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

Produits isolants thermiques destinés aux applications du bâtiment — Détermination de la déformation sous charge en compression et conditions de température spécifiées

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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 29764 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 1605:1996, EN 1605:1996/AC:1997 and its Amendment 1:2006 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 deformation under specified compressive load and temperature conditions

1 Scope

This International Standard specifies the equipment and procedures for determining the deformation occurring under specified conditions of compressive load, temperature and time. 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 term and definition apply.

3.1
relative deformation
ε
reduction in thickness of a specimen under specified compressive load, expressed as a percentage of its initial thickness, measured in the direction of compressive loading

4 Principle

A specified compressive load is applied to a specimen and the relative deformation is measured in two steps, each with a different temperature and time condition.

5 Apparatus

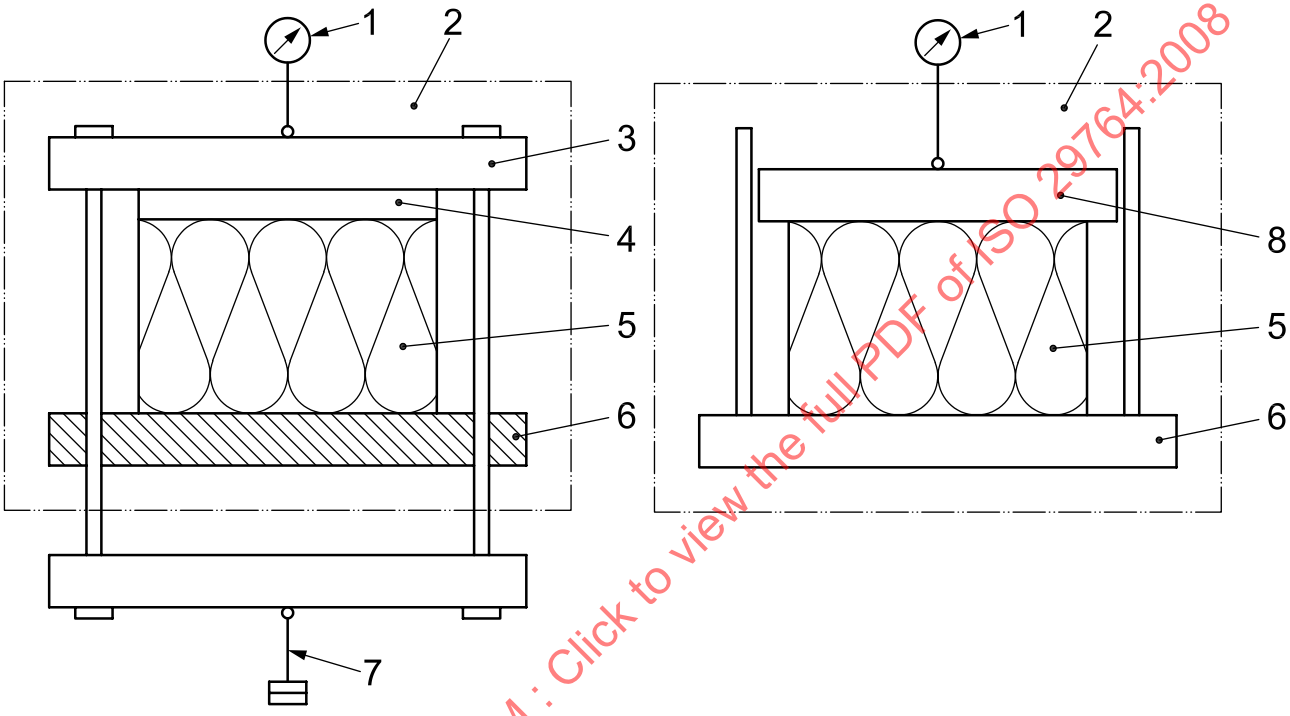
5.1 **Instruments**, capable of measuring linear dimensions of specimens in accordance with ISO 29768 to an accuracy of 0,5 % for length and width and 0,1 mm for thickness.

5.2 **Oven**, with thermostat and forced air circulation, capable of maintaining the required temperature to within ± 1 K.

5.3 Loading device, consisting of two flat platens, one of which shall be movable, so arranged that they compress the specimen in a vertical direction.

The movable platen shall be guided in such a manner as to be self-aligning. The platens shall be capable of being loaded smoothly and without distortion so that, during the test, the static stress does not change by more than ± 5 % (see Figure 1).

The two flat plates should be finely ground/polished. The distance between the upper plate and the reading device should be as short as possible. The zero setting of the deformation measurement should be done using a calibrated steel block approximately of the same thickness as the product to be tested.



