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

*Produits isolants thermiques destinés aux applications du bâtiment —  
Détermination de la résistance à la traction perpendiculairement aux  
faces*



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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 29765 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 1607:1996 and EN 1607:1996/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, <i>Thermal insulating products for building applications — Determination of length and width</i>	EN 822
ISO 29466, <i>Thermal insulating products for building applications — Determination of thickness</i>	EN 823
ISO 29467, <i>Thermal insulating products for building applications — Determination of squareness</i>	EN 824
ISO 29468, <i>Thermal insulating products for building applications — Determination of flatness</i>	EN 825
ISO 29469, <i>Thermal insulating products for building applications — Determination of compression behaviour</i>	EN 826
ISO 29470, <i>Thermal insulating products for building applications — Determination of the apparent density</i>	EN 1602
ISO 29471, <i>Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 °C/50 % relative humidity)</i>	EN 1603
ISO 29472, <i>Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions</i>	EN 1604
ISO 29764, <i>Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions</i>	EN 1605
ISO 29765, <i>Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces</i>	EN 1607
ISO 29766, <i>Thermal insulating products for building applications — Determination of tensile strength parallel to faces</i>	EN 1608
ISO 29767, <i>Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion</i>	EN 1609

ISO 29768, <i>Thermal insulating products for building applications — Determination of linear dimensions of test specimens</i>	EN 12085
ISO 29769, <i>Thermal insulating products for building applications — Determination of behaviour under point load</i>	EN 12430
ISO 29770, <i>Thermal insulating products for building applications — Determination of thickness for floating-floor insulating products</i>	EN 12431
ISO 29771, <i>Thermal insulating materials for building applications — Determination of organic content</i>	EN 13820
ISO 29803, <i>Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)</i>	EN 13497
ISO 29804, <i>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</i>	EN 13494
ISO 29805, <i>Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes</i>	EN 13496

# Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces

## 1 Scope

This International Standard specifies the equipment and procedures for determining the tensile strength of a product perpendicular to its faces. 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 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2:1994, *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

#### tensile strength perpendicular to faces

$\sigma_{mt}$

maximum recorded tensile force perpendicular to the product faces during the pulling operation, divided by the cross-sectional area of the test specimen

## 4 Principle

A specimen is attached between two rigid plates or blocks, fastened in a tensile testing machine and pulled apart at a given speed.

The maximum tensile force is recorded and the tensile strength of the specimen is calculated.

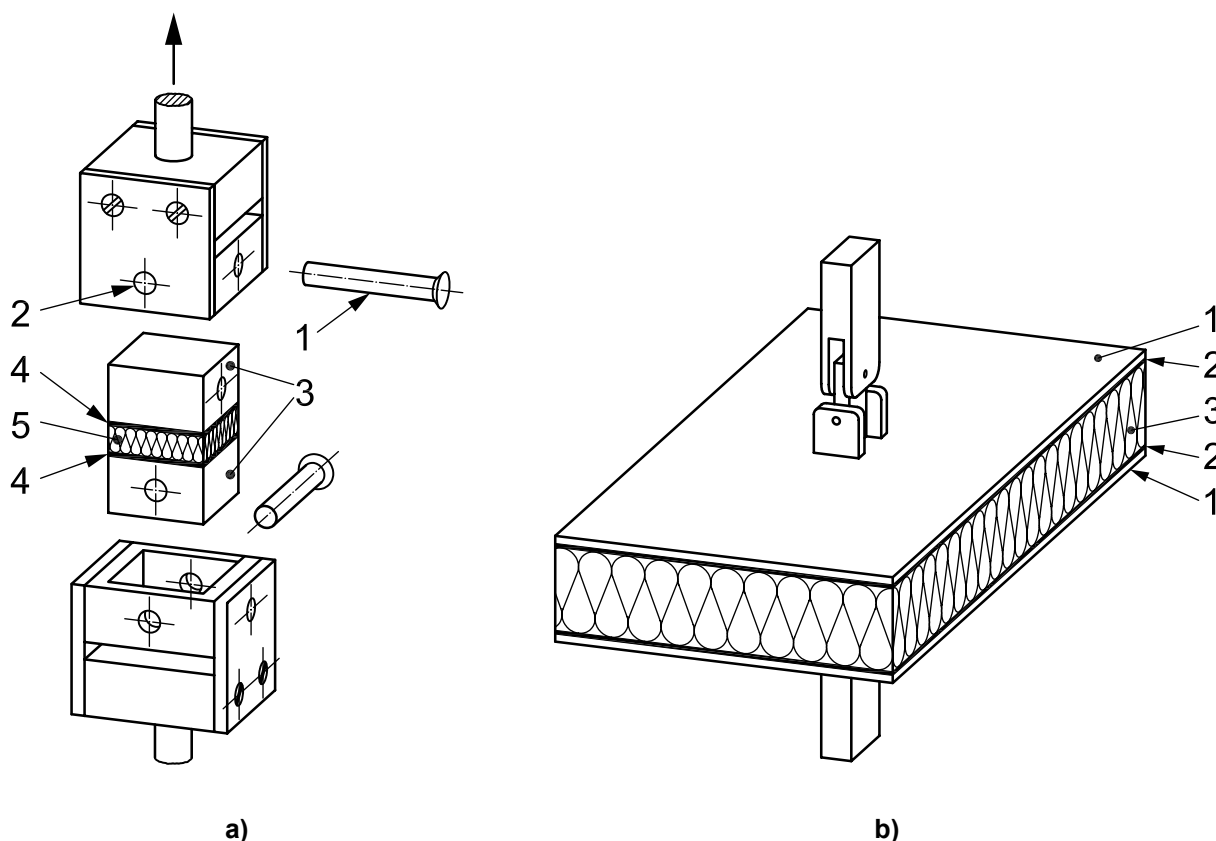
## 5 Apparatus

Any test equipment that provides the same result with at least the same accuracy may be used.

