INTERNATIONAL STANDARD

ISO 29472

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

Produits isolants thermiques destinés aux applications du bâtiment — Détermination de la stabilité dimensionnelle dans des conditions de température et d'humidité spécifiées

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 29472 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*.

Introduction

This International Standard comprises the original EN 1604:1996 and EN 1604:1996/AC:1997 prepared by Technical Committee CEN/TC 88, *Thermal insulating materials and products*, which have been amended by ISO/TC 163/SC 1 with reference to conditioning and testing conditions in tropical countries.

This International Standard is one of a series of documents specifying test methods, based on existing European Standards, that are being adopted by ISO. This "package" of standards includes the following group of interrelated documents.

International Standard	Respective EN standard
ISO 29465, *Thermal insulating products for building applications — Determination of length and width*	EN 822
ISO 29466, *Thermal insulating products for building applications — Determination of thickness*	EN 823
ISO 29467, *Thermal insulating products for building applications — Determination of squareness*	EN 824
ISO 29468, *Thermal insulating products for building applications — Determination of flatness*	EN 825
ISO 29469, *Thermal insulating products for building applications — Determination of compression behaviour*	EN 826
ISO 29470, *Thermal insulating products for building applications — Determination of the apparent density*	EN 1602
ISO 29471, *Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23°C/50 % relative humidity)*	EN 1603
ISO 29472, *Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*	EN 1604
ISO 29764, *Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*	EN 1605
ISO 29765, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*	EN 1607
ISO 29766, *Thermal insulating products for building applications — Determination of tensile strength parallel to faces*	EN 1608
ISO 29767, *Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*	EN 1609
ISO 29768, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens*	EN 12085

ISO 29769, *Thermal insulating products for building applications — Determination of behaviour under point load*	EN 12430
ISO 29770, *Thermal insulating products for building applications — Determination of thickness for floating-floor insulating products*	EN 12431
ISO 29771, *Thermal insulating materials for building applications — Determination of organic content*	EN 13820
ISO 29803, *Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)*	EN 13497
ISO 29804, *Thermal insulation products for building applications — Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material*	EN 13494
ISO 29805, *Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes*	EN 13496

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

1 Scope

This International Standard specifies the equipment and procedures for evaluating dimensional changes of specimens under specified conditions of temperature, relative humidity and duration of exposure. This International Standard proposes a range of conditions from which one or more desirable test conditions can be selected. This International Standard is applicable to thermal insulating products.

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.

ISO 29768, *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

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

3.1
length
l
dimension of the specimen parallel to the longer linear dimension of the major surface of the original product

3.2
width
b
linear dimension of the major surface of the specimen, measured at right angles to the length

3.3
thickness
d
linear dimension measured perpendicularly to the length and width plane

4 Principle

A determination is made of the changes in linear dimensions that occur when the specimens are conditioned, subjected to specified environments for a given period, and then reconditioned.

5 Apparatus

5.1 **Temperature-controlled** or **temperature- and humidity-controlled chamber**, capable of maintaining the specimens within the specified conditions and within the limits specified in 7.2.

5.2 **Measuring instruments**, capable of measuring linear dimensions of specimens in accordance with ISO 29768, to an accuracy of 0,1 mm.

6 Test specimens

6.1 Dimensions of test specimens

The thickness of specimens shall be equal to the original product thickness.

The specimens shall be squarely cut and have a side length of (200 ± 1) mm. If larger dimensions are used, the accuracy shall be as given in 5.2.

6.2 Number of test specimens

The number of specimens shall be as specified in the relevant product standard. If the number is not specified, then at least three specimens shall be tested for each set of chosen conditions. In the absence of a product standard or any other international or European technical specification, the number of specimens may be agreed between parties.

6.3 Preparation of test specimens

The specimens shall be cut so that they are representative of the full size product. Any surface skins, facings and/or coatings shall be retained. Length and width directions shall be marked on the specimens.

6.4 Conditioning of test specimens

The specimens shall be conditioned to equilibrium with an atmosphere at (23 ± 2) °C and (50 ± 5) % relative humidity. A specimen is considered to be conditioned when changes in length and in width, measured according to 7.2, between two consecutive measurements at a time interval of two weeks, are less than 0,1 %.

Other time intervals may be defined in the relevant product standard or any other international or European technical specification.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be 27 °C and 65 % RH and be stated clearly in the test report.

7 Procedure

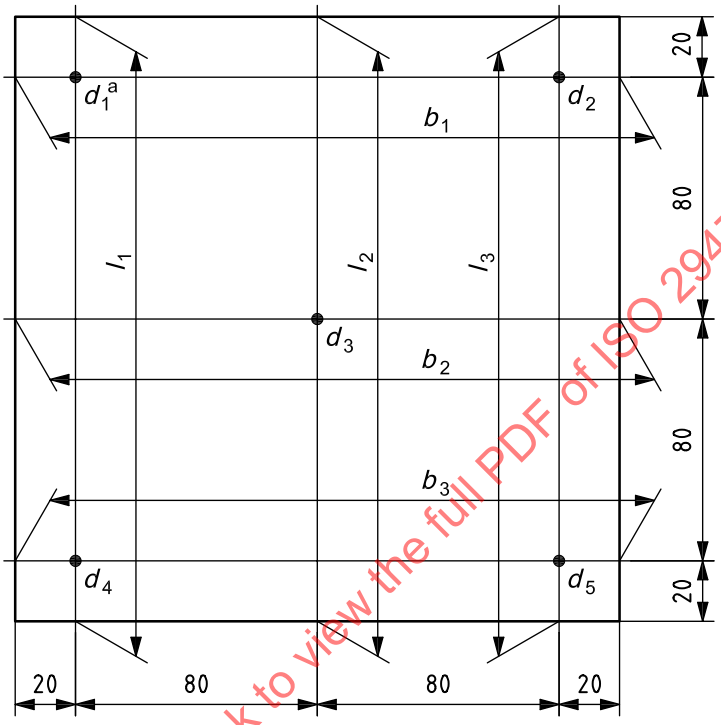
7.1 Test conditions

Condition the specimens in accordance with 6.4.

