SLOVENSKI STANDARD
oSIST prEN IEC 60068-3-14:2024

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Okoljsko preskušanje - 3-14. del: Podporna dokumentacija in navodilo - Razvoj klimatskega sekvenčnega preskušanja

Environmental testing - Part 3-14: Supporting documentation and guidance - Developing a climatic sequential test

Ta slovenski standard je istoveten z: **prEN IEC 60068-3-14:2024**

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19.040	Preskušanje v zvezi z okoljem	Environmental testing
29.020	Elektrotehnika na splošno	Electrical engineering in general

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COMMITTEE DRAFT FOR VOTE (CDV)

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IEC TC 104 : ENVIRONMENTAL CONDITIONS, CLASSIFICATION AND METHODS OF TEST	
SECRETARIAT: Sweden	SECRETARY: Mr Henrik Lagerström
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☒ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING
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TITLE:

Environmental testing – Part 3-14: Supporting documentation and guidance – Developing a climatic sequential test

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ENVIRONMENTAL TESTING –

Part 3-14: Supporting documentation and guidance — Developing a climatic sequential test

FOREWORD

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International Standard IEC 60068-3-14 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,

- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The IEC 60068-2 series includes a variety of single and combined climatic condition tests. Some of these tests can give cumulative effects or hysteretic effects, causing the unit-under-test deteriorates, making it more vulnerable to the follow-up tests. Thus the determination of test sequence can have significant influence to the conclusion of a test.

This part of IEC 60068 provides guidance for developing a climatic sequential test for a certain type of product (electrical, electromechanical or electronic equipment and devices, as well as their subassemblies, constituent parts and components). It is written for technicians, engineers and managers in environment testing, and for those who need to understand the results of sequential climatic environment tests.

With the increasing importance of the IEC Quality Assessment System for Electronic Components (IECQ), it has become necessary to define the test sequence more precisely than could be done in clause 7 of IEC 60068-1, in order to provide a satisfactory reproducibility of the test. This International Standard describes in detail a composite test specifying a “climatic sequence” for specimens of products, and it includes guidance in informative annexes for specification writers and those performing the test.

ENVIRONMENTAL TESTING –

Part 3-14: Supporting documentation and guidance — Developing a climatic sequential test

1 Scope

This part of IEC 60068-3 describes a generic process for developing a climatic sequential test programme by sequencing the test methods selected from IEC 60068-2 series. The generic process comprises a systematic approach to the development of a sequential environmental test programme. The process is applicable to electrical product, and can be customized according to specific product requirements and applications. The process is designed for use by both product suppliers and purchasers. The full process is particularly relevant to electrical products, which would include products containing any components or material that have the potential to degrade, as a consequence of environmental exposure.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
cumulative effects
permanently remained consequences of environmental conditions imposed on a product after the environmental exposures are removed

3.2
hysteretic effects
gradually attenuated consequences of an environmental condition after the environmental exposure are removed

3.3
Life Cycle Environmental Profile
LCEP
design and test decision baseline document outlining real-world environmental conditions that a product or component will experience during usage-related events (e.g., transportation, storage, operational usage, maintenance) from its release/ manufacturing to the end of its useful life

4 Background

4.1 Environmental exposure sequence in life cycle

When exposed to environmental conditions, products will be influenced by the surrounding environment. The influence is related to the environmental severity, the mechanism of environment effect to the product and the initial state. To provide confidence that a product is capable of surviving and operating in the environmental conditions which will encounter during its life cycle, it is necessary to evaluate the product against those conditions. As far as practicable, such evaluations need to consider all environmental conditions and their sequence the product can experience during its life cycle. An environmental test programme should, as far as practicable, replicate the usage environment and expose the product to the environmental conditions so that the product would experience from the point of manufacture to the end of its life. The environmental conditions that exist during storage, transportation, handling and operation should be contained.

See IEC 60721-1, IEC 60721-2 and IEC 60721-3 for the classification of environmental conditions.

4.2 Failure mechanism under a sequential test

The environmental worthiness assessment of products is generally conducted by serial laboratory environmental tests according to a specified environmental test programme. See IEC 60721-4 for guidance for the correlation and transformation of environmental condition classes to the environmental tests. While a specimen is exposed to one environmental test, its state changes somehow. The changes can be some permanent damages due to the previous environment exposed onto the specimen, or some remaining effects by the previous environmental exposure, which will disappear gradually in a long duration.

When an environmental test programme is to be specified for a particular product, the sequence in which tests are carried out is important. That is because damage or effect, initiated by the previous environmental test, will not probably become apparent or significant, until another is applied. Specifically, a product can survive from an environmental test programme if the test is carried out in one particular order, but fail if carry out the test in another order. Therefore, the order in which environmental tests are undertaken, should ideally reflect the order in which they appear in the life cycle. In practice, it is usually not possible to exactly reproduce every aspect of a product life cycle, as environmental exposure can vary, especially during operational conditions.

