
**Thermal insulating products
for building applications —
Determination of long-term water
absorption by immersion**

*Produits isolants thermiques destinés aux applications du bâtiment —
Détermination de l'absorption d'eau à long terme par immersion*

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[ISO 16535:2019](https://standards.iteh.ai/catalog/standards/sist/a7dd18d6-c34f-48ae-9e5a-8fe9b73520ff/iso-16535-2019)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see: www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 88, *Thermal insulating materials and products*, in collaboration with ISO Technical Committee TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 16535:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

- The content in [5.3](#), [6.4](#), [7.1](#) and [10](#) has been revised to reflect the conditions for tropical countries.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Thermal insulating products for building applications — Determination of long-term water absorption by immersion

1 Scope

This document specifies the equipment and procedures for determining the long-term water absorption of test specimens. It is applicable to thermal insulating products.

This document specifies two methods:

- Method 1: Partial immersion;
- Method 2: Total immersion.

The long-term water absorption by partial immersion is intended to simulate the water absorption caused by long-term water exposure.

The long-term water absorption by total immersion is not directly related to the conditions on site, but has been recognized as a relevant condition of test for some products in some applications.

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2 Normative references (standards.iteh.ai)

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 29768, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens*

3 Terms and definitions

No terms and definitions are listed in this document.

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

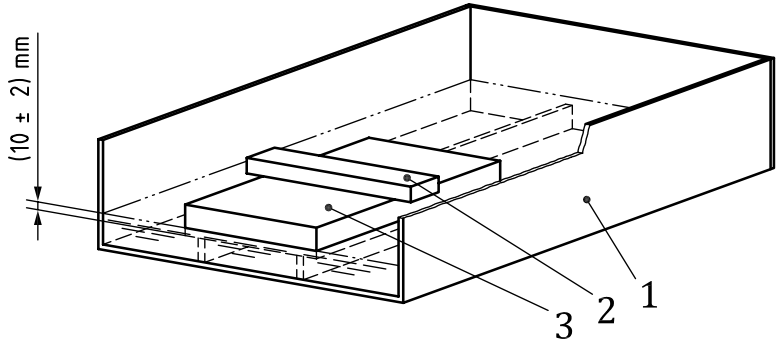
- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Principle

4.1 Method 1: Partial immersion

The long-term water absorption by partial immersion is determined by measuring the change in mass of a test specimen, the lower part of which is in contact with water for a period of 28 days.

The excess water adhering to the surface, not absorbed by the test specimen, is removed by drainage in method 1A or taken into account by deduction of the initial water uptake in method 1B.



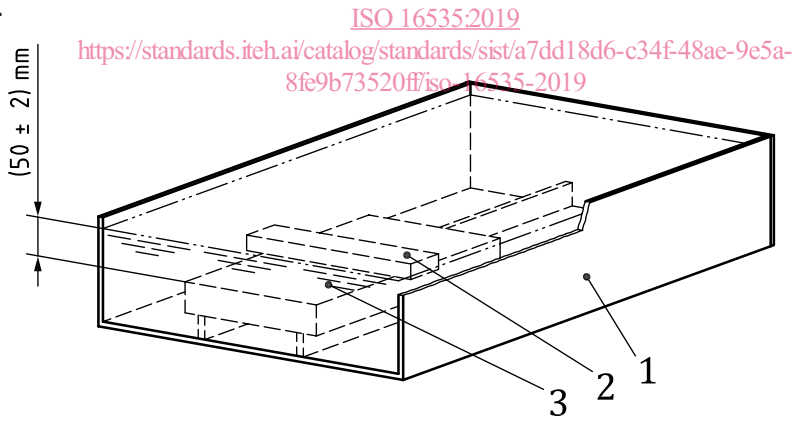
- Key**
- 1 water tank
 - 2 load to keep the test specimen in position
 - 3 test specimen

Figure 1 — Example of partial immersion test device (method 1A and 1B)

4.2 Method 2: Total immersion

The long-term water absorption by total immersion is determined by measuring the change in mass of the test specimen, totally immersed in water, over a period of 28 days.

The excess water adhering to the surface, not absorbed by the test specimen, is removed by drainage in method 2A or taken into account by deduction of the initial water uptake in method 2B. The method 2C use the Archimedes' principle to allow a determination of water absorption without moving the sample from the water tank.



