

# **Thermal insulation products for buildings — Factory made products of expanded perlite (EPB) — Specification**

ICS 91.100.60

## National foreword

This British Standard is the UK implementation of EN 13169:2008. It supersedes BS EN 13169:2001 which is withdrawn.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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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## Thermal insulation products for buildings - Factory made products of expanded perlite (EPB) - Specification

Produits isolants thermiques pour le bâtiment - Produits  
manufacturés en perlite expansée (EPB) - Spécification

Wärmedämmstoffe für Gebäude - Werkmäßig hergestellte  
Produkte aus Blähperlite (EPB) - Spezifikation

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

## Contents

Page

Foreword.....	4
1 Scope .....	6
2 Normative references .....	6
3 Terms, definitions, symbols, units and abbreviated terms .....	8
4 Requirements .....	11
5 Test methods.....	16
6 Designation code .....	20
7 Evaluation of conformity.....	20
8 Marking and labelling .....	21
Annex A (normative) Determination of the declared values of thermal resistance and thermal conductivity .....	22
Annex B (normative) Factory production control.....	24
Annex C (normative) Determination of the thermal conductivity in relation to moisture content .....	27
Annex D (normative) Composite insulation boards .....	29
Annex E (informative) Additional properties .....	35
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive.....	37
Bibliography .....	45

## Tables

Table 1 — Thickness tolerances .....	12
Table 2 — Levels for compressive stress or compressive strength.....	14
Table 3 — Levels for deformation under specified compressive load and temperature .....	14
Table 4 — Levels for water absorption by total immersion.....	15
Table 5 — Levels for bending strength at constant span.....	15
Table 6 — Test methods, test specimens and conditions.....	19
Table A.1 — Values for $k$ for one sided 90 % tolerance interval with a confidence level of 90 % .....	23
Table B.1 — Minimum product testing frequencies .....	24
Table B.2 — Minimum product testing frequencies for the reaction to fire characteristics .....	25
Table D.1 — Classes for thickness tolerances .....	30
Table D.2 — Levels of compressibility .....	30
Table D.3 — Test methods, test specimens and conditions .....	32
Table D.4 — Minimum product testing frequencies .....	33
Table E.1 — Test methods, test specimens, conditions and testing frequencies .....	36
Table ZA.1 — Relevant clauses for expanded perlite and intended use .....	38

<b>Table ZA.2 — Systems of attestation of conformity .....</b>	<b>39</b>
<b>Table ZA.3 — Assignment of evaluation of conformity tasks for products under system 1 .....</b>	<b>40</b>
<b>Table ZA.4 — Assignment of evaluation of conformity tasks for products under system 3 or system 3 combined with system 4 for reaction to fire .....</b>	<b>41</b>

## **Figures**

<b>Figure C.1 — Example of a graphic representation of “a” (<math>a = 0,04/0,037 = 1,08</math> in this example).....</b>	<b>28</b>
<b>Figure ZA.1 — Example CE marking information .....</b>	<b>44</b>

## Foreword

This document (EN 13169:2008) 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 May 2009, and conflicting national standards shall be withdrawn at the latest by May 2009.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

For relationship with EC Directive(s), see informative Annex ZA, which is an integral part of this document.

This document supersedes EN 13169:2001.

This document is one of a series of standards for insulation products used in buildings, but this standard may be used in other areas where appropriate.

In pursuance of Resolution BT 20/1993 Revised, CEN/TC 88 have proposed defining the standards listed below as a package of documents.

The package of standards comprises the following group of interrelated standards for the specifications of factory made thermal insulation products, all of which come within the scope of CEN/TC 88:

EN 13162, *Thermal insulation products for buildings — Factory made mineral wool (MW) products — Specification*

EN 13163, *Thermal insulation products for buildings — Factory made products of expanded polystyrene (EPS) — Specification*

EN 13164, *Thermal insulation products for buildings — Factory made products of extruded polystyrene foam (XPS) — Specification*

EN 13165, *Thermal insulation products for buildings — Factory made rigid polyurethane foam (PUR) products — Specification*

EN 13166, *Thermal insulation products for buildings — Factory made products of phenolic foam (PF) — Specification*

EN 13167, *Thermal insulation products for buildings — Factory made cellular glass (CG) products — Specification*

EN 13168, *Thermal insulation products for buildings — Factory made wood wool (WW) products — Specification*

EN 13169, *Thermal insulation products for buildings — Factory made products of expanded perlite (EPB) — Specification*

EN 13170, *Thermal insulation products for buildings — Factory made products of expanded cork (ICB) — Specification*



EN 13171, *Thermal insulation products for buildings — Factory made wood fibre (WF) products — Specification*

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

## 1 Scope

This European Standard specifies the requirements for factory made products of expanded perlite, with or without facings or coatings, which are used for the thermal insulation of buildings. The products are manufactured in the form of boards or multi-layered insulation.

This European Standard also covers composite insulation boards (see Annex D).

This European Standard specifies product characteristics and includes procedures for testing, evaluation of conformity, marking and labelling.

Products covered by this European Standard are also used in prefabricated thermal insulating systems and composite panels; the performance of systems incorporating these products is not covered.

This European Standard does not specify the required level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. The levels required for a given application are to be found in regulations or non-conflicting standards.

Products with a declared thermal resistance lower than  $0,20 \text{ m}^2\cdot\text{K}/\text{W}$  or a declared thermal conductivity greater than  $0,070 \text{ W}/(\text{m}\cdot\text{K})$  at  $10^\circ\text{C}$  are not covered by this European Standard.

