INTERNATIONAL TELECOMMUNICATION UNION

ITU-T M.730

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

MAINTENANCE:
INTERNATIONAL TELEPHONE CIRCUITS

MAINTENANCE METHODS

ITU-T Recommendation M.730

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation M.730 was published in Fascicle IV.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation M.730

MAINTENANCE METHODS

1 General

In order to meet the service demands of a progressive and rapidly expanding international fully automatic telephone network with the best possible quality of service, it is essential that all factors adversely affecting the quality of service should be detected and service restored as quickly as possible. In setting this objective it is recognized that perfect performance is unattainable and that beyond a certain point, costs can rise sharply out of proportion compared with service quality gain.

When choosing a suitable maintenance method or a combination of methods one should consider:

– the reliability of the plant to be maintained;

– the availability of testing and supervisory facilities as well as the availability and quality of manpower in the maintenance organization;

– the availability of facilities in the plant that indicate the existence and frequency of disturbances;

– the availability of arrangements for automatic remedial action;

– the availability of automatic means to process and analyse operational data received from the plant;

– the final objective i.e. to ensure a satisfactory overall service quality (subscriber-to-subscriber) in the international connection, giving equal importance to the national and international parts of the chain that constitute the connection.

It is recognized that a combination of maintenance methods may be applied.

2 Preventive maintenance methods

2.1 *General*

The introduction of stored program control (SPC) exchanges and digital transmission systems reduce the need for preventive maintenance. SPC exchanges should in general be provided with functions which supervise the signalling, switching and transmission processes. If a fault occurs or if pre-set disturbance limits are reached, data which indicate the concerned device(s) or circuit(s) should be printed out.

External supervision, testing and fault localization functions should be avoided if internal functions in SPC exchanges or digital transmission systems can provide the same facilities.

2.2 *Functional tests*

2.2.1 In carrying out functional tests, ordinary working conditions apply and the equipment and circuits are taken as found.

They are carried out on a systematic basis to discover faults that would influence the quality of service. The response to each signal may be tested by equipment provided for this purpose. Such tests may be applied to any part of the signalling path.

2.2.2 Functional tests are carried out locally, or from either end of an international circuit to the other.

2.2.3 The organization of the programme for carrying out functional tests locally is left to the discretion of the Administration responsible for the international exchange.

2.2.4 Overall functional tests on an international circuit are such that they can be made from one end of the circuit without cooperation of technical personnel at the other end of the circuit. These tests may utilize the switching equipment at each end of the circuit, but such equipment is not being tested directly, only the circuit.

The verification of satisfactory signalling operation may be done by using various types of tests:

– Certain types of tests not requiring any special equipment, for example checking that a seizing signal is followed by the return of a proceed-to-send signal and that a clear-forward signal is followed by the return of a release-guard signal.

– Other types combining several tests, using special equipment at both ends. Any type which is in general use by Administrations may be used if suitable and agreed between the Administrations concerned[1)].

2.3 *Circuit limit tests*

2.3.1 A circuit limit test is made to verify that the international circuit meets specified operating margins. These tests enable the performance of the whole international circuit to be checked. They will be made as required but normally at the following times:

– before putting the circuit into service;

– according to a systematic test programme which may be based on measurement results or fault (trouble) statistics or quality of service observations (see Recommendation M.605).

They may also be made if functional tests indicate a fault, in order to locate such a fault.

Circuit limit tests may be made with respect either to transmission or to signalling conditions.

2.3.2 The frequency of such tests will be determined by the Administrations concerned and the test conditions to be applied will be in conformity with CCITT Recommendations.

2.3.3 The test equipment, the specifications and methods of gaining access to this equipment are described in the specifications of international signalling, switching and transmission equipment.

2.4 *Limit tests on the constituent parts of a circuit*

2.4.1 These limit tests are made to verify that the constituent parts of a circuit meet specified operating margins. They will be made as required but normally at the following times:

– at installation;

– if functional or limit tests on the circuit indicate a fault, if such tests will help in fault location;

– systematic test programmes which may be based on measurement results or trouble statistics or quality of service observations.

2.4.2 The frequency of such tests will be determined by the Administrations concerned and the test conditions to be applied will be in conformity with CCITT Recommendations.

2.4.3 Limit tests on constituent parts may indicate that the latter need to be readjusted; in such a case, measurements are made on those constituent parts and they are then readjusted in accordance with the relevant CCITT Recommendations.

2.4.4 The test equipment, its specification and the provision of access points will be determined by the Administration concerned taking into account the relevant CCITT Recommendations.