- Key**
- 1 water tank
 - 2 load to keep the test specimen in position
 - 3 test specimen

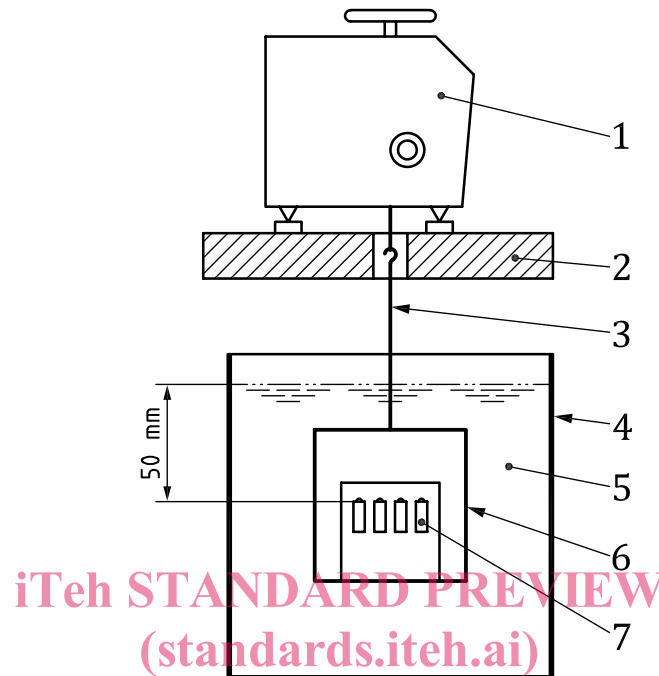
Figure 2 — Example of test device for the determination of water absorption by total immersion (method 2A and 2B)

5 Apparatus

5.1 Balance, capable of determining the mass of a test specimen with an accuracy of 0,1 g.

5.2 Water tank, with a device for keeping the water level constant to within ± 2 mm, and a device to keep the test specimen in the required position.

Examples of test devices are given in [Figures 1, 2 and 3](#). The device to keep the test specimen in position shall not cover more than 15 % of the cross-section area of the test specimen, which is exposed to water. The device shall be such that the original form of the test specimen is maintained.



Key

- | | | |
|---|--|---|
| 1 | balance | https://standards.iteh.ai/catalog/standards/sist/a7dd18d6-c34f-48ae-9e5a-8fe9b73520ff/iso-16535-2019 |
| 2 | weighing table | |
| 3 | linkage | |
| 4 | water container | |
| 5 | water | |
| 6 | mesh cage made of stainless material with fixing rods or a sinker large enough in mass to compensate for the upthrust of the test specimen | |
| 7 | test specimen | |

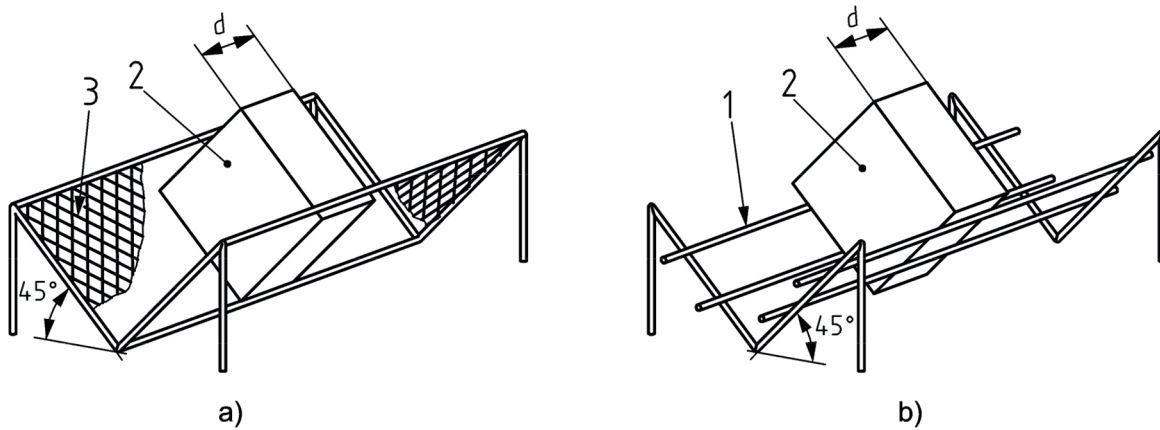
Figure 3 — Example of test device for determination of water absorption by total immersion (method 2C)

5.3 Tap water, adjusted to a temperature of (23 ± 5) °C. In case of dispute, deionised water shall be used.

In tropical countries, different conditions and testing conditions can be relevant. In such cases the temperature shall be (27 ± 5) °C, and this shall be stated in the test report.