This European Standard does not cover in situ insulation products and products intended to be used for the insulation of building equipment and industrial installations. This European Standard does not cover the following acoustical aspects: Acoustic absorption index and direct airborne sound insulation.

## 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.

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



EN 12086:1997, *Thermal insulating products for building applications — Determination of water vapour transmission properties*

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

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 12667, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Products of high and medium thermal resistance*

EN 12939, *Thermal performance of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Thick products of high and medium thermal resistance*

EN 13172:2008, *Thermal insulating products — Evaluation of conformity*<sup>1</sup>

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire test*

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

EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 29052-1, *Acoustics — Determination of dynamic stiffness — Part 1: Materials used under floating floors in dwellings*

EN ISO 354, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003)*

EN ISO 1182, *Reaction to fire tests for building products — Non-combustibility test (ISO 1182:2002)*

EN ISO 1716, *Reaction to fire tests for building products — Determination of the heat of combustion (ISO 1716:2002)*

EN ISO 9229, *Thermal insulation — Vocabulary (ISO 9229:2007)*

EN ISO 11654, *Acoustics — Sound absorbers for use in buildings — Rating of sound absorption (ISO 11654:1997)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of building products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2:2002)*

ISO 12491, *Statistical methods for quality control of building materials and components*

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<sup>1</sup> Under review

### 3 Terms, definitions, symbols, units and abbreviated terms

#### 3.1 Terms and definitions

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

##### 3.1.1 Terms and definitions as given in EN ISO 9229

###### 3.1.1.1

###### **expanded perlite**

lightweight granular (insulation) material manufactured from naturally occurring volcanic rock expanded by heat to form a cellular structure

###### 3.1.1.2

###### **multi-layered insulation**

combination of two or more layers of a specific insulation material. The thickness of the individual layers may differ

###### 3.1.1.3

###### **composite insulation**

combination of layers of at least two different insulation materials. The insulation property of the composite is derived from the insulation properties of the individual materials

##### 3.1.2 Additional terms and definitions

###### 3.1.2.1

###### **expanded perlite board**

rigid insulation board manufactured from expanded perlite, reinforcing fibres and binding agents

NOTE 1 It may be delivered as a board or as two or more boards bonded together with a suitable adhesive (multi-layered insulation: see 3.1.1.2).

NOTE 2 Boards may also have a profiled edge.

###### 3.1.2.2

###### **level**

given value which is the upper or lower limit of a requirement. The level is given by the declared value of the characteristic concerned

###### 3.1.2.3

###### **class**

combination of two levels of the same property between which the performance shall fall

#### 3.2 Symbols units and abbreviated terms

##### 3.2.1 Symbols and units used in this standard:

<i>a</i>	is the coefficient describing the influence of moisture on the thermal conductivity	—
<i>b</i>	is the width	mm
<i>c</i>	is the compressibility	mm
<i>d</i>	is the thickness	mm

$d_B$	is the thickness under a load of 2 kPa after removal of an additional load of 48 kPa	mm
$d_L$	is the thickness under a load of 250 Pa	mm
$d_N$	is the nominal thickness of the product	mm
$\Delta \varepsilon_b$	is the relative change in width	%
$\Delta \varepsilon_d$	is the relative change in thickness	%
$\Delta \varepsilon_l$	is the relative change in length	%
$k$	is a factor related to the number of test results available	—
$l$	is the length	mm
$\lambda_D$	is the declared thermal conductivity	W/(m·K)
$\lambda_i$	is one test result of thermal conductivity	W/(m·K)
$\lambda_{\text{mean}}$	is the mean thermal conductivity	W/(m·K)
$\lambda_{10,\text{dry}}$	is the thermal conductivity in the dry state	W/(m·K)
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)
$m_1$	is the mass of the test specimen after 2 h total immersion in water	kg
$m_{23,\text{dry}}$	is the mass of specimen in the dry state	kg
$m_{23,50}$	is the mass of specimen at 23 °C and 50 % relative humidity	kg
$\mu$	is the water vapour diffusion resistance factor	—
$n$	is the number of test results	—
$R_D$	is the declared thermal resistance	m <sup>2</sup> ·K/W
$R_i$	is one test result of thermal resistance	m <sup>2</sup> ·K/W
$R_{\text{mean}}$	is the mean thermal resistance	m <sup>2</sup> ·K/W
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m <sup>2</sup> ·K/W
$S_b$	is the deviation from squareness on length and width	mm/m
$S_{\text{max}}$	is the deviation from flatness	mm
$s_R$	is the estimate of the standard deviation of the thermal resistance	m <sup>2</sup> ·K/W
$s_\lambda$	is the estimate of the standard deviation of the thermal conductivity	W/(m·K)
$s'$	is the dynamic stiffness	MN/m <sup>3</sup>
$\sigma_b$	is the bending strength	kPa
$\sigma_{bc}$	is the bending strength at a constant span	kPa
$\sigma_c$	is the declared compressive stress	kPa
$\sigma_m$	is the compressive strength	kPa
$\sigma_{mt}$	is the tensile strength perpendicular to faces	kPa
$\sigma_{10}$	is the compressive stress at 10 % deformation	kPa
$u_{23,50}$	is the moisture content by mass at 23 °C and 50 % relative humidity	kg/kg

$V$	is the volume of the specimen	$\text{m}^3$
$W_p$	is the short-term water absorption by partial immersion	$\text{kg/m}^2$
$W_{st}$	is the short-term water absorption by total immersion	$\text{kg/dm}^3$
$X_0$	is the initial deformation after 60 s from the beginning of loading	mm
$X_{ct}$	is the compressive creep	mm
$X_t$	is the deformation at time $t$ (total thickness reduction)	mm
$Z$	is the water vapour resistance	$\text{m}^2 \cdot \text{h} \cdot \text{Pa/mg}$

