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Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes

Produits isolants thermiques destinés aux applications du bâtiment — Détermination des caractéristiques mécaniques des treillis de fibres de verre

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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 29805 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*.

ISO 29805 is based on EN 13496:2002, prepared by Technical Committee CEN/TC 88 *Thermal insulating materials and products*. However

— 6.4 conditioning of the test specimens and storage under ambient conditions,

— 7.1 test conditions, and

— Clause 10 test report,

have been modified to reflect the conditions for tropical countries. Other modifications were made in 3.1.1, 5.3, 6.4.2 and Clause 8.

This International Standard is based on EN 13496:2002 prepared by Technical Committee CEN/TC 88 *Thermal insulating materials and products*, which has 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	Title	Respective EN standard
12968	*Thermal insulation products for building applications — Determination of the pull-off resistance of external thermal insulation composite systems (ETICS) (foam block test)*	EN 13495
29465	*Thermal insulating products for building applications — Determination of length and width*	EN 822
29466	*Thermal insulating products for building applications — Determination of thickness*	EN 823
29467	*Thermal insulating products for building applications — Determination of squareness*	EN 824
29468	*Thermal insulating products for building applications — Determination of flatness*	EN 825
29469	*Thermal insulating products for building applications — Determination of compression behaviour*	EN 826
29470	*Thermal insulating products for building applications — Determination of the apparent density*	EN 1602
29471	*Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23°C/50 % relative humidity)*	EN 1603
29472	*Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*	EN 1604
29764	*Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*	EN 1605
29765	*Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*	EN 1607
29766	*Thermal insulating products for building applications — Determination of tensile strength parallel to faces*	EN 1608
29767	*Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*	EN 1609
29768	*Thermal insulating products for building applications — Determination of linear dimensions of test specimens*	EN 12085
29769	*Thermal insulating products for building applications — Determination of behaviour under point load*	EN 12430
29770	*Thermal insulating products for building applications — Determination of thickness for floating floor insulating products*	EN 12431
29771	*Thermal insulating materials for building applications — Determination of organic content*	EN 13820
29803	*Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)*	EN 13497
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
29805	*Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes*	EN 13496

Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes

1 Scope

This International Standard specifies equipment and procedures for determining the tensile strength and elongation of glass fibre meshes, which are used for the reinforcement of the base coat in External Thermal Insulation Composite Systems (ETICS).

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 29765, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

EN 13499, *Thermal insulation products for buildings — External thermal insulation composite systems (ETICS) based on expanded polystyrene — Specification*

ISO 9229, *Thermal insulation — Vocabulary*

ISO 1887, *Textile glass — Determination of combustible-matter content*

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9229 and EN 13499 and the following apply.

3.1.1
elongation of glass fibre mesh
ε_F
quotient of the change in length, $l_F - l_0$, and the initial length, before failure, of the test specimen between the clamps at the failure, l_0

3.1.2
tensile strength of glass fibre mesh
strength of the test specimen at failure relative to the width of the test specimen

3.2 Symbols and units

F_F is the force at failure, in N;

l_0 is the distance between the clamps, in mm;

l_F is the distance between the clamps at failure, in mm;

w is the width of the test specimen, in mm;

β_F is the tensile strength of the test specimen in relation to the width of the test specimen, in N/mm;

ε_F is the elongation at failure, in mm/mm.

4 Principle

The tensile strength and the elongation of glass fibre meshes are determined at failure using a tensile testing machine.

5 Apparatus

5.1 Tensile testing machine, appropriate for the range of force and displacement involved, capable of having a constant crosshead speed adjusted to (50 ± 5) mm/min. It shall be capable of measuring the force and elongation to an error limit of at least 1 % (in accordance with ISO 29765).

5.2 Clamps, of the tensile testing machine, coated with a material to ensure attachment without slippage of the test specimen, such as rubber, and shall fasten the test specimen across its whole width. The clamps shall be sufficiently rigid to resist deformation during the test.

5.3 Container, wide and deep enough so that the test specimens can be immersed completely in an alkaline test solution. This can be a cylindrical container, of volume $(2{,}5 \pm 0{,}5)$ l, of height (48 ± 1) cm, of internal diameter $(8 \pm 0{,}5)$ cm, in which $(2 \pm 0{,}1)$ l of the alkaline test solution is introduced. The container shall be covered. The material of the container shall be resistant to the alkaline test solution (e.g. plastics or stainless steel).

6 Test specimens

6.1 Number of test specimens

Seven test specimens shall be used in warp direction, stored under ambient conditions.

Seven test specimens shall be used in warp direction, stored in aggressive medium.

Seven test specimens shall be used in weft direction, stored under ambient conditions.

Seven test specimens shall be used in weft direction, stored in aggressive medium.

6.2 Dimensions of the test specimens

The tensile strength of the meshes are tested in both the warp and the weft directions. The test specimen shall contain a minimum number of five threads within the width. The ratio of the length between the clamps to the width of the test specimen shall be 4:1. The dimensions of the test specimens shall be a minimum of 300 mm $\times$ 50 mm.

6.3 Preparation of the test specimens

The test specimens shall be cut from the original packed product after removal of the first 5 m of the roll and at a distance of at least 100 mm from the edges. The test specimen shall be cut between the single warp or weft threads. The number of threads in the warp or in the weft direction shall be the same for the seven test specimens. The number of threads shall be indicated in the test report. Test specimens shall not be bent or folded and shall be handled carefully during the whole test procedure.

6.4 Conditioning of the test specimens

6.4.1 Storage under ambient conditions

The test specimens shall be stored at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 24 h.

In tropical countries, different conditioning and testing conditions might be relevant. In this case, the conditions shall be (27 ± 2) °C and (65 ± 5) % relative humidity and be stated clearly in the test report.

