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Thermal insulation products for building applications — Determination of the pull-off resistance of external thermal insulation composite systems (ETICS) (foam block test)

Produits isolants thermiques destinés aux applications du bâtiment — Détermination de la résistance à l'arrachement des systèmes d'isolation thermique par l'extérieur (systèmes ITE) (essai au bloc de mousse)

Reference number
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Foreword

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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 12968 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 is based on EN 13495:2002 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/TC 163/SC 1. 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

International Standard	Title	Respective EN standard
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 pull-off resistance of external thermal insulation composite systems (ETICS) (foam block test)

1 Scope

This International Standard specifies equipment and a procedure for determining the pull-off resistance of external thermal insulation composite systems (ETICS), which are mechanical fixed or mechanical fixed and bonded. The method described is known as the “foam block test”.

NOTE This test is not intended to measure the pull-off resistance of the ETICS to the substrate.

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 3251, *Paints, varnishes and plastics — Determination of non-volatile-matter content*

ISO 3386-1, *Polymeric materials, cellular flexible — Determination of stress-strain characteristics in compression — Part 1: Low-density materials*

ISO 3451-1, *Plastics — Determination of ash — Part 1: General methods*

ISO 9229, *Thermal insulation — Vocabulary*

ISO 29465, *Thermal insulating products for building applications — Determination of length and width*

ISO 29466, *Thermal insulating products for building applications — Determination of thickness*

ISO 29470, *Thermal insulating products for building applications — Determination of the apparent density*

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

EN 206-1, *Concrete — Part 1: Specification, performance, production and conformity*

EN 1015-1, *Methods of test for mortar for masonry — Part 1: Determination of particle size distribution (by sieve analysis)*

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

3 Terms and 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 apply.

3.2 Symbols and units

The symbols used in this International Standard are the following.

σ pull-off resistance, in kPa;

F maximum tensile load, in kN;

A cross-sectional area of the test specimen, in m^2.

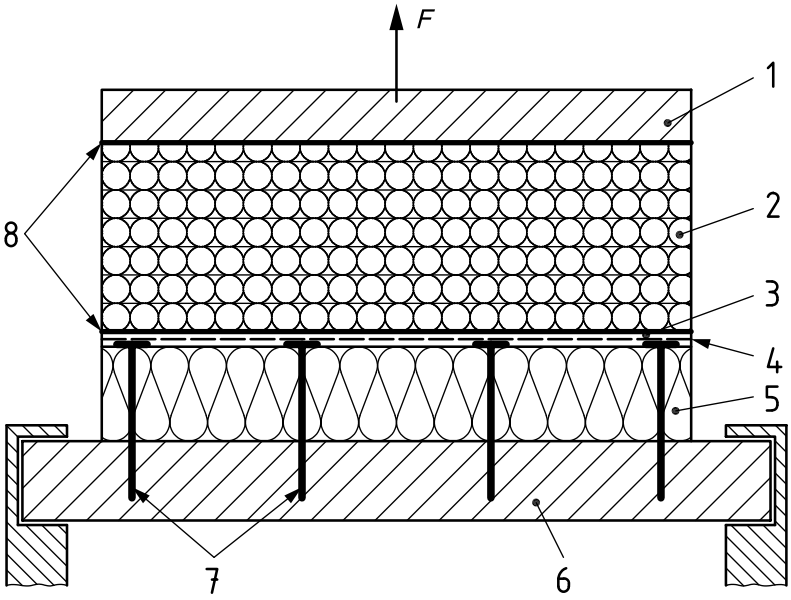
4 Principle

The pull-off resistance of external thermal insulation composite systems is determined by conducting the static foam block test. The pull-off resistance is calculated from the maximum tensile load.

5 Apparatus

5.1 Test apparatus, with which the testing load is generated by a hydraulic jack and transferred via a load cell to crossed steel joists. The joists are fixed with timber screws to the plywood panel in such a way that the load application is in the middle of the plywood panel.

An example of test apparatus and test specimen is given in Figure 1.



Key

1	timber panel	4	reinforcement	7	anchors
2	foam block	5	thermal insulation material	8	glue
3	base coat	6	reinforced concrete slab		

F tension force

Figure 1 — Example of a test apparatus and test specimen for the static foam block test

5.2 Concrete slab, the dimensions of which shall be at least the dimensions of the ETICS specimen. The thickness of the concrete slab shall take account of the lengths of the fixing devices having a minimum thickness of 100 mm. The concrete slab shall have a minimum strength class of C 20/25 in accordance with EN 206-1.

5.3 Foam blocks, of dimension between 200 mm $\times$ 200 mm and 333 mm $\times$ 333 mm. The thickness of the foam blocks shall be 300 mm to 500 mm. The foam block shall be weak enough to follow all deformations of the finishing coat without affecting the bending stiffness of the system. The tensile strength of the foam block, consisting e.g. of polyether foam, should be in the range of 80 kPa to 150 kPa and the rupture strain should exceed 160 %. The compression stress value conforming to ISO 3386-1 should be in the order of 1,5 kPa to 7,0 kPa.

