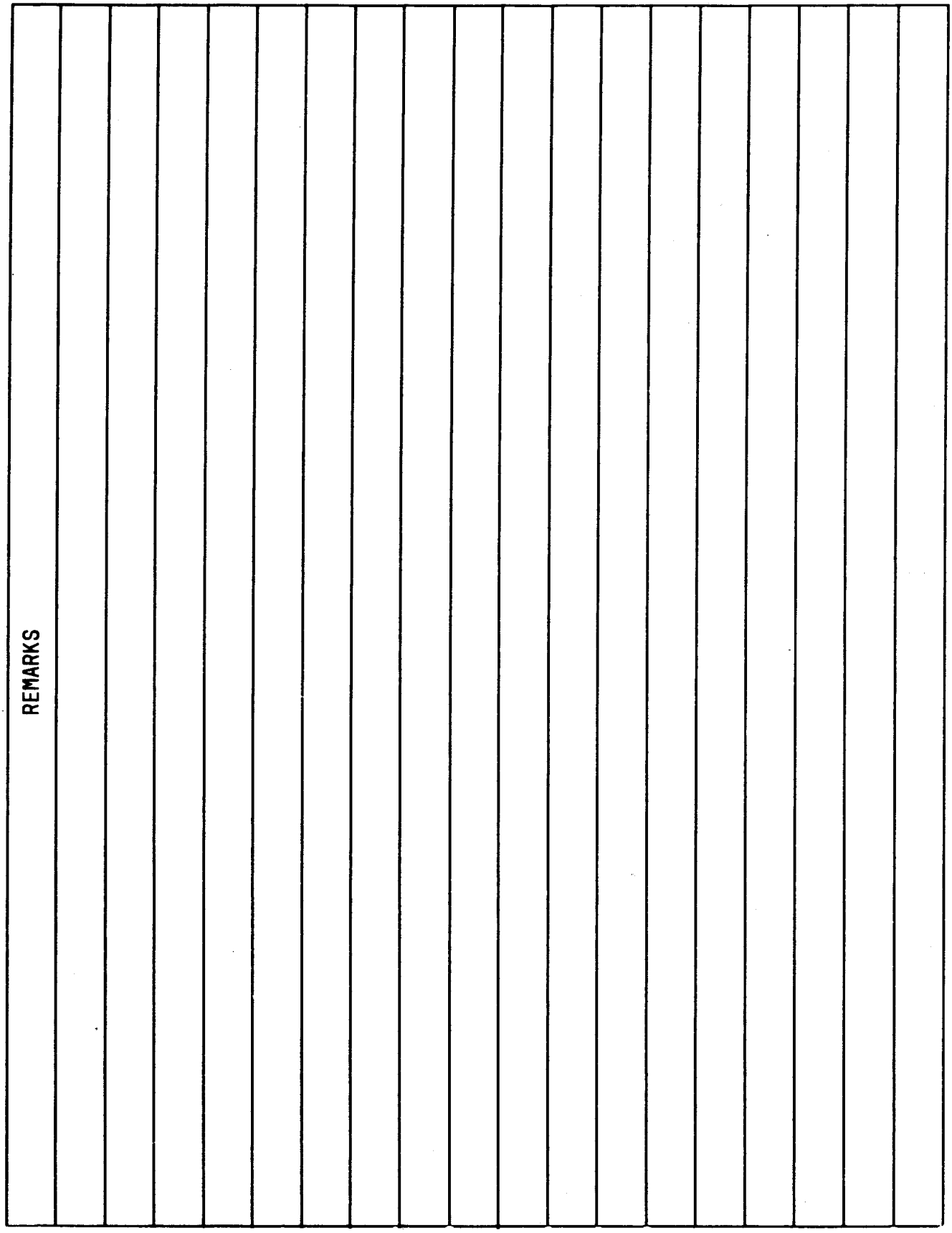


Fig. 16—Trouble Summary—Remarks (Form E-5463—Back)