BS EN 12090:2013

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Thermal insulating products for building applications — Determination of shear behaviour

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National foreword

This British Standard is the UK implementation of EN 12090:2013. It supersedes BS EN 12090:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540, Energy performance of materials components and buildings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Thermal insulating products for building applications - Determination of shear behaviour

Produits isolants thermiques destinés aux applications du bâtiment - Détermination du comportement en cisaillement

Wärmedämmstoffe für das Bauwesen - Bestimmung des Verhaltens bei Scherbeanspruchung

This European Standard was approved by CEN on 15 December 2012.

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Foreword

This document (EN 12090:2013) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2013, and conflicting national standards shall be withdrawn at the latest by September 2013.

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

This document supersedes EN 12090:1997.

The revision of this standard contains no major changes, only minor corrections and clarifications of an editorial nature.

This European Standard is one of a series of standards which specify test methods for determining dimensions and properties of thermal insulating materials and products. It supports a series of product standards for thermal insulating materials and products which derive from the Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products (Directive 89/106/EEC) through the consideration of the essential requirements.

This European Standard has been drafted for applications in buildings but it may also be used in other areas where it is relevant.

This European test standard is one of the following group of inter-related standards on test methods for determining dimensions and properties of thermal insulation materials and products, all of which fall within the scope of CEN/TC 88:

— EN 822, *Thermal insulating products for building applications — Determination of length and width*

— EN 823, *Thermal insulating products for building applications — Determination of thickness*

— EN 824, *Thermal insulating products for building applications — Determination of squareness*

— EN 825, *Thermal insulating products for building applications — Determination of flatness*

— EN 826, *Thermal insulating products for building applications — Determination of compression behaviour*

— EN 1602, *Thermal insulating products for building applications — Determination of the apparent density*

— EN 1603, *Thermal insulating products for building applications — Determination of dimensional stability under constant normal laboratory conditions (23 °C/50 % relative humidity)*

— EN 1604, *Thermal insulating products for building applications — Determination of dimensional stability under specified temperature and humidity conditions*

— EN 1605, *Thermal insulating products for building applications — Determination of deformation under specified compressive load and temperature conditions*

— EN 1606, *Thermal insulating products for building applications — Determination of compressive creep*

— EN 1607, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

— EN 1608, *Thermal insulating products for building applications — Determination of tensile strength parallel to faces*

— EN 1609, *Thermal insulating products for building applications — Determination of short-term water absorption by partial immersion*

— EN 12085, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens*

— EN 12086, *Thermal insulating products for building applications — Determination of water vapour transmission properties*

— EN 12087, *Thermal insulating products for building applications — Determination of long-term water absorption by immersion*

— EN 12088, *Thermal insulating products for building applications — Determination of long-term water absorption by diffusion*

— EN 12089, *Thermal insulating products for building applications — Determination of bending behaviour*

— EN 12090, *Thermal insulating products for building applications — Determination of shear behaviour*

— EN 12091, *Thermal insulating products for building applications — Determination of freeze-thaw resistance*

— EN 12429, *Thermal insulating products for building applications — Conditioning to moisture equilibrium under specified temperature and humidity conditions*

— EN 12430, *Thermal insulating products for building applications — Determination of behaviour under point load*

— EN 12431, *Thermal insulating products for building applications — Determination of thickness for floating floor insulating products*

— EN 13793, *Thermal insulating products for building applications — Determination of behaviour under cyclic loading*

— EN 13820, *Thermal insulating materials for building applications — Determination of organic content*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the equipment and procedures for determining shear behaviour. It is applicable to thermal insulating products.

NOTE The tests described in this standard do not determine pure shear behaviour, but measure the effects of applying two opposite parallel forces to the major faces of the test specimen. The test is however called shear in this text by convention. The application of a force tangentially to the major surface of the test specimen is considered to represent more closely the stresses imposed upon thermal insulation products in many building applications, particularly walls, than other methods of measuring shear performance e.g. bending tests.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12085, *Thermal insulating products for building applications — Determination of linear dimensions of test specimens*

3 Terms and definitions

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

3.1
shear strength
τ
ratio of the maximum force applied to the product, which will cause rupture along a plane parallel to the direction of the applied force, to the area of the plane on which the force acts

3.2
shear modulus,
G
shear stress divided by the corresponding relative deformation below the proportional limit, when the relationship is linear

Note 1 to entry: See Figure 3.

4 Principle

A test specimen is subjected to a shear stress transmitted to the test specimen through rigid supports to which it is bonded. The corresponding force-displacement curve is determined.

NOTE Tests carried out using the single test specimen method have produced results for shear strength, which indicate the result to be dependent upon test specimen thickness, with more scattered results at greater thicknesses. Tests using the double test specimen method have also shown test specimen thickness to influence results for shear strength.

