BS EN 12087:2013

BSI Standards Publication

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

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**National foreword**

This British Standard is the UK implementation of EN 12087:2013. It supersedes BS EN 12087:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540, Energy performance of materials components and buildings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.



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EUROPEAN STANDARD

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EUROPÄISCHE NORM

**EN 12087**

March 2013

ICS 91.100.60

Supersedes EN 12087:1997

English Version

# 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

Wärmedämmstoffe für das Bauwesen - Bestimmung der Wasseraufnahme bei langzeitigem Eintauchen

This European Standard was approved by CEN on 15 December 2012.

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# Foreword

This document (EN 12087:2013) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2013, and conflicting national standards shall be withdrawn at the latest by September 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12087:1997.

The revision of this standard contains no major changes, only minor corrections and clarifications of an editorial nature.

This European Standard is one of a series of standards which specify test methods for determining dimensions and properties of thermal insulating materials and products. It supports a series of product standards for thermal insulating materials and products which derive from the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products (Directive 89/106/EEC) through the consideration of the essential requirements.

This European Standard has been drafted for applications in buildings but may also be used in other areas where it is relevant.

This European test standard is one of the following group of inter-related standards on test methods for determining dimensions and properties of thermal insulation materials and products, all of which fall within the scope of CEN/TC 88:

— EN 822, *Thermal insulating products for building applications — Determination of length and width*

— EN 823, *Thermal insulating products for building applications — Determination of thickness*

— EN 824, *Thermal insulating products for building applications — Determination of squareness*

— EN 825, *Thermal insulating products for building applications — Determination of flatness*

— EN 826, *Thermal insulating products for building applications — Determination of compression behaviour*

— EN 1602, *Thermal insulating products for building applications — Determination of the apparent density*

— EN 1603, *Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 °C/50 % relative humidity)*

— EN 1604, *Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*

— EN 1605, *Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*

— EN 1606, *Thermal insulating products for building applications — Determination of compressive creep*

— EN 1607, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

— EN 1608, *Thermal insulating products for building applications — Determination of tensile strength parallel to faces*

— EN 1609, *Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*

— EN 12085, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens*

— EN 12086, *Thermal insulating products for building applications — Determination of water vapour transmission properties*

— EN 12087, *Thermal insulating products for building applications — Determination of long-term water absorption by immersion*

— EN 12088, *Thermal insulating products for building applications — Determination of long-term water absorption by diffusion*

— EN 12089, *Thermal insulating products for building applications — Determination of bending behaviour*

— EN 12090, *Thermal insulating products for building applications — Determination of shear behaviour*

— EN 12091, *Thermal insulating products for building applications — Determination of freeze-thaw resistance*

— EN 12429, *Thermal insulating products for building applications — Conditioning to moisture equilibrium under specified temperature and humidity conditions*

— EN 12430, *Thermal insulating products for building applications — Determination of behaviour under point load*

— EN 12431, *Thermal insulating products for building applications — Determination of thickness for floating floor insulating products*

— EN 13793, *Thermal insulating products for building applications — Determination of behaviour under cyclic loading*

— EN 13820, *Thermal insulating materials for building applications — Determination of organic content*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

# 1 Scope

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

This European Standard specifies two options:

— 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 recognised as a relevant condition of test for some products in some applications.

# 2 Normative references

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

EN 12085, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

# 3 Terms and definitions

This European Standard contains no terms and definitions.

# 4 Principle

## 4.1 Partial immersion (method 1)

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.

## 4.2 Total immersion (method 2)

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.

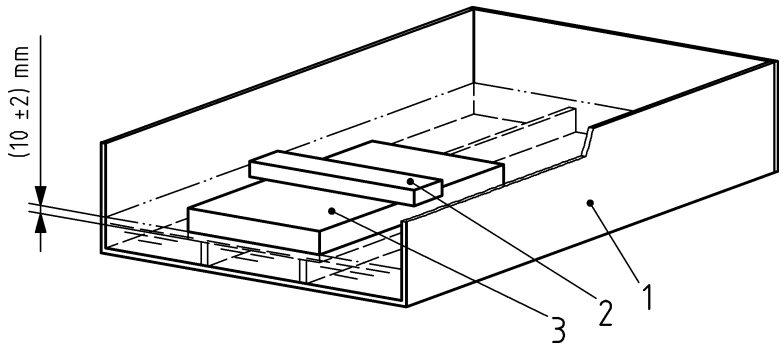
The excess water adhering to the surface, not absorbed by the test specimen, is removed by drainage in method 2A or taken into account by deduction of the initial water uptake in method 2B.