BS	is the symbol of the declared level of bending strength
BS(z)	is the symbol of the declared level of bending strength at a constant span
CC( $i_1/i_2/y$ ) $\sigma_c$	is the symbol of the declared level for compressive creep*
CP	is the symbol of the declared level for compressibility
CS(10\Y) $i$	is the symbol of the declared level for compressive stress or compressive strength*
DLT(i)5	is the symbol of the declared level of deformation under load and temperature
DS(H)	is the symbol of the declared value for dimensional stability under humidity condition
DS(T+/50)	is the symbol of the declared value for dimensional stability under specified temperature and humidity
MU $i$	is the symbol of the declared value for water vapour diffusion resistance factor*
PL(2) $i$	is the symbol of the declared level of point load for 2 mm deformation*
SD	is the symbol of the declared level of dynamic stiffness
T	is the symbol of the declared class for thickness tolerances
TR $i$	is the symbol of the declared value for tensile strength perpendicular to faces*
WS	is the symbol of the declared level for short term water absorption absorption by partial immersion
WS(T)	is the symbol of the declared level of short term water absorption by total immersion
Z $i$	is the symbol of the declared value for water vapour resistance*

\* "i" is the relevant class or level, " $\sigma_c$ " is the compressive stress, and "y" is the number of years

### 3.2.2 Abbreviated terms used in this standard:

EPB	Expanded Perlite Board
ITT	Initial Type Test
RTF	Reaction To Fire
FPC	Factory Production Control



## 4 Requirements

### 4.1 General

Product properties shall be assessed in accordance with clause 5. To comply with this standard, products shall meet the requirements of 4.2, and the requirements of 4.3 as appropriate.

NOTE Information on additional properties is given in Annex E.

One test result on a product property is the average of the measured values on the number of test specimens given in Table 6.

### 4.2 For all applications

#### 4.2.1 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be based upon measurements carried out in accordance with EN 12667 or EN 12939 for thick products.

The thermal resistance and thermal conductivity shall be determined in accordance with Annex A and Annex C, and declared by the manufacturer according to the following:

- the reference mean temperature shall be 10 °C;
- the measured values shall be expressed with three significant figures;
- for products of uniform thickness, the thermal resistance,  $R_D$ , shall always be declared. The thermal conductivity,  $\lambda_D$ , shall be declared where possible. Where appropriate, for products of non-uniform thickness (e.g. for sloped and tapered products) only the thermal conductivity,  $\lambda_D$ , shall be declared.
- the declared thermal resistance,  $R_D$ , and thermal conductivity,  $\lambda_D$ , shall be given as limit values representing at least 90 % of the production, determined with a confidence level of 90 %;
- the value of thermal conductivity,  $\lambda_{90/90}$ , shall be rounded upwards to the nearest 0,001 W/(m·K) and declared as  $\lambda_D$  in levels with steps of 0,001 W/(m·K);
- the declared thermal resistance,  $R_D$ , shall be calculated from the nominal thickness,  $d_N$ , and the corresponding thermal conductivity,  $\lambda_{90/90}$ ;
- the value of thermal resistance,  $R_{90/90}$ , when calculated from the nominal thickness,  $d_N$ , and the corresponding thermal conductivity,  $\lambda_{90/90}$ , shall be rounded downwards to the nearest 0,05 m<sup>2</sup>·K/W, and declared as  $R_D$  in levels with steps of 0,05 m<sup>2</sup>·K/W;
- the value of  $R_{90/90}$ , for those products for which only thermal resistance is measured directly, shall be rounded downwards to the nearest 0,05 m<sup>2</sup> K/W, and declared as  $R_D$  in levels with steps of 0,05 m<sup>2</sup>·K/W.

#### 4.2.2 Length and width

Length,  $l$ , and width,  $b$ , shall be determined in accordance with EN 822. No test result shall deviate from the nominal values by more than the following:

± 3 mm for length and width not exceeding 1 200 mm;



$\pm 5$  mm for length and width exceeding 1 200 mm.

In the case of bonded boards, the offset on the edges shall not exceed 3 mm.

#### 4.2.3 Thickness

Thickness,  $d$ , shall be determined in accordance with EN 823, using a load equal to 250 Pa. No test result shall deviate from the nominal thickness,  $d_N$ , by more than the corresponding tolerances given in Table 1.

**Table 1 — Thickness tolerances**

Dimensions in millimetres

Nominal thickness	$d_N \leq 35$	$35 < d_N \leq 70$	$70 < d_N \leq 120$	$d_N > 120$
Tolerance	$\pm 1$	$\pm 2$	$\pm 3$	$\pm 4$

This test shall not be performed when the tests described in D.2.7 are used.

#### 4.2.4 Squareness

Squareness shall be determined in accordance with EN 824. The deviation from squareness on length and width,  $S_b$ , shall not exceed 3 mm/m.

#### 4.2.5 Flatness

Flatness shall be determined in accordance with EN 825. The deviation from flatness,  $S_{max}$ , shall not exceed the following:

3 mm for length and width not exceeding 1 200 mm;

5 mm for length and width exceeding 1 200 mm.

#### 4.2.6 Bending strength

Bending strength,  $\sigma_b$ , shall be determined in accordance with EN 12089. For handling purpose, the bending strength of boards shall not be less than 250 kPa.

