

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Standard conditions for use prior to and during the testing of solid electrical insulating materials

(standards.iteh.ai)

Conditions normales à observer avant et pendant les essais de matériaux isolants électriques solides

<https://standards.iteh.ai/catalog/standards/sist/9871969c-60a0-4086-afe1-4a006369586d/iec-60212-2010>



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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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Email: csc@iec.ch

Tél.: +41 22 919 02 11

Fax: +41 22 919 03 00



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**STANDARD CONDITIONS FOR USE PRIOR TO AND DURING
THE TESTING OF SOLID ELECTRICAL INSULATING MATERIALS**

FOREWORD

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International Standard IEC 60212 has been prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems.

This third edition cancels and replaces the second edition published in 1971 and constitutes a technical revision.

The significant technical changes with respect to the previous edition are as follows:

- the scope and normative references have been updated and terms and definitions completely reviewed;
- technical details in Table 2 have been aligned to today's usage.

The text of this standard is based on the following documents:

CDV	Report on voting
112/148/CDV	112/162/RVC

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

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

Many electrical insulating materials have properties which are affected by the temperature or humidity, or both, of the atmospheres to which they are subjected. It is usually necessary, therefore, when testing these materials, to control both temperature and humidity prior to testing, as well as the conditions in which the specimens are actually tested. The selection of appropriate conditions and tests should be decided according to the materials specification and the intended application. Unless otherwise specified, specimens should be conditioned and measured in the same climate as that in which they are to be tested.

When giving results of tests on electrical insulating materials likely to be affected by those factors, it is important that the relevant conditions to which the test specimens were exposed are reported. Specifications for such materials should, therefore, identify the atmospheres to which the test specimens should be exposed before testing and the conditions under which the tests are to be made.

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STANDARD CONDITIONS FOR USE PRIOR TO AND DURING THE TESTING OF SOLID ELECTRICAL INSULATING MATERIALS

1 Scope

This International Standard gives the accepted conditions of exposure time, temperature, atmospheric humidity and liquid immersion for use in testing solid electrical insulating materials. The range is sufficiently wide to enable suitable conditions to be selected so that either of the primary objects, set out below as a) and b), of conditioning can be achieved. These objectives aim to obtain greater reproducibility of test results by:

- a) partly counteracting the variations of the properties of the material due to the past history of the test specimens (often known as "normalizing", here called preconditioning), and
- b) ensuring uniformity of conditions during the testing.

This standard is not intended to be applied for determining the influence of exposure to certain temperatures and humidity or immersions in liquids, on the properties of a material. Procedures pertaining to the effect of an environment on a material are given in various parts of IEC 60068.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

<https://standards.iteh.ai/catalog/standards/sist/9871969c-60a0-4086-afe1-16073695834c/iec-60068-1-1988-amendment-1-1992>

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*
Amendment 1 (1992)

IEC 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens*

ISO 62:2008: *Plastics – Determination of water absorption*

3 Terms and definitions

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

3.1

insulating material

solid with negligibly low electric conductivity, used to separate conducting parts at different electrical potentials

NOTE 1 In English, the term "insulating material" is sometimes used in a broader sense to also designate insulating liquids and gases.

NOTE 2 An insulating material may be a solid, a liquid or a gas, or a mixture of these. This standard refers only to a solid insulating material.

3.2

specimen

typical sample of the insulating material under test, as described in the relevant test specification

3.3 preconditioning

treatment of a specimen with the object of removing or partly counteracting the effect of its previous history with respect, principally, to the temperature and humidity to which it has been exposed

NOTE 1 This treatment is sometimes known as "normalizing".

NOTE 2 Preconditioning usually precedes conditioning of a specimen. When the combination of temperature and humidity for conditioning is the same as that prescribed for preconditioning, the preconditioning may be said to take the place of conditioning.

NOTE 3 Preconditioning may be effected by subjecting the specimen to climatic, electrical or any other conditions required by the relevant test specification.