5 Apparatus

5.1 Test machine

5.1.1 General

A test machine capable of applying a sufficient force within the maximum displacement experienced in the shear test. It shall be capable of operating at a constant rate of movement of the movable head of (3 ± 0,5) mm/min in a direction parallel to the longitudinal axis of the test specimen assembly.

The test machine shall exert a force *F* on the test specimen with a maximum error of 1 %, and produce a displacement γ, of the movable support relative to the fixed supports, having a maximum error of 1 %.

If the shear modulus is required, the force *F* and the displacement γ shall be simultaneously recorded to provide the curve of *F*, γ required in Clause 7.

It may be necessary to use a displacement transducer for accurate measurement of deformation particularly where a thick adhesive layer has been used in preparing the test specimen.

The null or zero displacement of the test specimen may be calculated by subtraction from γ, the displacement due to the equipment and the same thickness of adhesive measured without the test specimen, e.g. replace the test specimen by metal block(s) in a blank test.

5.1.2 Single test specimen arrangement

The test machine shall exert longitudinal shear forces through parallel plates bonded to a single test specimen of dimensions as in 6.1.2. The parallel plates shall be rigid with one plate attached to the fixed and the other to the movable parts of the test machine.

5.1.3 Double test specimen arrangement

The test machine shall exert longitudinal shear forces through parallel plates bonded to a double test specimen of dimensions as in 6.1.3. The parallel plates shall be rigid with the outer plates attached to the fixed and the central plate to the movable parts of the test machine.

5.2 Specimen supports

5.2.1 Single test specimen assembly

Two flat rigid specimen supports of length 330 mm and width 50 mm which shall be attached to the grips of the test machine via an adaptor and universal joint. The method of attaching the specimen supports to the grips is shown in Figure 1. The thickness of the adaptors that connect the specimen supports to the test machine grips shall be the same as the thickness of the test specimen.

Flat rectangular sectioned mild steel plates with a thickness of 16 mm have proved suitable for the support material.

5.2.2 Double test specimen assembly

The essential features are three flat rigid supports of which two can be maintained with their planes parallel and vertical. Two suitable arrangements are shown in Figure 2.

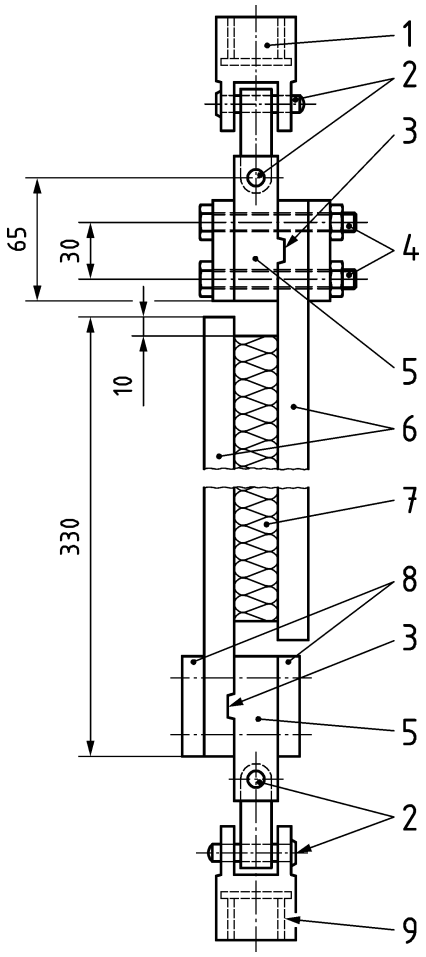
Experience gained using both the single and double test specimen methods with several products indicated that it is of paramount importance that the specimen supports are very rigid. With the double test specimen arrangement, the fixed supports should be maintained in parallel vertical planes. Both the arrangements shown in Figure 2 have proved suitable.

5.3 Adhesive

The adhesive used to fix the test specimen shall be such that the shear strength and modulus of the adhesive film is greater than that of the product under test. This ensures that rupture occurs in the test specimen rather than failure in the adhesive.

Information on suitable adhesives and their use may be provided in the relevant product standard or any other European Technical Specification.