NOTE The requirement for handling applies to individual boards. In the case of multi-layered boards, it may be assumed that the requirement is satisfied when each of the individual layers fulfills this requirement.

#### 4.2.7 Dimensional stability under specified temperature and humidity conditions

Dimensional stability under specified humidity conditions shall be determined in accordance with EN 1604. The test shall be carried out for 48 h at  $(23 \pm 2)$  °C and  $(90 \pm 5)$  % relative humidity. The relative changes in length,  $\Delta\epsilon_l$ , and width,  $\Delta\epsilon_b$ , shall not exceed 0,5 %. The relative changes in thickness,  $\Delta\epsilon_d$ , shall not exceed 1 %.

#### 4.2.8 Reaction to fire

Reaction to fire classification (Euroclasses) shall be determined in accordance with EN 13501-1.

## **4.2.9 Durability characteristics**

### **4.2.9.1 General**

The appropriate durability characteristics have been considered and are covered in 4.2.9.2, 4.2.9.3 and 4.2.9.4.

### **4.2.9.2 Durability of reaction to fire against ageing/ degradation**

The reaction to fire performance of factory made products of expanded perlite does not change with time.

### **4.2.9.3 Durability of thermal resistance against ageing/ degradation**

The thermal conductivity of factory made products of expanded perlite does not change with time. This is covered by 4.2.1 thermal conductivity, 4.2.2 Length and width and 4.2.7 Dimensional stability or 4.3.2 Dimensional stability.

### **4.2.9.4 Durability of compressive strength against ageing/degradation**

The durability of compressive strength is covered by 4.3.9 Compressive creep.

## **4.3 For specific applications**

### **4.3.1 General**

If there is no requirement for a property described in 4.3 for a product in use, then the property does not need to be determined and declared by the manufacturer.

### **4.3.2 Dimensional stability under specified temperature and humidity conditions**

Dimensional stability under specified temperature conditions shall be determined in accordance with EN 1604. The test shall be carried out for 48 h exposure at  $(70 \pm 2) ^\circ\text{C}$  and  $(50 \pm 5) \%$  relative humidity. The relative changes in length,  $\Delta\epsilon_l$ , and width,  $\Delta\epsilon_b$ , shall not exceed 0,5 %. The relative changes in thickness,  $\Delta\epsilon_d$ , shall not exceed 1 %.

### **4.3.3 Compressive stress or compressive strength**

Compressive stress at 10 % deformation,  $\sigma_{10}$ , or the compressive strength,  $\sigma_m$ , shall be determined in accordance with EN 826. No test result for either the compressive stress at 10 % deformation,  $\sigma_{10}$ , or the compressive strength,  $\sigma_m$ , whichever is the smaller, shall be less than the value given in Table 2, for the declared level.

**Table 2 — Levels for compressive stress or compressive strength**

Level	Requirement kPa
CS(10\Y)100	$\geq 100$
CS(10\Y)125	$\geq 125$
CS(10\Y)150	$\geq 150$
CS(10\Y)200	$\geq 200$
CS(10\Y)300	$\geq 300$
CS(10\Y)450	$\geq 450$
CS(10\Y)700	$\geq 700$
CS(10\Y)800	$\geq 800$

#### 4.3.4 Deformation under specified load and temperature

Deformation in thickness under specified load and temperature conditions shall be determined in accordance with EN 1605. The relative deformation in thickness,  $\Delta\varepsilon_d$ , shall not exceed the values given in Table 3 for the declared level.

**Table 3 — Levels for deformation under specified compressive load and temperature**

Level	Requirement %	Test conditions
DLT(1)5	$\leq 5$	Load: 20 kPa Temperature: $(80 \pm 1)^\circ\text{C}$ Time: $(48 \pm 1)$ h
DLT(2)5	$\leq 5$	Load: 40 kPa Temperature: $(70 \pm 1)^\circ\text{C}$ Time: $(168 \pm 1)$ h
DLT(3)5	$\leq 5$	Load: 80 kPa Temperature: $(60 \pm 1)^\circ\text{C}$ Time: $(168 \pm 1)$ h

#### 4.3.5 Tensile strength perpendicular to faces

Tensile strength perpendicular to faces,  $\sigma_{mt}$ , shall be determined in accordance with EN 1607, using the additional provisions of 5.3.3. No test result shall be lower than 20 kPa.

#### 4.3.6 Water absorption

##### 4.3.6.1 Short-term water absorption by partial immersion

Short-term water absorption by partial immersion,  $W_p$ , shall be determined in accordance with EN 1609. No test result shall exceed the declared value.

#### 4.3.6.2 Short-term water absorption by total immersion

Short-term water absorption by total immersion,  $W_{st}$ , shall be determined in accordance with 5.3.4. No test result shall exceed the value, given in Table 4, for the declared level.

**Table 4 — Levels for water absorption by total immersion**

Level	Requirement kg/dm <sup>3</sup>
WS(T) 8	≤ 0,08
WS(T) 6	≤ 0,06
WS(T) 4	≤ 0,04
WS(T) 2	≤ 0,02

#### 4.3.7 Bending strength at a constant span

Bending strength at a constant span of 250 mm,  $\sigma_{bc}$ , shall be determined in accordance with EN 12089. No test result shall be lower than the value given in Table 5, for the declared level.

**Table 5 — Levels for bending strength at constant span**

Level	Requirement kPa
BS(250)700	≥ 700
BS(250)900	≥ 900
BS(250)1100	≥ 1 100
BS(250)1300	≥ 1 300

#### 4.3.8 Point load

Point load at 2 mm deformation shall be determined in accordance with EN 12430 and declared in levels with steps of 50 N. No test result shall be less than the declared level.