6.4.2 Storage in aggressive medium

The test specimens shall be stored in the following alkaline test solution for 28 days for a 3-ions test at (23 ± 2) °C.

Concentrations in g/l distilled water:

$Ca(OH)_2$	0,5 g	at 96 %
NaOH	1 g	at 97 %
KOH	4 g	at 85 %

For the preparation of the alkaline test solution, the reagents shall be dissolved in distilled water in the given order above. For the storage of 30 g to 35 g glass fibre mesh, 1 l of the alkaline test solution is necessary.

After 28 days of storage, the samples are rinsed by immersion for 5 min in acid solution [5 ml HCl (35 % diluted) to 4 litres water] and then placed successively in 3 baths of water (4 litres each). The samples are left for 5 min in each bath. They are subsequently dried at (23 ± 2)°C and (50 ± 5) % relative humidity for 48 h.

Users who do not have reagents in the indicated concentration shall correct for the difference in mass.

For FPC, the storage of 24 h at (60 ± 2)°C may be used instead of the 28 days at (23 ± 2)°C.

If the glass mesh to be tested is only used in a specified base coat, an aggressive medium consisting of a 20 % suspension of base coat in water at (60 ± 2) °C may be used.

6.4.3 Wash and drying procedure

After storage in the aggressive medium, the test specimens shall be gently rinsed in running tap water at (20 ± 5) °C until the pH value at the surface of the specimens is less than 9, as measured with pH indicator paper. The test specimens shall be stored for 1 h in 0,5 % hydrochloric acid. After this storage, the test specimens shall be gently rinsed in running tap water at (20 ± 5) °C, without significant mechanical movement, until a pH value of 7 is measured carefully with pH indicator paper. The test specimens shall be dried for 60 min at (60 ± 2) °C and afterwards stored for at least 24 h at (23 ± 2) °C and (50 ± 5) % relative humidity before testing.

7 Procedure

7.1 Test conditions

The test shall be carried out at (23 ± 2) °C and (50 ± 5) % relative humidity.

In tropical countries, different conditioning and testing conditions might be relevant. In this case, the conditions shall be (27 ± 2) °C and (65 ± 5) % relative humidity and be stated clearly in the test report.

7.2 Attachment of the test specimens in the tensile testing machine

The test specimens shall be attached between the two clamps, which are fastened in the tensile testing machine. A self-aligning attachment on the top clamp avoids uneven distribution of tensile stress during the test. The test specimen shall be located perpendicular to the clamps of the tensile testing machine.

The distance between the clamps shall be a minimum of 200 mm.

7.3 Test procedure

The test shall be carried out in the warp and the weft directions before and after storage of the test specimens in the aggressive medium.

Preload the test specimens at 5 mm/min until the load of 10 N is reached. Measure the resulting length l_0 of the test specimen. Increase the tensile force with a constant crosshead speed of (50 ± 5) mm/min until failure occurs. Record the force, F_F, in newtons and the length, l_F, in millimetres.

Discard any test specimen where the specimen is displaced within the clamp, or where the failure occurred at the clamp.

NOTE If the change of length at increasing tensile force is recorded, further information on the mechanical properties of glass fibre meshes is acquired.

8 Calculation and expression of results

Calculate and express the following values for each type of conditioning and direction of testing, using Equations (1) and (2).

All individual values of the tensile strength, β_F, in newtons per millimetre using Equation (1):

$$\beta_F = F_F / w \tag{1}$$

where

F_F is the force at failure, in newtons;

w is the width of the test specimen, in millimetres.

All individual values of elongation at failure, ε_F, in millimetres per millimetre, using Equation (2):

$$\varepsilon_F = (l_F - l_0)/l_0 \tag{2}$$

where

l_F is the distance between the clamps at failure, in millimetres;

l_0 is the initial distance between the clamp before failure.

Calculate β_F/ε_F, in kilo newtons per millimetre, using Equations (1) and (2).

9 Accuracy of measurement

NOTE It was not possible to include a statement on the accuracy of the measurement at the date of publication of this International Standard. However, the intention is to include such a statement in a revision of this International Standard.

10 Test report

The test report shall include the following information:

a) a reference to this International Standard, i.e. ISO 29805:2009;

b) the product identification given by the system manufacturer:

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

   2) the batch number;

   3) the type and construction of product;

   4) the packaging;

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

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

   7) the mass per unit area, in grams per square metre;

   8) the loss on ignition, in per cent, in accordance with ISO 1887;

   9) the thread count in warp and weft per 100 mm and mesh dimensions;

c) the test procedure:

   1) the pre-test history and sampling, e.g. who sampled and where;

   2) the conditioning, if a base coat is used for conditioning, and the type of base coat;

   3) any deviation from Clauses 6 and 7;

   4) the conditioning and testing conditions in tropical countries, if applicable;

   5) the date of testing;

   6) the number of test specimens;

   7) the size of the test specimens;

   8) the number of threads in the width of the test specimens;

   9) any general information regarding the test;

   10) events which may have affected the results;

   11) the number and type of test specimens which have been discarded and why;

NOTE Information about the apparatus and identity of the technician can be available in the laboratory, but need not be recorded in the report.

d) the results for each type of conditioning and direction of test:

   1) the individual values and mean value of the tensile strength (β_F);

   2) the individual values and mean value of the elongation at failure (ε_F);

   3) the individual values and mean value of the relation of the tensile strength to the elongation at failure, β_F/ε_F;

   4) the identification tests on the tested mesh, carried out by the laboratory:

      i) the mass per unit area;

      ii) the ash content;

      iii) the thread count;

      iv) the mesh size.

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