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European Standard (Telecommunications series)

**Environmental Engineering (EE);
Environmental conditions and environmental tests
for telecommunications equipment;
Part 2-0: Specification of environmental tests;
Introduction**



Reference

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE).

The present document is part 2, sub-part 0 of a multi-part deliverable covering environmental conditions and environmental tests for telecommunications equipment, as identified below:

Part 1: "Classification of environmental conditions";

Part 2: "Specification of environmental tests"

Sub-part 0: "Introduction";

Sub-part 1: "Storage";

Sub-part 2: "Transportation";

Sub-part 3: "Stationary use at weatherprotected locations";

Sub-part 4: "Stationary use at non-weatherprotected locations";

Sub-part 5: "Ground vehicle installations";

Sub-part 6: "Ship environments";

Sub-part 7: "Portable and non-stationary use";

Sub-part 8: "Stationary use at underground locations".

Part 1 specifies different standardized environmental classes covering climatic and biological conditions, chemically and mechanically active substances and mechanical conditions during storage, transportation and in use.

Part 2 specifies the recommended test severities and test methods for the different environmental classes.

National transposition dates	
Date of adoption of this EN:	5 September 2003
Date of latest announcement of this EN (doa):	31 December 2003
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2004
Date of withdrawal of any conflicting National Standard (dow):	30 June 2004

1 Scope

The purpose of the present document is to specify the test severities and methods for verification of the required resistibility for equipment which is to be stored, transported and used in the environments stated in Part 1 of the present document.

The purpose of the present document is to form a general overview of Part 2.

TR 100 035 [1] should be used in conjunction with all parts of EN 300 019 series. It gives an introduction to the main concepts of environmental engineering, the purpose and use of environmental classes and the corresponding test philosophy.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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| [1] | ETSI TR 100 035: "Environmental Engineering (EE); Environmental engineering; Guidance and terminology". |
| [2] | ETSI EN 300 019-1 (all subparts): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Classification of environmental conditions". |
| [3] | ETSI EN 300 019-2 (all subparts): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Specification of environmental tests". |
| [4] | IEC 60721-2-4: "Classification of environmental conditions - Part 2-4: Environmental conditions appearing in nature - Solar radiation and temperature". |
| [5] | IEC 60068: "Environmental testing". |

3 Definitions, symbols and abbreviations

Void

4 General

The purpose of environmental testing is to demonstrate that an equipment under defined environmental conditions can survive without irreversible failures and perform according to requirements.

These tests are not reliability tests or lifetime tests.

The severities of testing in EN 300 019-2-1 to 2-8 [3] are closely correlated with the characteristic severities of the environmental classes in EN 300 019-1-1 to 1-8 [2]. The transformation has been made taking into account failure consequences, performance requirements and the graded test severities in IEC 60068-2 [5] test methods. In EN 300 019-2-1 to 2-8 [3], "moderate failure consequences" and "normal performance requirements" shall be taken as standards, unless otherwise stated (see also TR 100 035 [1]).

In order to satisfy the environmental resistibility requirements, EN 300 019-2-1 to 2-8 [3] detail the severities and methods used. In many cases these conditions are different from those shown in EN 300 019-1-1 to 1-8 [2] and for some parameters no testing is recommended. Where conditions have been changed, this is done in order to:

- produce the effect of the environment rather than attempt to reproduce the actual physical environmental conditions; and/or
- enable standard testing to IEC 60068-2 [5]; and/or
- recognize that the given characteristic severity relates to a condition with a very low probability of occurrence.

Where no test is specified:

- other specified tests are considered to be more severe and cover that parameter; and/or
- the condition is benign and consequently does not require testing. However certain product specifications may require additional testing; and/or
- the condition is a valid one, but no standard test method exists; and/or
- the condition is considered when choosing components and materials.

The mechanical test severities given may deviate from the characteristic severities and may even be split into several test alternatives, taking into consideration equipment mass. The method given may also be different. This does not invalidate the verification because:

- depending on the equipment category, size, installation method and location inside the premises, the probable stresses are different within the class;
- usually only one combination of several existing complex mechanical stresses are given as a characteristic. Therefore, tests with different severities and methods can serve as verification and reveal the same failure mechanisms.