#### 4.3.9 Compressive creep

Compressive creep,  $X_{ct}$ , and total thickness reduction,  $X_t$ , shall be determined after at least one hundred twenty two days of testing at a declared compressive stress,  $\sigma_c$ , given in steps of at least 1 kPa, and the result extrapolated thirty times corresponding to ten years to obtain the declared levels in accordance with EN 1606.

Compressive creep shall be declared in levels,  $i_2$ , and the total thickness reduction shall be declared in levels,  $i_1$ , with steps of 0,1 mm at the declared stress. No test result shall exceed the declared levels at the declared stress.

NOTE Referring to the designation code  $CC(i_1/i_2/y)\sigma_c$ , according to Clause 6, a declared level  $CC(2,5/2/10)100$ , as for example, indicates a value not exceeding 2 mm for compressive creep and 2,5 mm for total thickness reduction after extrapolation at 10 years (i.e. 30 times one hundred twenty two days of testing) under a declared stress of 100 kPa.



#### 4.3.10 Water vapour transmission

Water vapour transmission properties shall be determined in accordance with EN 12086, and declared as the water vapour diffusion resistance factor,  $\mu$ , for homogeneous products and as the water vapour resistance,  $Z$ , for faced or non-homogeneous products. No test result of  $\mu$  shall be greater than the declared value and no test result of  $Z$  shall be less than the declared value.

In the absence of measurements, the water vapour diffusion resistance factor,  $\mu$ , of expanded perlite products, either unfaced, or faced with a fabric with an open structure may be assumed to be equal to 5.

#### 4.3.11 Release of dangerous substances

NOTE See Annex ZA.

#### 4.3.12 Continuous glowing combustion

NOTE A test method is under development and the standard will be amended when this is available.

### 5 Test methods

#### 5.1 Sampling

Test specimens shall be taken from the same sample which shall be at least one full board.

#### 5.2 Conditioning

For test specimens consisting of full boards, no conditioning is needed unless otherwise specified in the test standard. In case of dispute, the test specimens shall be stored at  $(23 \pm 2)^\circ\text{C}$  and  $(50 \pm 5)\%$  relative humidity for at least 6 weeks prior to testing.

When cut from boards, except for 5.3.2, test specimens shall be stored in an atmosphere of  $(23 \pm 2)^\circ\text{C}$  and  $(50 \pm 5)\%$  relative humidity until stabilisation at constant weight is achieved. Stabilisation is obtained when the relative change in weight does not exceed 0,5 % between two consecutive weekly measurements. In case of dispute, the following stepwise procedure shall be carried out:

- step 1 (dry reference): The specimens are stored for 72 h at  $(70 \pm 2)^\circ\text{C}$ , in an oven ventilated with an air taken at  $(23 \pm 2)^\circ\text{C}$  and  $(50 \pm 5)\%$  relative humidity, and then weighed. The mass of the test specimen at step 1 is  $m_{23,\text{dry}}$ .
- step 2 (normal reference): After conditioning according to step 1, the specimens are stored in an atmosphere of  $(23 \pm 2)^\circ\text{C}$  and  $(50 \pm 5)\%$  relative humidity until stabilisation, and then weighed. Stabilisation, by definition, takes at least 6 weeks with some additional time so that the relative change in moisture does not increase by more than 5 % between two consecutive weekly measurements. The mass of the test specimen at step 2 is  $m_{23,50}$ .

Moisture content,  $u_{23,50}$ , expressed in kilogram per kilogram, shall be determined by weighing the specimens at each step with an accuracy of 0,1 g, and calculated using equation (1):

$$u_{23,50} = \frac{m_{23,50} - m_{23,\text{dry}}}{m_{23,\text{dry}}} \quad (1)$$



## 5.3 Testing

### 5.3.1 General

Table 6 gives the dimensions of the test specimens, the minimum number of measurements required to get one test result, and any specific conditions which are necessary.

### 5.3.2 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be determined in accordance with EN 12667 or EN 12939 for thick products and under the following conditions:

- at mean temperature of  $(10 \pm 0,3) ^\circ\text{C}$ ;
- after conditioning according to step 1 of 5.2 (i.e. under dry condition);
- using the provisions given in Annex C for the determination of the thermal conductivity in the relation to moisture content.

NOTE Thermal resistance and thermal conductivity may also be measured at mean temperatures other than  $10 ^\circ\text{C}$ , providing that the accuracy of the relationship between temperature and thermal properties is well documented.

Thermal resistance and thermal conductivity shall be determined directly at measured thickness. In the event that this is not possible, they shall be determined by measurements on other thicknesses of the product providing that:

- product is of similar chemical and physical characteristics and is produced on the same production line;
- and it can be demonstrated in accordance with EN 12939 that the thermal conductivity,  $\lambda$ , does not vary more than 2 % over the range of thicknesses where the calculation is applied.

### 5.3.3 Tensile strength perpendicular to faces

For measurements of tensile strength perpendicular to faces, additional provisions to the test method and test procedures of EN 1607 shall be as follows:

- rigid plates, made of steel, having a thickness of at least 5 mm;
- adhesion of the test specimen to the rigid plates with oxydised hot bitumen, such as type 85/25, or 100/40, or 110/30 for example;
- cooling the test specimens, bonded to the metal plates, for a minimum of 6 h at  $(23 \pm 5) ^\circ\text{C}$ , before testing.