Dimensions in millimetres



Key

1 fixed machine grip
2 universal joint connection pins
3 tongue and groove
4 nut and bolt supports
5 adaptor
6 test specimen supports (length 330 mm, width 50 mm, thickness 16 mm)
7 test specimen (length 250 mm, width 50 mm)
8 load distribution plates
9 movable machine grip

Figure 1 — Example of single specimen test assembly

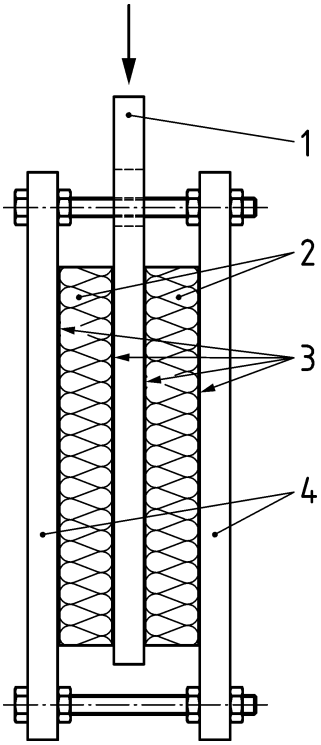


Figure 2 a)

Key

1 loading plate (length 300 mm, width 100 mm, thickness 16 mm)

2 test specimen (length 200 mm, width 100 mm)

3 adhesive

4 metal test specimen supports (length 300 mm, width 100 mm, thickness 16 mm)

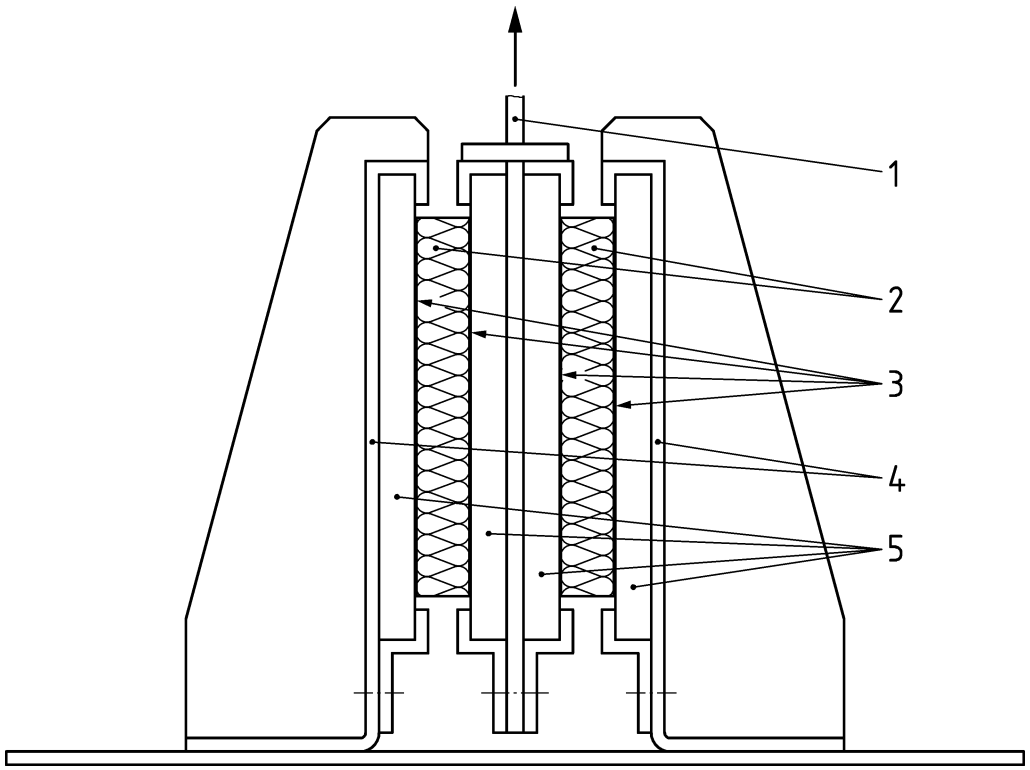


Figure 2 b)

Key

1 loading plate

2 test specimen (length 200 mm, width 100 mm)

3 adhesive

4 metal supports

5 plywood test specimen supports

Figure 2 — Examples of double specimen test assemblies

6 Test specimens

6.1 Dimensions of test specimens

6.1.1 General

The thickness of the test specimens shall be the original product thickness. Any moulded skins, facings and/or coatings shall be retained.

The dimensions shall be determined in accordance with EN 12085. The tolerance on parallelism and flatness between the two major faces of the test specimen shall not be more than 0,5 % of the specimen thickness with a maximum of 0,5 mm.

6.1.2 Single test specimen

The test specimen shall be square and squarely cut with dimensions:

Length: 250 mm $^{0}_{-5}$ mm

Width: 50 mm $^{0}_{-1}$ mm

The thickness of the test specimen is the product thickness (maximum 50 mm).

6.1.3 Double test specimen

The separate parts of the test specimen shall be square and squarely cut with dimensions:

Length: 200 mm $^{0}_{-5}$ mm

Width: 100 mm $^{0}_{-5}$ mm

The thickness of each part is the product thickness.