# 5 Apparatus

**5.1 Balance**, which allows the determination of the mass of a test specimen to 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 the 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.



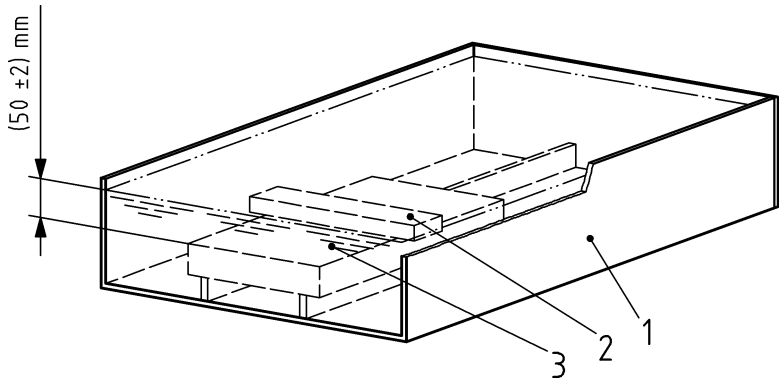

**Key**

1 watertank

2 load to keep the test specimen in position

3 test specimen

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



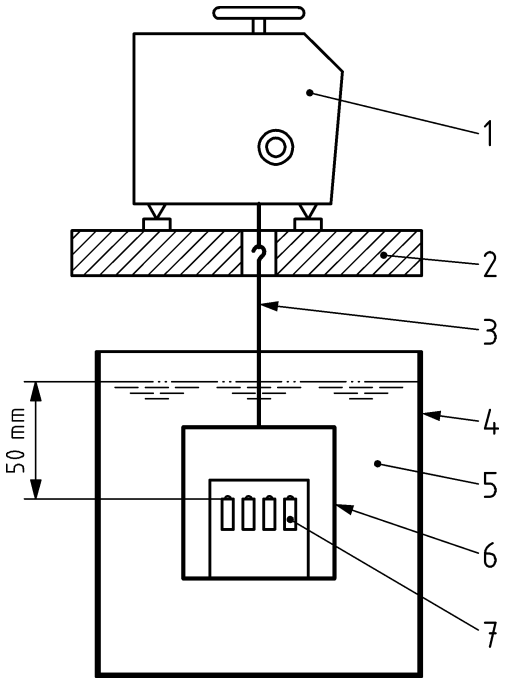

**Key**

1 watertank

2 load to keep the test specimen in position

3 test specimen

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




**Key**

1 balance

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

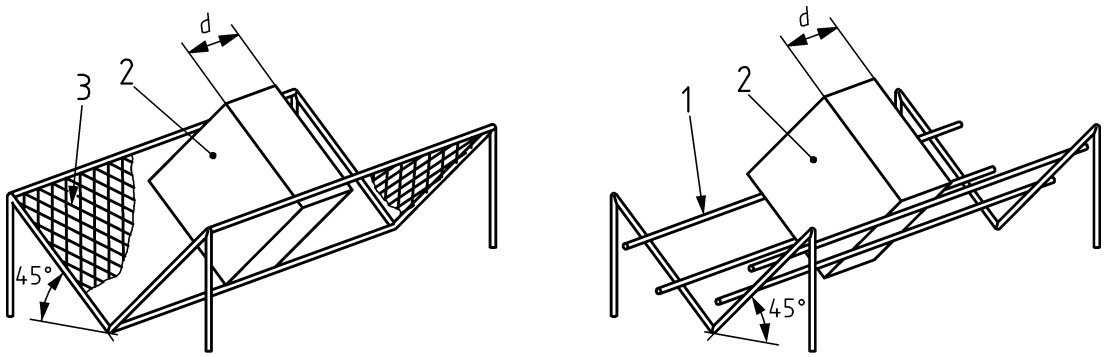
**Figure 3 — Example of equipment for determination of water absorption by total immersion (method 2C)**

**5.3 Tap water**, adjusted to a temperature of (23 ± 5) °C.

In case of dispute, deionised water shall be used.

**5.4 Equipment for drainage**

The principle for methods 1A and 2A is illustrated in Figures 4a and 4b.