### 5.3.4 Water absorption by total immersion

Short-term water absorption by total immersion shall be measured, using the following test procedure:

- use apparatus and relevant normative references as mentioned in EN 1609;
- select a test specimen of nominal product thickness, including facing or coating if any, with dimensions as given in Table 6;
- weigh the test specimen to the nearest 0,1 g to determine its initial mass  $m_{23,50}$ ;
- place the test specimen in a water tank, and keep it totally immersed for  $(2 \pm 0,02)$  h, so that its top face remains under at least 2 mm of water;

- remove the test specimen and drain for  $(600 \pm 30)$  s by placing it vertically on a mesh inclined at  $45^\circ$ ;
- weigh the test specimen to the nearest 0,1 g to determine its mass  $m_1$ .

The water absorption,  $W_{st}$ , of the specimen, expressed in  $\text{kg/dm}^3$ , shall be calculated using equation (2):

$$W_{st} = 10^{-3} \times \frac{m_1 - m_{23,50}}{V} \quad (2)$$

Table 6 — Test methods, test specimens and conditions

Dimensions in millimetres

Clause		Test method	Test specimen length and width <sup>a</sup>	Minimum number of measurements to get one test result	Specific conditions
No.	Title				
4.2.1	Thermal resistance – thermal conductivity	EN 12667 or EN 12939	See EN 12667 or EN 12939	1	–
4.2.2	Length and width	EN 822	Full size	1	–
4.2.3	Thickness	EN 823	Full size	3	Load: (250 ± 5) Pa
4.2.4	Squareness	EN 824	Full size	1	–
4.2.5	Flatness	EN 825	Full size	1	–
4.2.6	Bending strength	EN 12089	See EN 12089	3	Method B
4.2.7	Dimensional stability under specified temperature and humidity conditions	EN 1604	200 × 200	3	–
4.2.8	Reaction to fire	See EN 13501-1			–
4.3.2	Dimensional stability under specified temperature and humidity	EN 1604	200 × 200	3	–
4.3.3	Compressive stress or compressive strength	EN 826	100 × 100	5	If $d_N \leq 100$
			150 × 150	5	If $d_N > 100$
4.3.4	Deformation under specified load and temperature conditions	EN 1605	100 × 100	3	If $d_N \leq 100$
			150 × 150	3	If $d_N > 100$
4.3.5	Tensile strength perpendicular to faces	EN 1607	80 × 80 or 100 × 100	8	See 5.3.3 If board > 1 m <sup>2</sup>
				5	See 5.3.3 If board ≤ 1 m <sup>2</sup>
4.3.6.1	Short term water absorption by partial immersion	EN 1609	200 × 200	4	Method A
4.3.6.2	Short term water absorption by total immersion	See 5.3.4	300 × 300	3	–
4.3.7	Bending strength at constant span	EN 12089	300 × 50	3	Method B Span: 250 mm
4.3.8	Point load	EN 12430	300 × 300	3	–
4.3.9	Compressive creep	EN 1606	100 × 100	3	If $d_N \leq 100$
			150 × 150	3	If $d_N > 100$
4.3.10	Water vapour transmission	EN 12086	See 6.1 in EN 12086:1997	3	–
4.3.11	Release of dangerous substances	–	b	–	–
4.3.12	Continuous glowing combustion	–	b	–	–

<sup>a</sup> Full-size product thickness.<sup>b</sup> When drafting this standard, no European harmonized test method was available.

## 6 Designation code

A designation code for the product shall be given by the manufacturer. The following shall be included except when there is no requirement for a property described in 4.3:

— Expanded perlite board abbreviated term	EPB
— Document number	EN 13169
— Bending strength	BS
— Dimensional stability under specified temperature and humidity conditions	DS(H)
— Dimensional stability under specified temperature and humidity conditions	DS(T+50)
— Compressive stress or compressive strength	CS(10\Y)i
— Deformation under load and temperature	DLT(i)5
— Tensile strength perpendicular to faces	TR
— Short term water absorption by partial immersion	WSi
— Short term water absorption by total immersion	WS(T)i
— Bending strength at constant span	BS(250)i
— Point load	PL(2)i
— Compressive creep	CC(i <sub>1</sub> /i <sub>2</sub> /y)σ <sub>c</sub>
— Water vapour transmission	MUi or Zi

where “i” shall be used to indicate the relevant class or level, “σ<sub>c</sub>” shall be used to indicate the compressive stress expressed in kPa, “y” to indicate the number of years.

The designation code for an expanded perlite product is illustrated by the following example:

EPB EN 13169 — BS — DS(H) — DS(T+50) — CS(10\Y)200 — DLT(3)5 — TR — WS — WS(T)4 — BS(250)700 — PL(2)300 — CC(2,5/2/10)80 — MU5

NOTE The characteristics determined in 4.2 are not included in the designation code if a limit value (threshold value) is given for the product.

## 7 Evaluation of conformity

The manufacturer or his authorised representative shall be responsible for the conformity of his product with the requirements of this European Standard. The evaluation of conformity shall be carried out in accordance with EN 13172 and shall be based on initial type testing (ITT), factory production control (FPC) by the manufacturer, including product assessment and tests on samples taken at the factory.

The compliance of the product with the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

- initial type testing (ITT),
- factory production control by the manufacturer, including product assessment.

If a manufacturer decides to group his products, it shall be done in accordance with EN 13172.

The minimum frequencies of tests in the factory production control shall be in accordance with Annex B of this standard. When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172.

The manufacturer or his authorised representative shall make available, in response to a request, a certificate or declaration of conformity as appropriate.