In meeting the test requirements shown in EN 300 019-2-1 to 2-8 [3], the equipment shall be deemed to comply with the resistibility requirements shown in EN 300 019-1-1 to 1-8 [2].

It is emphasized that performance requirements and the individual failure criteria which apply to a specific equipment shall be included in the relevant product specification. In particular, if relevant, the distinction between normal and reduced performance and between intermittent function and cessation of function should be precisely defined.

The classifications given in EN 300 019-1-1 to 1-8 [2] and the test severities given in EN 300 019-2-1 to 2-8 [3] do not cover any microenvironment caused by installing one equipment inside another, e.g. several sub-racks installed inside one miscellaneous rack. In such cases the applicable conditions shall be agreed between vendor and buyer.

In some cases test severities have been chosen which are not IEC preferred values, e.g. in order to stay within the prescribed limits of a climatogram.

5 Users guide

5.1 Test specifications and the states of test item

The relevant environmental test programme shall specify whether the test item is powered-up and whether it is in-use during each phase of the tests.

Two states of test item are usually required. These are the equipments "not in-use" and "in-use" states where:

- "not in-use" is normally the condition applicable to storage and transportation (for which the test programme shall specify if the equipment is to be in its packaging or not);
- "in-use" is normally the condition of the equipment in its working environment (for which the test programme shall specify the equipment's performance criteria, heat dissipation, failure consequences, etc.).

5.1.1 In-use tests

The required performance before, during and after the test shall be specified in the product specification. Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The dissipation shall be maximized by selection of supply power and load conditions, except for the steady-state-low-temperature test, where it shall be minimized.

The tests shall be conducted in accordance with IEC 60068-2 [5], unless otherwise stated in Part 2 of this EN 300 019-2-1 to 2-8 [3]. However, in all "in-use" tests, the equipment under test shall remain in its operational state with the exception of the cold test, in which the equipment will not be powered-up until temperature stabilization has been achieved.

The above operational conditions form a deviation from the conditioning requirements of IEC 60068-2-2 [5].

5.1.2 Not in-use tests

The test specifications corresponding to storage and transportation may call for the same or different test severities. The relevant environmental test programme shall describe the final compilation, where states of test item, performance requirements and failure consequences have been taken into account.

5.2 Selection of tests and test severities

In EN 300 019-1-1 to 1-8 [2], alternative characteristic severities for certain parameters may be chosen as special requirements in the environmental class. These special requirements shall be described in the relevant product specification and noted also in the test specification.

Some special test requirements may also exist. Usually they are based on the simultaneous combined effect of parameters causing similar stresses to the equipment.

Information about the combined effect of air temperature and solar radiation and the cooling effect of heat radiation are given in IEC 60721-2-4 [4]. The effect of surface colour and roughness on reflection of light and emission of heat are given in IEC 60068-2-5 [5].

For each environmental parameter all test severities in the chosen classes for storage, transportation and in-use should be considered and the relevant severity or severities should be chosen for the test. Non-relevant tests should be deleted. Experience from earlier tests may justify deletion of some tests.

6 Topics on making a test programme

The various aspects to be considered when formulating a test programme are discussed in TR 100 035 [1], clause 6.4.3:

- the programme is a result of co-operation between environmental experts, test engineers and equipment development engineers;
- an efficient way to perform the complete test programme requires engineering experience (knowledge about materials, components, construction and design), common sense and realistic judgements;
- considerations on testing costs, technology of equipment and life cycle costs shall be included;
- failure consequences other than moderate and/or degraded performance requirements can be taken into account by choosing, for example, a larger test sample or by modification of test severities. For further information see TR 100 035 [1].

Clauses 6.1 to 6.3 describe the most important items.

6.1 Environmental resistibility requirements

The environmental class defines the overall requirements.

The resistibility requirement for a given class is valid whether or not a test is included in the test specification programme.

The test specifications give the test severities for the verification of the resistibility.

The equipment under test shall be identical to that placed on the market.

For storage and transportation tests, if the equipment is normally packaged then it shall be tested in its packaging. For "in-use" tests, if the equipment is specially mounted (e.g. in a protective enclosure or with shock absorbing buffers), then it shall be tested as such.