NOTE A suitable initial thickness of the block elements is 500 mm. After the determination is finished, the blocks can be cut off with a hot wire. They can be re-used at least 20 times until the remaining length is still about 300 mm.

5.4 Glue, suitable for rough surfaces (render surface), for timber and for the foam block used (e.g. solvent free epoxy adhesive or polyurethane adhesive). The glue shall not damage the thermal insulation material, the base coat or the adhesive, and shall not influence the results.

5.5 Timber panel, having the same dimensions as the test specimen. The mechanical stability of the timber panels shall not influence the test results.

5.6 Tensile testing machine, appropriate for the range of force and displacement involved, and capable of having a constant crosshead speed adjusted to (10 $\pm$ 1) mm/min. It shall be capable of measuring the force with an error limit of 1 % (see ISO 29765).

6 Test specimens

6.1 Preparation of test specimens

Apply the ETICS to be tested to a concrete slab by using the mechanical fixing devices in accordance with the specifications of the manufacturer of the ETICS. When using solely fixing anchors, these may be uniformly distributed over the test specimen area. Coat the surface of the specimen with the base coat containing the embedded reinforcement in accordance with the manufacturer's instructions. The test specimen shall reflect a realistic area of the whole system including, if necessary, several boards.

The pull-off resistance is dependent on the thickness of the thermal insulation material. For this reason, the thermal insulation material at the test shall have the minimum thickness which is supplied by the manufacturer of the system and which fulfils the requirement of ETICS with a declared thermal resistance equal to or greater than 1 $m^2 \cdot K/W$.

After a time period which is specified by the manufacturer, glue foam blocks over the whole render surface of the test specimen (5.4). Then, glue a timber panel (5.5) to the foam blocks, using the same glue. The determination can be performed after the glue has completely hardened.

6.2 Number of test specimens

At least three test specimens are required for the determination.

6.3 Conditioning of test specimens

The conditioning of the test specimens shall be carried out as specified in the relevant ETICS product standard.

NOTE In the absence of a product standard for ETICS or any other European technical specification, the conditioning procedure can be agreed on between the parties.

7 Procedure

7.1 Test conditions

The test shall be carried out at (23 ± 5) °C.

In tropical countries, different conditioning and testing conditions can 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 Test procedure

Carry out the pull-off resistance measurement in accordance with ISO 29765 until failure occurs. Apply the tensile load perpendicular to the test area (see Figure 1). Unless otherwise specified or agreed, increase the load with a constant crosshead speed adjusted to (10 ± 1) mm/min.

Record the tensile force at the maximum load achieved. Reject any test where the mode of failure is a fracture at the glue layer between the test specimen and the foam block or between foam block and timber panel.

7.3 Calculation and expression of results

Calculate the pull-off resistance, σ, in kPa, using Equation (1):

$$\sigma = \frac{F}{A} \tag{1}$$

where

F is the maximum tensile load, in kN;

A is the cross-sectional area of the test specimen, in m^2;

σ is the pull-off resistance, in kPa.

The results shall be rounded to the nearest 1 kPa.

8 Accuracy of measurement

NOTE It was not possible to include a statement on the accuracy of the measurement at the time of publication of this International Standard, however, it is intended to include such a statement upon revision of this International Standard.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard, i.e. ISO 12968:2009;

b) the product identification given by the system manufacturer;

1) ETICS:

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

ii) the batch numbers of the components;

2) base coat:

   i) the packaging when the product arrived at the laboratory;

   ii) the form of the product (paste or powder);

   iii) the preparation of the product (with adding cement, water or other components, time and procedure for mixing the components before application);

   iv) the type of the main binders of the product (lime, cement, organic binder);

   v) if the product is a paste, the non-volatile matter determined in accordance with ISO 3251, test conditions 3 h at 105 °C;

   vi) if the main binder of the product is organic, ash content determined in accordance with ISO 3451-1, test conditions 2 h at 450 °C;

   vii) maximum grain size measured in accordance with EN 1015-1;

   viii) thickness of base coat;

   ix) adhesive pattern and thickness;

3) reinforcement:

   i) the type, product name and manufacturer;

   ii) the mass per square metre of the reinforcement in gram per square metre;

   iii) the thread count in warp and weft per 100 mm or mesh dimensions of the reinforcement;

4) thermal insulating material:

   i) the type, product name and manufacturer;

   ii) the thickness in accordance with ISO 29466;

   iii) the length and width in accordance with ISO 29465;

   iv) the declared density in accordance with ISO 29470;

   v) the declared tensile strength perpendicular to faces in accordance with ISO 29765;

5) relevant information for the fixing devices;

c) the test procedure:

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

   2) the conditioning;

   3) the type and name of the glue used;

   4) any deviation from Clauses 6 and 7;

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

   6) the date of the test;

7) the number and dimensions of test specimens;

8) the displacement speed;

9) general information regarding the test;

10) the events which could 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 made available in the laboratory, but it need not be recorded in the report.

d) the results:

1) all individual values and the mean value of the pull-off resistance;

2) a description of the mode of failures.

ICS 91.100.60

Price based on 6 pages