5 Introduction to the Process

5.1 General

The process to develop a climatic environmental test sequence, as set out in this document, is considered in three stages:

a) Stage 1: review environmental requirements of products and compile a provisional sequence;

b) Stage 2: establish critical environments, based upon knowledge and refine sequence;

c) Stage 3: prepare a technically reliable, cost-effective sequential test programme.

5.2 Stage 1: review environmental requirements and compile a provisional test sequence

Stage 1 of the process, considers the product usage requirements to establish a provisional environmental sequence. Generally, the requirements of specific concerns are; the product life cycle, usually contained within the technical requirement, as well as the product environmental requirements. Together these can be used to generate a provisional list of environmental requirements and sequence. At this stage, the environmental sequence will comprise a list of environmental conditions arising from each phase of the product life cycle. This provisional environmental sequence will be extensive, with many similar environmental conditions appearing within a number of different phases, of the life cycle.

5.3 Stage 2: establish critical environments and refine sequence

Stage 2 of the process, refines the provisional environmental sequence to eliminate unnecessary repetition of environmental conditions, as well as consider the effects of the sequence and of potential product failure modes. The elimination of unnecessary repetition of environmental conditions is achieved by consideration of the operational state. For example, the environmental conditions occurring when the product is packaged and non-operational, have the potential to be merged.

It is possible for coincident environmental conditions to have an effect on the product, which is greater than the case if they are applied separately. In such cases, the coincident environmental conditions sometimes have a synergistic effect. If the synergistic effect is likely to be significant for a particular product, consideration should be given to undertaking combined environmental testing.

In parallel, consideration of the potential failure modes of the product, should allow a sequential order of the environmental conditions to be established. For example, if temperature variation testing degrades seals and joints, allowing moisture around to pass through these seals and joints when the product is exposed to a damp heat condition, the temperature variation test

should be done before the humidity test. Conversely, when moisture penetrates into electrical box during the humidity test, a following low temperature test can cause the test sample to condense or freeze inside. It is for this reason that recursive and iterative philosophy (so called “shake it, bake it and shake it again”) to refine test sequence is generally the keyword throughout the whole process to develop a test programme. Stage 2 of the process, also considers the environmental conditions which need to be considered as part of a sequential programme and those than can be considered separately, as non-sequential tests.

5.4 Stage 3: prepare sequential test programme

Stage 3 of the process considers the environmental sequence generated by the preceding stages and then generates a technically reliable, cost-effective test programme. Having identified the appropriate sequences of environments these can be converted into a test programme. This should also consider the need to include appropriate functional testing of the product during and after the testing as well as the need for any post-test destructive or non-destructive inspection. In certain cases, greater technical credibility and cost effectiveness can be achieved by modifying the sequence, to allow more effective use and time. Although, such modifications should not override the order identified in Stage 2, some adjustments can still be achieved.

5.5 Overall process

The overall process is illustrated in Table 1 and is discussed in detail hereinafter.

Table 1 – The process to develop an environmental test sequence

Stage	Task	Sub-Task
1	review equirements and compile a provisional test sequence	evaluate life cycle
		evaluate environmental requirements
		compile provisional lists of critical environments
2	establish critical environments, based upon knowledge of product and refine test sequence	consideration of the operational state of the product
		identification of potential failure modes
		review sensitivity of the product to sequential environmental conditions
		identify need for combined testing, and refine test programme
		consideration of sequential and non-sequential testing
3	prepare a sequential test programme	review programme for technical credibility and cost effectiveness

6 Stage 1: review requirements and compile provisional test sequence

6.1 Evaluate product life cycle

Consideration of the product life cycle should have occurred as part of the exercise to generate the environmental requirements document. The environmental requirements document should reflect the predominant phases of the life cycle. However, a product life cycle can contain multiple iterations of some events, such as the product has the potential to be transported several times in its entire life. As a consequence, even a well-constructed environmental requirements document should be considered alongside the life cycle, when identifying all the sequential conditions the particular equipment experiences.

The product life cycle can also be used to identify whether changes in logistics and operational usage will occur in the future. For example, one type of transport vehicle can be replaced by another. Even when information of future potential environmental conditions is not known, identifying the possibility permits the management of potential consequences. It is also necessary to consider a worst-case usage to future proof against unknown usage requirements.

6.2 Evaluate environmental requirements

6.2.1 Identify major phases

The information in the environmental requirements document can be presented in several ways. Whichever approach is used, the logistical and operational requirements should be broken down into their major phases. The phases will differ for each type of product, but typically will consist of the following, which reflect the layout used in other parts of this standard.