3.4 conditioning (of a specimen)

subjection of a specimen for a specified duration to specific climatic conditions (usually a specified temperature and a specified relative humidity) or to an atmosphere of specified relative humidity or to complete immersion in water or other liquid at a specified temperature

NOTE 1 When the combination of temperature and humidity for conditioning is the same as that prescribed for preconditioning, the preconditioning and conditioning may be merged and the preconditioning may be said to take the place of conditioning.

NOTE 2 According to circumstances, the space used for conditioning may be a whole laboratory room in which the specified conditions are maintained within the prescribed tolerances, or a special chamber.

3.5 chamber

enclosure or space in some part of which the specified conditions can be achieved

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3.6 working space

part of the chamber in which the specified conditions can be maintained within the specified tolerances

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3.7 period of conditioning

time that a specimen is subjected to conditioning

3.8 recovery

treatment of a specimen, after conditioning, in order that the properties remain stable before measurement

3.9 test conditions

temperature and humidity of the atmosphere surrounding the specimen, or temperature and kind of liquid (for liquid immersion), at the time tests are carried out

3.10 standard reference atmosphere

atmosphere to which values measured under any other atmospheric conditions are corrected by calculation

3.11 relative humidity

ratio of the actual vapour pressure (which indicates the amount of water vapour present in the air) to the theoretical maximum (saturation) vapour pressure at the same temperature, expressed as a percentage

3.12**vapour pressure**

pressure exerted by a vapour in equilibrium with its solid or liquid phase

3.13**saturation vapour pressure**

maximum possible pressure exerted by a vapour in equilibrium with its solid or liquid phase, such that any increase will initiate within the vapour a change to a more condensed state

3.14**ageing**

irreversible changes in one or more properties of a material as a result of its normal use or as a result of time through the action of an electrical, thermal, mechanical and/or environmental stress

4 Temperature and humidity (or liquid immersion) recommended for preconditioning, conditioning and testing

The recommended standard conditions of temperature and humidity (or liquid immersion) for preconditioning, conditioning and testing are given in Tables 2 and 3. Parameters should be carefully chosen so that treatment does not cause ageing in a test specimen.

When preconditioning is required, one of the standard atmospheres or one of the dry-hot conditions given in Table 2 may be used for a time specified in the material specification, (e.g. $24 \text{ h} \pm 2 \text{ h}$). It is usual to specify $(55 \pm 2) ^\circ\text{C}$ with a relative humidity of less than 20 %.

Preconditioning can be necessary in order to eliminate the effects of stress appearing after the moulding process of some plastic materials or as a drying treatment before the test procedure starts. The preconditioning shall normally be handled in a different environment.

The environment surrounding the sample (such as oil) shall be defined such that it does not have a deleterious effect on the sample's properties. There may be more than one preconditioning environment required to remove previous history and maximize reproducibility of results. Immersion in oil/liquid is only needed if testing is required to be undertaken in a liquid. A preconditioning fluid will have an influence on the test properties so further conditioning may be needed before testing and a recovery procedure required, as given in IEC 60068-1. The property of the sample will change through the time frame of the test unless it is correctly prepared beforehand.

5 Period of conditioning

The period of conditioning should be specified in the relevant material standard or test method. The period of conditioning will usually depend upon the type of material being tested.

In general, it is not intended that the period of conditioning shall be sufficient to enable the specimens to reach equilibrium with the surrounding atmosphere. The rate at which equilibrium is reached depends largely upon the nature and dimensions of the test specimens. Consequently, the period of exposure necessary to obtain equilibrium may in some cases (e.g. thin paper) be only a matter of a few minutes, but in others (such as hard rubber) it may be many months.

It is recommended that periods of conditioning be selected from the list given in Table 4.

6 Procedures for atmospheric preconditioning, conditioning and testing

It is strongly recommended that, whenever possible, tests should be made on specimens in a room or in a suitable chamber in which the required conditions are maintained throughout the test.

The test specimens may be conditioned (e.g. in a suitable chamber) and rapidly transferred to the testing room atmosphere, provided that the conditions in the testing room do not differ materially from the required conditions. This is admissible only when the property of the material under test is unlikely to be affected appreciably by transfer from the required conditioning atmosphere to the testing atmosphere. The maximum period allowed between the transfer and the test should be indicated in the test specification. The tests should be made within a few minutes of such a transfer if the maximum period allowable is not given.