5.4 Equipment for drainage.

Examples are shown in [Figures 4 a\)](#) and [4 b\)](#).



- Key**
- 1 stainless steel mesh
 - 2 test specimen
 - 3 perforated stainless steel
 - d* thickness of the sample

Figure 4 — Examples of equipment for drainage

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6 Test specimens

6.1 Dimensions of test specimens

The thickness of the test specimens shall be equal to the original product thickness.
The test specimens shall be prisms with squarely cut edges having sides of (200 ± 1) mm.

6.2 Number of test specimens

The number of test specimens shall be as specified in the relevant product standard or any other technical specification for thermal insulation products. In the absence of such a specification, at least four test specimens shall be used.
In the absence of a product standard or any other technical specification the number of test specimens may be agreed between parties.

6.3 Preparation of test specimens

The test specimens shall be cut so that they do not include original product edges.
Test specimens shall be prepared by methods that do not substantially change the original structure of the product. Any skins, facings and/or coatings shall be retained.
Special methods of preparation, when needed, are given in the relevant product standard or any other technical specification for thermal insulation products

6.4 Conditioning of test specimens

The test specimens shall be conditioned for at least 6 h at (23 ± 5) °C. In case of dispute they shall be stored at (23 ± 2) °C and (50 ± 5) % relative humidity for the time stated in the relevant product standard with a minimum of 6 h.

In tropical countries, different conditioning can be relevant. In this case, the conditions shall be $(27 \pm 5) ^\circ\text{C}$ (65 ± 5) RH (relative humidity), for at least 6 h and be stated clearly in the test report.

7 Procedure

7.1 Test conditions

The test shall be carried out at $(23 \pm 5) ^\circ\text{C}$. In case of dispute it shall be carried out at $(23 \pm 2) ^\circ\text{C}$.

In tropical countries, different testing conditions can be relevant. In this case, the conditions shall be $(27 \pm 2) ^\circ\text{C}$ (65 ± 5) % RH (relative humidity) and be stated clearly in the test report.

7.2 Test procedure

The method shall be as specified in the relevant product standard or any other technical specification for thermal insulation products.

In the absence of such a specification the method can be agreed between parties.

The long-term water absorption is determined after 28 days immersion.

If requested, readings can be made at shorter time periods, e.g. after 7- and 14-day immersion periods.

The dimensions of the test specimens shall be measured in accordance with ISO 29768 to the nearest 0,5 mm before the test.

If any dimensional changes are noticed after the immersion period, the dimensions of the test specimens should be measured again.

7.2.1 Long-term water absorption by partial immersion (method 1)

Method 1A (drainage)

Weigh the test specimen to the nearest 0,1 g to determine its initial mass, m_0 .

The test is carried out with half of the test specimens with one major face upwards and with the other half with the same major face downwards.

Place the test specimen in the empty water tank and apply a sufficient load to keep it partially immersed when water is added. Carefully add the water to the tank until the bottom face of the test specimen is (10 ± 2) mm below the surface of the water (see example in [Figure 1](#)). Ensure that the water level remains constant during the test.

After 28 days remove the test specimen; drain it for $(10 \pm 0,5)$ min by placing it vertically on a mesh, inclined at 45° , as shown in [Figure 4](#) a) or 4 b). Weigh the test specimen again to determine its mass, m_{28} .

Method 1B (deduction of initial water uptake)

Weigh the test specimen to the nearest 0,1 g to determine its initial mass, m_0 .

The test is made with half of the test specimens with one major face upwards and with the other half with the same major face downwards.

Place the test specimen in the water tank in such position that it is partially immersed in water with the bottom face of the test specimen (10 ± 2) mm below the water level. Remove the test specimen after 10 s holding it horizontally and place it, within 5 s, in a plastic tray of known mass. Reweigh this tray with the test specimen to determine the mass, m_1 , of the test specimen including the initial water uptake.