All characteristics defined in 4.2 and those in 4.3 where required shall be subject to an initial type testing.

NOTE For the EC certificate and declaration of conformity, as appropriate, see ZA.2.2.

## **8 Marking and labelling**

Products conforming to this standard shall be clearly marked, either on the product or on the label or on the packaging, with the following information:

- product name or other identifying characteristic;
- name or identifying mark and address of the manufacturer or his authorised representative;
- shift or time of production and manufacturing plant or traceability code;
- reaction to fire class;
- declared thermal resistance;
- declared thermal conductivity;
- nominal thickness;
- designation code as given in Clause 6;
- type of facing or coating, if any;
- nominal length, nominal width;
- number of pieces and area in the package, as appropriate.

NOTE For CE marking and labelling see ZA.3.



## Annex A (normative)

### Determination of the declared values of thermal resistance and thermal conductivity

#### A.1 General

It is the responsibility of the manufacturer to determine the declared values of thermal conductivity and thermal resistance. He will have to demonstrate conformity of the product to its declared values. The declared values of thermal conductivity and thermal resistance of a product are the expected values of these properties during an economically reasonable working life under normal conditions, assessed through measured data at reference conditions.

#### A.2 Input data

The manufacturer shall have at least ten test results for thermal conductivity or thermal resistance, obtained from internal or external direct measurements in order to calculate the declared values. The direct thermal resistance or thermal conductivity measurements shall be carried out at regular intervals spread over a time period of the last twelve months. If less than 10 test results is available, that period may be extended until ten test results are obtained, but with a maximum period of three years, within which the product and production conditions have not changed significantly.

For new products, the thermal resistance or thermal conductivity test results shall be carried out spread over a minimum period of ten days.

The declared values shall be calculated according to the method given in A.3 and shall be recalculated at intervals not exceeding three months of production.

#### A.3 Declared values

##### A.3.1 General

The derivation of the declared values  $R_D$  and  $\lambda_D$  from the calculated values  $R_{90/90}$  and  $\lambda_{90/90}$  shall use the rules given in 4.2.1 which include the rounding conditions.

##### A.3.2 Case where thermal resistance and thermal conductivity are declared

The declared values  $R_D$  and  $\lambda_D$  shall be derived from the calculated values  $R_{90/90}$  and  $\lambda_{90/90}$  which are determined using the Equations A.1, A.2 and A.3.

$$\lambda_{90/90} = \lambda_{\text{mean}} + k \times s_{\lambda} \quad (\text{A.1})$$

$$s_{\lambda} = \sqrt{\frac{\sum_{i=1}^n (\lambda_i - \lambda_{\text{mean}})^2}{n-1}} \quad (\text{A.2})$$

$$R_{90/90} = d_N / \lambda_{90/90} \quad (\text{A.3})$$

**A.3.3 Case where thermal resistance alone is declared**

The declared values  $R_D$  shall be derived from the calculated value  $R_{90/90}$  which is determined using the equations A.4 and A.5.

$$R_{90/90} = R_{\text{mean}} - k \times s_R \quad (\text{A.4})$$

$$s_R = \sqrt{\frac{\sum_{i=1}^n (R_i - R_{\text{mean}})^2}{n-1}} \quad (\text{A.5})$$

**Table A.1 — Values for  $k$  for one sided 90 % tolerance interval with a confidence level of 90 %**

Number of test results	$k$
10	2,07
11	2,01
12	1,97
13	1,93
14	1,90
15	1,87
16	1,84
17	1,82
18	1,80
19	1,78
20	1,77
22	1,74
24	1,71
25	1,70
30	1,66
35	1,62
40	1,60
45	1,58
50	1,56
100	1,47
300	1,39
500	1,36
2 000	1,32
For other numbers of test results use ISO 12491 or linear interpolation.	

## Annex B (normative)

### Factory production control

**Table B.1 — Minimum product testing frequencies**

Clause		Minimum testing frequency <sup>a</sup>
No	Title	
4.2.1	Thermal resistance – thermal conductivity	1 per 24 h
4.2.2	Length and width	1 per 4 h
4.2.3	Thickness	1 per 2 h
4.2.4	Squareness	1 per 4 h
4.2.5	Flatness	ITT <sup>b</sup>
4.2.6	Bending strength	ITT <sup>b</sup>
4.2.7	Dimensional stability under specified temperature and humidity conditions	ITT <sup>b</sup>
4.2.8	Reaction to fire	See Table B.2
4.3.2	Dimensional stability under specified temperature and humidity conditions	ITT <sup>b</sup>
4.3.3	Compressive stress or strength	1 per 8 h
4.3.4	Deformation under specified load and temperature conditions	ITT <sup>b</sup>
4.3.5	Tensile strength perpendicular to faces	1 per 8 h
4.3.6.1	Short term water absorption by partial immersion	ITT <sup>b</sup>
4.6.3.2	Short term water absorption by total immersion	1 per 8 h
4.3.7	Bending strength at a constant span	1 per 8 h
4.3.8	Point load	ITT <sup>b</sup>
4.3.9	Compressive creep	ITT <sup>b</sup>
4.3.10	Water vapour transmission	ITT <sup>b</sup>
4.3.11	Release of dangerous substances	<sup>c</sup>
<p><sup>a</sup> The minimum testing frequencies shall be understood as the minimum for each production unit/line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.</p> <p>For mechanical properties, the testing frequencies given are independent of the change of product. In addition the manufacturer shall establish internal rules for process adjustments related to these properties when changing the product.</p> <p><sup>b</sup> ITT, see EN 13172.</p> <p><sup>c</sup> When drafting this standard, no European harmonized test method was available.</p>		