**Key**

1 stainless steel mesh

2 test specimen

3 perforated stainless steel

**Figure 4 — Examples of equipment for drainage**

# 6 Test specimens

## 6.1 Dimensions of test specimens

The thickness of the test specimens shall be the original product thickness.

The test specimens shall be squares 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 European Technical Specification. In the absence of such a specification, at least four test specimens shall be used.

## 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 European Technical Specification.

## 6.4 Conditioning of test specimens

The test specimens shall be stored 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.

# 7 Procedure

## 7.1 Test conditions

The test shall be carried out at (23 ± 5) °C. In case of dispute it shall be carried out at (23 ± 2) °C.

## 7.2 Test procedure

### 7.2.1 General

The method shall be as specified in the relevant product standard or any other European Technical Specification.

In the absence of such a specification, the method may 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 days and 14 days immersion periods.

The dimensions of the test specimens shall be measured in accordance with EN 12085 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.

### 7.2.2 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 conducted 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 ± 0,5) min by placing it vertically on a mesh, inclined at 45°, as shown in Figure 4a or 4b. 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 conducted 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.

Replace the test specimen in the water tank and apply a sufficient load to keep the test specimen partially immersed in water with the bottom face of the test specimen (10 ± 2) mm below the water level (see example in Figure 1). Ensure that the water level remains constant during the test.

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

After 28 days remove the test specimen holding it horizontally and place it, within 5 s, in the plastic tray of previously determined mass to determine its mass, $m_{28}$.

Method 1B is only applicable if the initial water uptake is less than or equal to 0,5 kg/m², where this is calculated using the expression:

$$\frac{m_1 - m_0}{A_p} \quad (1)$$

where

$m_0$ is the initial mass of the test specimen as determined in method 1B, in kilograms;

$m_1$ is the mass of the test specimen including the initial water uptake in method 1B, in kilograms;

$A_p$ is the bottom surface area of the test specimen, in square metres.

### 7.2.3 Long term water absorption by total immersion (method 2)

**Method 2A (drainage)**. Weigh the test specimen to the nearest 0,1 g to determine its initial mass, $m_0$.

Place the test specimen in the empty water tank and apply a sufficient load to keep the test specimen totally immersed in water. Carefully add water to the tank until the top face of the test specimen is (50 ± 2) mm below the surface of the water (see Figure 2). Ensure that the water level remains constant during the test.

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

**Method 2B (deduction of initial water uptake)**. Weigh the test specimen to the nearest 0,1 g to determine its initial mass, $m_0$.

Place the test specimen in the water tank in such position that it is totally immersed in water with the top face of the test specimen (50 ± 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 of the test specimen, $m_1$, including the initial water uptake.

Replace the test specimen in the water tank and apply a sufficient load to keep the test specimen totally immersed in water, with the top face of the test specimen (50 ± 2) mm below the water level (see example in Figure 2). Ensure that the water level remains constant during the test.

After 28 days remove the test specimen, holding it horizontally, and place it within 5 s in the plastic tray of previously determined mass to determine its mass, $m_{28}$.

Method 2B is only applicable if the initial water uptake is less than or equal to 0,5 kg/m², where this is calculated using the expression:

$$\frac{m_1 - m_0}{A_t} \quad (2)$$

where

$m_0$ is the initial mass of the test specimen as determined in method 2B, in kilograms;

$m_1$ is the mass of the test specimen including the initial water uptake in method 2B, in kilograms;

$A_t$ is the total surface area of the test specimen exposed to water, in square metres.

**Method 2C**. Weigh the test specimen to the nearest 0,1 g to determine its initial mass, $m_0$.

Determine the linear dimensions of the test specimen ($l_0$, $b_0$, $d_0$) according to EN 12085 to the nearest 0,5 mm. Fill the water container with the tap water. Weigh the immersed empty cage to the nearest 0,1 g (mass $m_1$).

Remove the cage and attach the test specimen horizontally in the cage so that the distance between the surface of the water and the top surface of the test specimen will be (50 ± 2) mm. Ensure that this distance remains constant during the test. Immerse the assembled cage, and attach it to the balance.

Remove obvious air bubbles from the test specimen with a brush or by agitation.

Ensure that the cage remains at the same level relative to the surface of the water for all weighings.

After 28 days determine the apparent mass, $m_{28}$, of the submerged cage containing the test specimen, to the nearest 0,1 g.

Re-measure the linear dimensions of the test specimen as before ($l_1$, $b_1$, $d_1$) to the nearest 0,5 mm.