**5.1 Tensile testing machine**, appropriate for the range of force and displacement involved, capable of having a constant crosshead speed adjusted to  $(10 \pm 1)$  mm/min and capable of measuring the force to an accuracy of  $\pm 1$  %.

**5.2 Rigid plates or blocks**, with self-aligning attachment to avoid uneven distribution of tensile stress during the test.

Examples of suitable arrangements to bond the specimen are shown in Figure 1.



### Key

- 1 bolt
- 2 connecting shaft
- 3 metal blocks
- 4 adhesive
- 5 test specimen

### Key

- 1 rigid plate
- 2 adhesive
- 3 test specimen

**Figure 1 — Examples of suitable arrangements to bond the specimen**

**5.3 Adhesive**, used to bond the specimen between the rigid plates or blocks, with a consideration of the following.

- The adhesive shall not reinforce or damage the surface layers of the product.
- Hot adhesives shall be avoided if they damage the product.
- Any solvent used shall be compatible with the product.



## 6 Test specimens

### 6.1 Dimensions of test specimens

The thickness of specimens shall be equal to the original product thickness including any skins, facings and/or coatings.

The specimens shall be prisms of square cross section having sides of 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.

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 specimens may be agreed between parties.

The linear dimensions shall be determined in accordance with ISO 29768 to an accuracy of  $\pm 0,5$  %.

### 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 five specimens shall be used. 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 from the product so that the specimen base is normal to the direction of the tensile force applied to the product in use.

Specimens shall be prepared by methods that do not change the original structure of the product. Any skins, facings and/or coatings shall be retained. The specimens shall be representative of the product and preferably not taken closer than 15 mm from the edges of the product to avoid the influence of any handling damage. For products with non-plane or non-parallel faces, or that have skins, facings and/or coatings, preparation of specimens shall be as specified in the relevant product standard.

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

Before conditioning, the specimens shall be attached to the two rigid plates or blocks using a suitable adhesive.

### 6.4 Conditioning of test specimens

The specimens (including the two rigid plates or blocks) shall be conditioned for at least 6 h at  $(23 \pm 5)$  °C. In case of dispute, they shall be conditioned at  $(23 \pm 2)$  °C and  $(50 \pm 5)$  % relative humidity for the time specified in the relevant product standard.

Other conditions may be used, provided that they give the same results.

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

Testing shall be carried out at  $(23 \pm 5) ^\circ\text{C}$ . In cases of dispute, testing shall be carried out at  $(23 \pm 2) ^\circ\text{C}$  and  $(50 \pm 5) \%$  relative humidity.

In tropical countries, different conditioning and testing conditions can be relevant. In this case, the conditions shall be  $27 ^\circ\text{C}$  and  $65 \%$  RH and be stated clearly in the test report.

### 7.2 Test procedure

Determine the cross-sectional area of the specimens in accordance with ISO 29768.

Carry out this determination preferably before the specimen is attached to the two rigid plates or blocks.

Attach the specimen in the tensile testing machine by means of the plate/block fixings and increase the tensile force at a constant speed of the crosshead (see 5.1) until failure occurs.

Record the maximum force in kilonewtons.

Record the way in which the material or the skin, facing and/or coating, fails.

Discard any specimen showing total or partial failure in the adhesive layer between the specimen and the rigid plates or blocks.

## 8 Calculation and expression of results

Calculate the tensile strength,  $\sigma_{\text{mt}}$ , expressed in kilopascals, perpendicular to faces, using Equation (1):

$$\sigma_{\text{mt}} = \frac{F_{\text{m}}}{A} = \frac{F_{\text{m}}}{l \times b} \quad (1)$$

where

$F_{\text{m}}$  is the maximum tensile force recorded, expressed in kilonewtons;

$A$  is the cross-sectional area of the specimen, expressed in square metres;

$l, b$  are length and width of the specimen, respectively, expressed in metres.

The result shall be expressed as the mean value of the measured values, to two significant figures.

NOTE The test results obtained with specimens of different dimensions can be different.

## 9 Accuracy of measurement

Following the experience from a “round robin test”, where comparable test equipment and specimen preparation were used, the precision for tensile strength,  $\sigma_{\text{mt}}$ , perpendicular to faces can be estimated as given below:

- 95 % repeatability limit: approximately 5 %;
- 95 % reproducibility limit: approximately 15 %.

The above-mentioned terms are applied in accordance with ISO 5725-1 and ISO 5725-2.

## 10 Test report

The test report shall include the following information:

- a) reference to this International Standard;
- b) product identification:
  - 1) product name, 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);
- c) test procedure:
  - 1) pre-test history and sampling (e.g. person taking the sample, place of sampling),
  - 2) conditioning,
  - 3) any deviation from Clauses 6 and 7,
  - 4) conditioning and testing conditions in tropical countries, if applicable,
  - 5) date of testing,
  - 6) dimensions and number of specimens,
  - 7) general information relating to the test (e.g. type of adhesive and where the failure occurs),
  - 8) any events that can have affected the results,
- d) results: all individual values and the mean value.

**NOTE** It is expected that information about the apparatus and identity of the person responsible for the test be available in the laboratory, but it is not necessary that it be recorded in the report.