Key

1 dial gauge
2 oven
3 loading bridge
4 load distribution platen (movable, self-aligning)
5 specimen
6 crosshead
7 loading by weights
8 load

Figure 1 — Examples of test apparatus

6 Test specimens

6.1 Dimensions of test specimens

The thickness of the specimens shall be equal to the original product thickness, provided that the thickness is at least 20 mm.

The specimens shall be squarely cut and have sides with the following recommended dimensions:

— 50 mm × 50 mm; or

— 100 mm × 100 mm; or

— 150 mm × 150 mm; or

— 200 mm × 200 mm; or

— 300 mm × 300 mm.

The side length shall be equal to or greater than the thickness.

Dimensions used shall be as specified in the relevant product standard.

In the absence of a product standard or any other international or European technical specification, the dimensions of the specimens may be agreed between parties.

The tolerance on the parallelism between the two faces of the specimen shall not be greater than 0,5 % of its side length, with a maximum of 0,5 mm.

If the specimen is not flat, it shall be ground flat or an adequate coating shall be applied to prepare the surface for the test. Where it is coated, no significant deformation should occur in the coating or it shall be taken into account by deducting the deformation of the coating.

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 used for each selected set of 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 the direction of loading applied to the product corresponds to the direction in which the compressive forces are applied to the product in use.

Natural surface skins and any facings and/or coatings that form an integral part of the product shall be retained.

NOTE Special methods of preparation, when needed, are given in the relevant product standard or any other international or European technical specification.

6.4 Conditioning of test specimens

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

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

The test conditions shall be as specified in Table 1.

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.

Table 1 — Test conditions

Set of conditions	Stress	Step A		Step B	
		Temperature	Time	Temperature	Time
	kPa	°C	h	°C	h
1	20	(23 ± 5)	(48 ± 1)	(80 ± 1)	(48 ± 1)
2	40	(23 ± 5)	(48 ± 1)	(70 ± 1)	(168 ± 1)
3	80	(23 ± 5)	(48 ± 1)	(60 ± 1)	(168 ± 1)

7.2 Test procedure

7.2.1 Measure the length and width of each specimen to an accuracy of 0,5 %, in accordance with ISO 29768. These dimensions are used for calculating the initial area of the cross-section of the specimen for determining the load.

The test shall be carried out with one of the three different sets of conditions (1, 2 or 3) as shown in Table 1. The set used shall be as specified in the relevant product standard or any other international or European technical specification.

Measure the thickness, d_s, of each specimen after conditioning in accordance with ISO 29768, to an accuracy of 0,1 mm.

7.2.2 The test is to be made in two steps, A and B, using the following procedure.

7.2.2.1 Step A

Load the specimen at a temperature of (23 ± 5) °C for (48 ± 1) h with a load corresponding to the set of conditions (1, 2 or 3) selected from Table 1.

Determine the thickness, d_1, of the specimen after (48 ± 1) h under load, to the nearest 0,1 mm.

7.2.2.2 Step B

Expose the loaded specimen to the temperature for the time indicated, in accordance with the selected set of conditions (1, 2 or 3).

Determine the thickness, d_2, of the specimen after the selected time at the test temperature under the load, to the nearest 0,1 mm.

8 Calculation and expression of results

The results are the mean values of the measurements, which shall be expressed to three significant figures.

NOTE Results obtained with specimens of different thicknesses can be different.

Calculate the relative deformation, ε_1, expressed as a percentage, after step A of the test using Equation (1):

$$\varepsilon_1 = \frac{d_s - d_1}{d_s} \times 100 \quad (1)$$

where

d_s is the thickness of the specimen (in accordance with 7.2) before applying the selected load, expressed in millimetres;

d_1 is the thickness of the specimen after applying the selected load (in accordance with 7.2.2.1), expressed in millimetres.

Calculate the total relative deformation, ε_2, as a percentage, after step B of the test using Equation (2):

$$\varepsilon_2 = \frac{d_s - d_2}{d_s} \times 100 \quad (2)$$

where

d_s is the thickness of the specimen (in accordance with 7.2) before applying the selected load, expressed in millimetres;

d_2 is the thickness of the specimen after applying the selected load and temperature condition (in accordance with 7.2.2.2), expressed in millimetres (mm).

9 Accuracy of the method

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

Note The choice of products was selected to get a wide range of dimensional changes. The testing conditions were chosen to get a large variation in test results.

The results were analysed and the terms applied in accordance with ISO 5725-2.

The results from the test are given in the Tables 2 and 3. For all other test conditions the accuracy is expected to be the same.

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

Table 2 — Percentage deformation under specified conditions
(stress, 20 kPa; temperature, 23 °C; time, 48 h)

Test conditions	Relative deformations after step A $\varepsilon(d_1)$ %				
	Range of measured ε_1	Estimate of repeatability variance S_r	95 % repeatability limit	Estimate of reproducibility variance S_R	95 % reproducibility limit
Stress	–0,2 to 2,9	0,2	0,5	0,4	1,2