# 8 Calculation and expression of results

## 8.1 General

The test result shall be the mean value of the individual values (for products having different faces (facings) on each side two mean values are calculated in method 1).

Results shall not be extrapolated to other thicknesses.

Results obtained by different water absorption test methods are not comparable.

## 8.2 Long-term water absorption by partial immersion

Calculate the long-term water absorption by partial immersion for each test specimen, $W_{lp}$, in kilograms per square metre using Formula (3) or (4):

**Method 1A**

$$W_{lp} = \frac{m_{28} - m_0}{A_p} \quad (3)$$

**Method 1B**

$$W_{lp} = \frac{m_{28} - m_1}{A_p} \quad (4)$$

where

$m_0$ is the initial mass of the test specimen as determined in method 1A, in kilograms;

$m_1$ is the mass of the test specimen including the initial water uptake in method 1B, in kilograms;

$m_{28}$ is the mass of the test specimen after partial immersion for 28 days (method 1A and 1B), in kilograms;

$A_p$ is the bottom surface area of the test specimen, in square metres.

$W_{lp}$ shall be rounded to the nearest 0,01 kg/m$^2$.

## 8.3 Long-term water absorption by total immersion

Calculate the long-term water absorption by total immersion, $W_{lt}$, in volume percent using Formula (5) or (6):

**Method 2A**

$$W_{lt} = \frac{m_{28} - m_0}{V} \; x \; \frac{100}{\rho_W} \tag{5}$$

**Method 2B**

$$W_{lt} = \frac{m_{28} - m_1}{V} \; x \; \frac{100}{\rho_W} \tag{6}$$

where

$m_0$ is the initial mass of the test specimen as determined in method 2A,in kilograms;

$m_1$ is the mass of the test specimen including the initial water uptake in method 2B, in kilograms;

$m_{28}$ is the mass of the test specimen after total immersion for 28 days in method 2A and 2B, in kilograms;

$V$ is the initial volume of the test specimen, in cubic metres;

$\rho_W$ is the density of water, assumed to be 1 000 kg/m³.

$W_{lt}$ shall be rounded to the nearest 0,1 volume percent.

**Method 2C**

Calculate the water absorption after the immersion time of 28 days, $W_{28}$, in percent volume using Formula (7):

$$W_{28} = \frac{m_{28} + V_1 \, x \, \rho_W - m_0 - m_1}{V_0 \, x \, \rho_W} \; \text{x} \; 100 \tag{7}$$

where

$m_0$ is the initial mass of the test specimen, in kilograms;

$m_1$ is the mass of the empty cage immersed, in kilograms;

$m_{28}$ is the mass of the test specimen and the cage submerged after 28 days of immersion, in kilograms;

$V_0 = l_0 \times b_0 \times d_0$ is the initial volume of the test specimen, in cubic metres;

$V_1 = l_1 \times b_1 \times d_1$ is the volume of the test specimen after 28 days of immersion, in cubic metres;

$\rho_W$ is the density of water, assumed to be 1 000 kg/m³.

$W_{28}$ shall be rounded to the nearest 0,1 volume percent.

## 9 Accuracy of measurement

Following the experience of a "round robin test" where comparable test equipment and test specimen preparation were used, the accuracy for long-term water absorption by partial immersion $W_{ip}$ for methods 1A and 1B, can be estimated as given below:

95 % reproducibility limit for method 1A: Approximately 0,15 kg/m$^2$

95 % reproducibility limit for method 1B: Approximately 0,20 kg/m$^2$

The above mentioned terms are applied as described in ISO 5725-2.

## 10 Test report

The test report shall include the following information:

a) reference to this European Standard;

b) product identification:

   1) product name, factory, manufacturer, or supplier;

   2) production code number;

   3) type of product;

   4) packaging;

   5) the form in which the product arrived at the laboratory;

   6) other information as appropriate, e.g. nominal dimensions, nominal density;

c) test procedure:

   1) pre-test history and sampling (e.g. who sampled and place of sampling);

   2) conditioning;

   3) dimensions of the test specimens;

   4) deviation from Clauses 6 and 7, if any;

   5) date of testing;

   6) general information related to the test including reference to methods used (1A, 2A, 1B, 2B or 2C) and, if relevant, the initial water uptake;

   7) events which may have affected the results. Information about the apparatus and identity of the technician should be available in the laboratory but it need not be recorded in the report;

d) results: all individual values and the mean value(s).

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