7.2 Test procedure

7.2.1 In the same atmosphere as used for conditioning, determine the initial length and width of each specimen (l_0 and b_0, respectively) by taking readings at three positions (l_{01}, l_{02}, l_{03} and b_{01}, b_{02}, b_{03}, respectively) and the initial thickness (d_0) at five positions (d_{01}, d_{02}, d_{03}, d_{04}, d_{05}) as shown in Figure 1, using the appropriate methods described in ISO 29768, to an accuracy of 0,1 mm.

Dimensions in millimetres



[a] The subscript indicates the number of the reading, e.g., d_1 stands for d_{01} and d_{t1}.

Figure 1 — Positions for measuring dimensions

7.2.2 Expose a set of specimens to each of the conditions specified in the relevant product standard.

7.2.3 In the absence of such a specification, test conditions may be agreed between parties, chosen from 7.2.3.1 and 7.2.3.2. Other conditions may be used.

7.2.3.1 For a specified temperature without a specified relative humidity:

— (−40 ± 3) °C;

— (−30 ± 3) °C;

— (+40 ± 2) °C;

— (+60 ± 2) °C.

7.2.3.2 For a specified temperature with a relative humidity specified in the range 30 % to 90 %, to an accuracy of ± 5 % relative humidity:

— $(+20 \pm 2)^{0}0$;

— (+23 ± 2) °C;

— (+60 ± 2) °C;

— (+70 ± 2) °C.

7.2.4 Lay the specimens horizontally or place them vertically in the test chamber, not less than 25 mm apart, on rigid wire mesh or perforated metal plate such that substantially free air circulation occurs around the specimens.

The specimens shall not be exposed to direct radiation from any heating elements.

The preferred duration of exposure is (24 ± 1) h or (48 ± 1) h.

Other exposure times may be as specified in the relevant product standard or any other international or European technical specification or may be agreed between parties.

7.2.5 Remove the specimens after exposure to the test atmosphere and expose them for a further (3 ± 1) h at (23 ± 2) °C and (50 ± 5) % relative humidity.

7.2.6 Determine the final length, width, and thickness of the specimens (l_t and b_t and d_t, respectively) by taking readings (l_{t1}, l_{t2}, l_{t3} and b_{t1}, b_{t2}, b_{t3} and d_{t1}, d_{t2}, d_{t3}, d_{t4}, d_{t5}, respectively) at the same positions as for the initial measurements (see Figure 1).

7.2.7 Examine the specimens visually.

If requested in the relevant product standard or any other international or European technical specification, the specimens may be re-exposed to the test conditions for periods of 7 days and the dimensions re-determined at the positions shown in Figure 1, at the end of the requested periods.

8 Calculation and expression of results

Calculate the dimensional changes, $\Delta\varepsilon_1$, $\Delta\varepsilon_b$ and $\Delta\varepsilon_d$, expressed as percentages, from the individual measurements, using the Equations (1) to (3):

$$\Delta\varepsilon_1 = 100 \times \frac{l_t - l_0}{l_0} \quad (1)$$

$$\Delta\varepsilon_b = 100 \times \frac{b_t - b_0}{b_0} \quad (2)$$

$$\Delta\varepsilon_d = 100 \times \frac{d_t - d_0}{d_0} \quad (3)$$

where

l_0, b_0 and d_0 are the initial dimensions after conditioning, expressed in millimetres;

l_t, b_t and d_t are the final dimensions after exposure, expressed in millimetres (mm).

Calculate the mean values of each dimensional change, $\Delta\varepsilon_1$, $\Delta\varepsilon_b$ and $\Delta\varepsilon_d$, from the individual test results.

The dimensional changes, $\Delta\varepsilon_1$, $\Delta\varepsilon_b$ and $\Delta\varepsilon_d$, shall be given to the nearest 0,1 %.

9 Accuracy of measurement

An interlaboratory test was performed with nine laboratories. Three products were tested.

The results, analysed in accordance with ISO 5725-2, are given in Table 1.

Table 1 — Dimensional stability under specified conditions

Test conditions	Relative change in dimensions %				
	Range of measured $\Delta\varepsilon_l, \Delta\varepsilon_b, \Delta\varepsilon_d$	Estimate of repeatability variance S_r	95 % repeatability limit	Estimate of reproducibility variance S_R	95 % reproducibility limit
Specified temperature	−1,0 to 2,1	0,1	0,4	0,2	0,7
Specified temperature and relative humidity	−0,7 to 2,5	0,2	0,6	0,3	1,0

All values given in Table 1 are expressed in percentage of the test specimen dimension.

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

Bias cannot be determined in this test method as there is not any accepted reference material for it.

10 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) product identification:

   1) trademark, factory, manufacturer, or supplier,

   2) production code number,

   3) type of product,

   4) packaging,

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

   6) other information as appropriate (e.g. nominal thickness, nominal density, skins, facings);