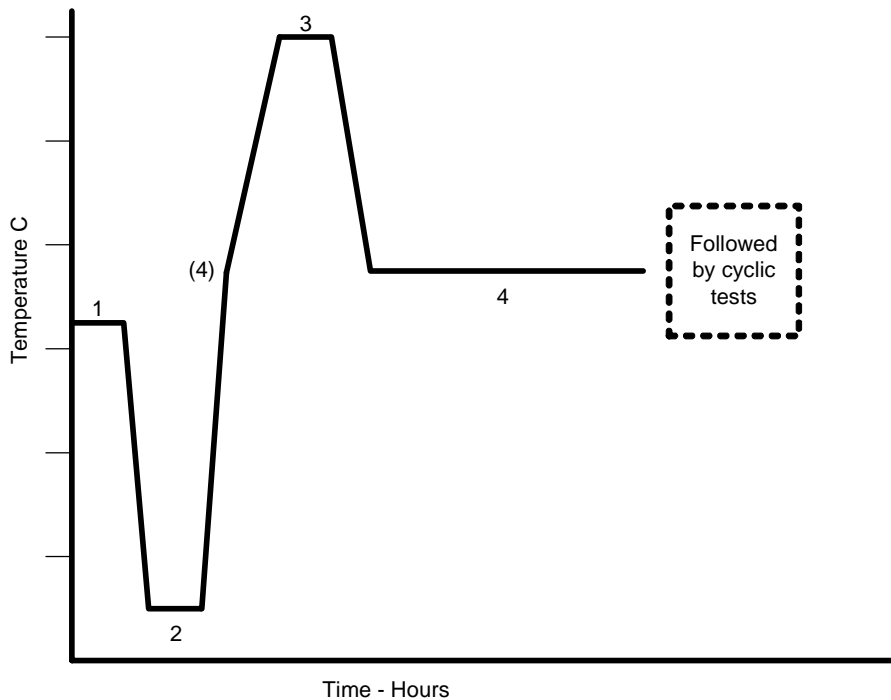
6.2 Test programme

For certain reasons (e.g. economic) the test programme can have several tests in sequence on one single equipment. Because of the impact of one test on another the test programme should avoid over-stress, since each test is defined as a stand-alone test.

A test sequence is strongly advised to provide a satisfactory reproducibility of a test program. The test sequence can be set up by taking into account the test severity and duration of the relevant class. Particularly the rate of change (0,5°C or 1°C/min) should not be exceeded during the whole sequence.

Only results from identical test sequences are comparable.

The preferred climatic test sequence is to start with a thermal stabilized system at room temperature and test first the cold test then the dry heat test, followed by the damp heat steady state test.



- 1) Stabilization and measurements at room temperature
- 2) Cold test
- 3) Dry heat test
- 4) Damp heat steady state test

NOTE 1: If conditions allow 4 can be carried out at (4) before 3. However, results of the two sequence tests are not comparable.

NOTE 2: The sequence in figure 1 is schematic only. The test severity, rate of change of temperature, stabilization, test duration and measuring points for each test are defined in references [2] and [5].

Figure 1: Preferred Climatic Test Sequence

If a failure occurs during the test cycle then only the test condition where the failure occurred should be repeated with a repaired test object. The complete test duration of that condition must be repeated.

The cyclic temperature and cyclic humidity (condensation) tests should be treated as individual cycles and could be tested after the test sequence. If specified, the cold start test should be performed separately.

6.3 Verification

The tests cover conditions during "not in-use" (transportation, and storage) and "in-use".

The "not in-use" tests with the same test procedure for storage and transportation shall be considered together and the most severe test should be selected for the test programme.

For equipment whose performance may be reduced at a characteristic severity, a statement shall be made in the test programme which details the acceptable degradation. The functional requirements may be separated into primary and secondary functions and those deemed to be essential shall be clearly identified.

In order to reduce the testing time, the number of functions to be checked shall be reduced to a minimum ensuring a high degree of confidence in the equipment's overall functionality.

The test programme shall detail which functions are to be checked before, during and after conditioning.

In-use tests require checking the item under test during conditioning.

Actions to be taken in case of failure should be decided before testing.

Failure criteria should be explicit.

History

Document history		
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