Any technique may be used for obtaining the required conditions for the test specimens prior to, and during, testing (e.g. controlling temperature and humidity in the room or chamber). The required conditions shall be maintained throughout the preconditioning, conditioning and testing operations.

Care should be taken to allow free access of the conditioning atmosphere to all the specimens, and to ensure uniform conditions throughout the conditioning atmosphere in the neighbourhood of the specimens.

Where assisted drying is required before commencing testing, the hot dry atmosphere at 55 °C, given in Table 2, may be used for at least 4 h, unless otherwise prescribed in the relevant materials standard and test specification.

When dry-hot conditions are used, the oven should be ventilated. Information on oven ventilation is given in IEC 60216-4-1. [IEC 60212:2010](https://standards.iteh.ai/catalog/standards/sist/9871969c-60a0-4086-afe1-4a006369586d/iec-60212-2010)

When certain types of materials are being conditioned, harmful products may develop and it is important to prevent these from contaminating specimens of other materials.

When measuring leads are passed through the wall of a chamber, care should be taken to prevent significant leakage paths in parallel with the electrodes or measuring instrument, e.g. over the surfaces of the insulation of the leads.

7 Liquid immersion, conditioning and testing

The recommended temperatures for liquid immersion, conditioning and testing are given in Table 3. Specimens should be preconditioned, if specified, and immersed in the liquid at the specified temperature for the required time given in the material specification.

Care should be taken to allow free access of the liquid to all the specimens and to ensure uniform conditions throughout the liquid in the neighbourhood of the specimens.

When some materials are being conditioned, harmful products may develop and it is important to prevent contamination of specimens of other materials.

If the specimen cannot be tested in the liquid, it should be taken from the liquid and the surface liquid removed by pressing with a clean, dry filter, or blotting paper, or by wiping with a clean absorbent cloth before testing. The test should be commenced immediately after the surplus liquid has been removed, and completed as soon as possible. The maximum time between the removal of the specimen from the liquid and the measurement should be specified in the material specification.

8 Standard reference atmosphere

The standard atmosphere (B) of 23 °C ±2 °C and 50 % ±10 % relative humidity, see Table 2, is the preferred ambient atmosphere for conditioning and testing and should be used unless otherwise prescribed in the test specification. It is recommended that no other atmospheres are used if the insulating material is to be used at ambient conditions.

Results of tests which have been obtained at different temperatures and/or humidities cannot be correlated to a standard atmosphere.

9 Code for specifying preconditioning, conditioning and testing

Where it is desired to use a code for describing the conditions used for preconditioning, conditioning and testing, the following codes, shown in Table 1, should be used.

Table 1 – Codes for preconditioning, conditioning and testing

Conditioning	Code
As received	R
Atmospheric preconditioning and conditioning	(Hours) h/(temperature) °C/(r.h.) %
Immersion conditioning	(Hours) h/(temperature) °C/liquid
Testing (M)	M/(temperature) °C/(r.h.) %

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When the conditioning time is in weeks, the time portion of the code may be expressed as weeks (w).

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When preconditioning is used before conditioning, the two codes should be connected with a plus sign (+). A semicolon should separate the conditioning code from the testing code. Thus, if a specimen is to be preconditioned for 48 h at 55 °C and less than 20 % r.h., conditioned 96 h at 23 °C and 50 % r.h. and tested in the same atmosphere, the code would read:

48 h/55 °C/<20 % + 96 h/23 °C/50 %; M/23 °C/50 %.

If preconditioning is not foreseen, the first part of the code is omitted.

If the required tolerances are different from those designated in Tables 2 and 3, the tolerance should be included in the code as, for instance, 96 h/20 ± 0,5 °C/93 ± 1 %.

10 Report

The reporting procedure, as set out in the test specification, shall be followed and should include a reference to this standard and the preconditioning, conditioning and test conditions that the specimens were exposed to – in the form of the code described above.