2.5 *Maintenance measurements*

2.5.1 *General*

Maintenance measurements are made periodically on complete circuits (and exceptionally, are indicated in Recommendation M.610 on their constituent parts). Their object is to indicate whether the circuits and equipments are maintained to their specified values when first put into service and, if not, to allow the necessary readjustment to be carried out.

Some maintenance measurements are made to check signalling; others are made to check transmission. They are carried out by the respective technical services responsible for signalling and transmission.

2.5.2 *Measurements concerning signalling*

The conditions for carrying out such measurements, the apparatus used and the periodicity of operations are determined by the relevant Series Q Recommendations. Interventions following such measurements are determined by:

a) CCITT Recommendations;

b) equipment specifications when these are not given in detail by the CCITT.

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1) See the specification for the CCITT Automatic Transmission Measuring and Signalling Testing Equipment ATME No. 2 (Recommendation O.22 [1]).

Information on the equipment and functions required are given in the Recommendations listed in Table 1/M.730.

TABLE 1/M.730

Signalling System	Recommendation
No. 4	Q.138 [2]
No. 5	Q.164 [3]
No. 6	Q.295 [4]
R2	Q.490 [5]
No. 7	Q.707 [6]

2.5.3 *Measurements concerning transmission*

These measurements include:

– local measurements, for which the Administrations concerned decide the conditions and periodicity;

– circuit and line measurements for which the conditions are generally defined in the Series M Recommendations.

These Series M Recommendations give, in particular, the periodicity of the measurements and the conditions for readjustment of transmission equipment. (See also Recommendation M.733.)

The CCITT has already specified certain transmission measuring apparatus, and other apparatus specifications are being studied.

3 Corrective maintenance methods

These methods may apply to certain parts of the plant where it is possible to locate and clear faults solely after they have affected the service. Corrective maintenance, if exclusively practised in the entire plant, can create unsatisfactory service conditions due to extreme variations in functional quality and can cause very irregular application of maintenance effort.

The application of exclusively corrective maintenance methods would presuppose such system design that even if breakdowns of single units or parts of the plant occur, they should have a minor effect on the service quality offered to the subscribers.

4 Controlled maintenance methods

Whereas it has been the practice to undertake programmes of preventive maintenance procedures together with day-to-day corrective maintenance procedures, recent equipment development has made it possible to introduce new maintenance methods. Modern systems can provide immediate information concerning the existence of irregularities and of abnormal conditions. Although preventive maintenance gives a comparatively good service, the number of defects caused by interference of preventive operations may be considerable.

A maintenance method utilizing the supervising facilities now available may enable the maintenance organization to considerably reduce preventive routines in the maintenance work. Preventive routine tests may then be replaced by methods of continuous supervision of the function of the plant and by means which check continuously the performance of the equipment and give signals to the maintenance staff when the quality of service is below a preset acceptance limit. Alternatively, when facilities for continuous supervision are not available, a sampling technique could be introduced to determine the number of routine tests necessary to gain a reasonable assurance that all equipments are in proper order.

Introduction of a system of maintenance control of this kind will necessitate a certain degree of centralization of administrative and technical means in the maintenance organization. Rapid and informative indication of the state and performance of the international and concerned parts of the national network is required from the maintenance point of view at strategic points in the network.

Various types of information on operational conditions in the plant can be utilized for maintenance supervision purposes, such as:

– traffic data;

– accounting data;

– maintenance data;

– service performance data.

Such data may be analysed manually but could also be processed in computers, allowing for a more extensive analysis, for instance, to compare performance statistics with preset standards which are set for particular routes, circuits, etc. Information held in the computer store may be extracted on-line and could be made directly available to those maintenance and management centres where it is required.

Application of computer processing as described necessitates a high degree of centralization, but also other factors support a centralized maintenance organization such as the increasing use of network management signals. The introduction of processor-controlled switching and digital transmission systems is also expected to increase the possibilities to apply remote controlled and centralized maintenance supervision methods in the future.

References

[1] CCITT Recommendation *CCITT automatic transmission measuring and signalling testing equipment ATME No. 2*, Vol. IV, Rec. O.22.

[2] CCITT Recommendation *Instruments for checking equipment and measuring signals*, Vol. VI, Rec. Q.138.

[3] CCITT Recommendation *Test equipment for checking equipment and signals*, Vol. VI, Rec. Q.164.

[4] CCITT Recommendation *Testing and maintenance – Overall tests of Signalling System No. 6*, Vol. VI, Rec. Q.295.

[5] CCITT Recommendation *Testing and maintenance*, Vol. VI, Rec. Q.490.

[6] CCITT Recommendation *Testing and maintenance*, Vol. VI, Rec. Q.707.