6.2 Number of test specimens

The number of test specimens shall be as specified in the relevant product standard or any other European Technical Specification. In the absence of such a specification, at least five test specimens shall be used.

In the absence of a product standard or any other European Technical Specification the number of test specimens may be agreed between parties.

6.3 Preparation of test specimens

The test specimens shall be prepared by cutting methods that do not change the structure of the original product. The method of selection of the test specimens shall be given in the relevant product standard or any other European Technical Specification or by agreement between the parties.

6.4 Conditioning of test specimens

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

7 Procedure

7.1 Test conditions

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

7.2 Test procedure

Measure the three dimensions of the test specimen in accordance with EN 12085.

Attach the test specimen to the rigid supports using a suitable adhesive.

The distance between the two major planes of the test assembly shall not vary more than 1 %.

The test specimen assembly shall be attached to the test machine and a force applied to the movable support plate sufficient to produce movement in a vertical direction at a rate of (3 ± 0,5) mm/min.

The force-displacement curve shall be recorded (F, γ).

Discard any test specimen where the failure occurs in the adhesive layer between the test specimen and the rigid supports and make a new test.

8 Calculation and expression of results

8.1 General

The results are the mean value of the individual measurements and shall be expressed to two significant figures.

Results shall not be extrapolated to other thicknesses.

Comparison between products should only be made on test results obtained on test specimens of similar thickness, from either single or double test specimen tests.

8.2 Shear strength

Calculate the shear strength, τ , in kilopascals using Formula (1):

$$\tau = \frac{F_m}{A} \quad (1)$$

where

A is *l* x *b* for a single test specimen, in square metres;

A is 2 x *l* x *b* for a double test specimen, in square metres;

l is initial length of the test specimen, in metres;

b is initial width of the test specimen, in metres;

F_m is maximum force applied to the test specimen, in kilonewtons.

8.3 Shear modulus

If required calculate the shear modulus, *G*, in kilopascals using Formula (2):

$$G = \frac{d\ x \tan\alpha}{A} \quad (2)$$

where

A is *l* x *b* for a single test specimen, in square metres;

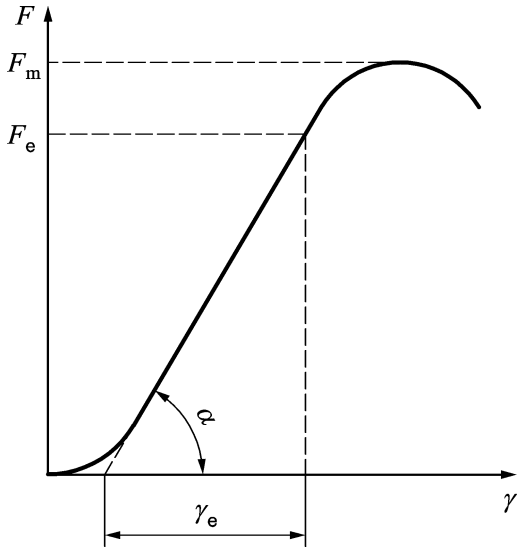
A is 2 x *l* x *b* for a double test specimen, in square metres;

l is initial length of the test specimen, in metres;

b is initial width of the test specimen, in metres;

d is thickness of the test specimen, in metres;

$\tan\alpha$ is the slope of the linear portion of the force-displacement curve, if detectable (see Figure 3), expressed in kilonewtons per metre.



Key

$$\tan\alpha = \frac{F_e}{\gamma_e}$$

F_m maximum force

F_e force corresponding to γ_e (limit of proportionality)

γ_e displacement in the elastic zone (well-defined straight portion of the force/displacement curve)

Figure 3 — Force - displacement curves

9 Accuracy of measurement

NOTE It has not been possible to include a statement on the accuracy of measurement in this edition of the standard, but it is intended to include such a statement when the standard is next revised.

10 Test report

The test report shall include the following information:

a) reference to this European Standard;

b) product identification:

1) product name, factory, manufacturer or supplier;

2) production code number;

3) type of product;

4) packaging;

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

6) presence of facing or coating;

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

c) test procedure:

1) pre-test history and sampling (e.g. who sampled and place of sampling);

2) conditioning;

3) deviation from Clauses 6 and 7, if any;

4) date of testing;

5) dimensions and number of test specimens;

6) general information related to the test including reference to the method used (single or double test specimen arrangement);

7) events which may have affected the results. Information about the apparatus and identity of the technician should be available in the laboratory, but it need not be recorded in the report;

d) results: all individual values and the mean value of the shear strength and if required the shear modulus.

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