Table B.2 — Minimum product testing frequencies for the reaction to fire characteristics

Clause		Minimum testing frequency <sup>a</sup>							
No	Title	Direct testing <sup>b</sup>		Indirect testing <sup>c</sup>					
	Reaction to fire			Product		Components <sup>d, e</sup>			
						Substantial		Non-substantial	
4.2.8	class	Test method	Frequency	Test method	Frequency	Test method	Frequency	Test method	Frequency
	A1 without testing <sup>f</sup>	EN 13820	1 per 3 months <sup>g</sup> or 1 per 2 years and indirect testing	–	–	–	–	–	–
				–	–	Loss on ignition	1 per 4 h	Weight per unit area	1 per 1 h
	A1	EN ISO 1182 and EN ISO 1716 (and EN 13823)	1 per 2 years and indirect testing	–	–	Loss on ignition	1 per 4 h	Either loss on ignition or calorific potential	1 per 4 h 1 per 4 h
						Apparent density	1 per 1 h	Weight per unit area	1 per 1 h
	A2	EN ISO 1182 and EN ISO 1716 (and EN 13823)	1 per 2 years and indirect testing	–	–	Loss on ignition	1 per 4 h	Either organic content or calorific potential	1 per 4 h 1 per 4 h
						Apparent density	1 per 1 h	Weight per unit area	1 per 1 h
	B C D	EN 13823 and	1 per month or 1 per 2 years and indirect testing <sup>h</sup>	–	–	–	–	–	–
				Manufacturer's method	1 per day	Loss on ignition	1 per 4 h	Either loss on ignition or calorific potential	1 per 4 h 1 per 4 h
						Apparent density	1 per 1 h	Weight per unit area	1 per 1 h
		EN ISO 11925-2	1 per week or 1 per 2 years and indirect testing	–	–	–	–	–	–
				Manufacturer's method	1 per day	–	–	–	–

Table B.2 (continued)

Clause		Minimum testing frequency <sup>a</sup>							
No	Title	Direct testing <sup>b</sup>		Indirect testing <sup>c</sup>					
	Reaction to fire			Product		Components <sup>d, e</sup>			
						Substantial		Non-substantial	
4.2.8	class	Test method	Frequency	Test method	Frequency	Test method	Frequency	Test method	Frequency
	E	EN ISO 11925-2	1 per week or 1 per 2 years and indirect testing	–	–	–	–	–	–
				Manufacturer's method	1 per day	–	–	–	–
	F	–	–	–	–	–	–	–	–
NOTE Not all Euroclasses may apply for the products conforming to this standard.									
<p><sup>a</sup> The minimum testing frequencies, expressed in test results, shall be understood as the minimum for a product or product group for each production unit/line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.</p> <p><sup>b</sup> Direct testing may be conducted either by third party or by the manufacturer.</p> <p><sup>c</sup> Indirect testing may be either on the product or on its components.</p> <p><sup>d</sup> Definition as given in the Euroclasses Decision 2000/147/EC:</p> <ul style="list-style-type: none"><li>– Substantial component: a material that constitutes a significant part of a non-homogeneous product. A layer with a mass per unit area <math>\geq 1,0 \text{ kg/m}^2</math> or a thickness <math>\geq 1,0 \text{ mm}</math> is considered to be a substantial component.</li><li>– Non-substantial component: a material that does not constitute a significant part of a non-homogeneous product. A layer with a mass per unit area <math>&lt; 1,0 \text{ kg/m}^2</math> and a thickness <math>&lt; 1,0 \text{ mm}</math> is considered to be a non-substantial component.</li></ul> <p><sup>e</sup> In case of certified component, the frequency is once per delivery of the component.</p> <p><sup>f</sup> European Decision 96/603EC: Materials to be considered as reaction to fire class A provided for in Decision 94/611/EC without the need for testing (of reaction to fire characteristics).</p> <p><sup>g</sup> Only for unfaced products.</p> <p><sup>h</sup> Indirect testing is only possible in the case of products falling within the system 1 for attestation of conformity of reaction to fire, or by having a notified body verifying the correlation to the direct testing.</p>									



## Annex C (normative)

### Determination of the thermal conductivity in relation to moisture content

The thermal conductivity corresponding to a conditioning atmosphere of  $(23 \pm 2) ^\circ\text{C}$  and  $(50 \pm 5) \%$  relative humidity shall be calculated using the equation (C.1):

$$\lambda = \lambda_{10,\text{dry}} \times [1 + (a \times u_{23,50})] \quad (\text{C.1})$$

where

$\lambda_{10,\text{dry}}$  is the thermal conductivity measured in accordance with EN 12667 or EN 12939 after conditioning at a dry reference state (see 5.2, step 1);

$u_{23,50}$  is the moisture content of the specimen measured in accordance with 5.2, step 2;

$a$  is a coefficient obtained by regression.

The coefficient  $a$  shall be determined using the measurements of  $\lambda$  made in accordance with EN 12667 or EN 12939 under the following procedure for conditioned test specimens:

- in the dry reference state (see 5.2, step 1);
- at  $(23 \pm 2) ^\circ\text{C}$  and  $(50 \pm 5) \%$  relative humidity;
- under another set of conditions, preferably  $(23 \pm 2) ^\circ\text{C}$  and  $(80 \pm 5) \%$  relative humidity.

For the determination of  $a$ , at least five specimens shall be taken from different runs.

NOTE The coefficient  $a$  may be represented on a graph, as shown in Figure C.1.

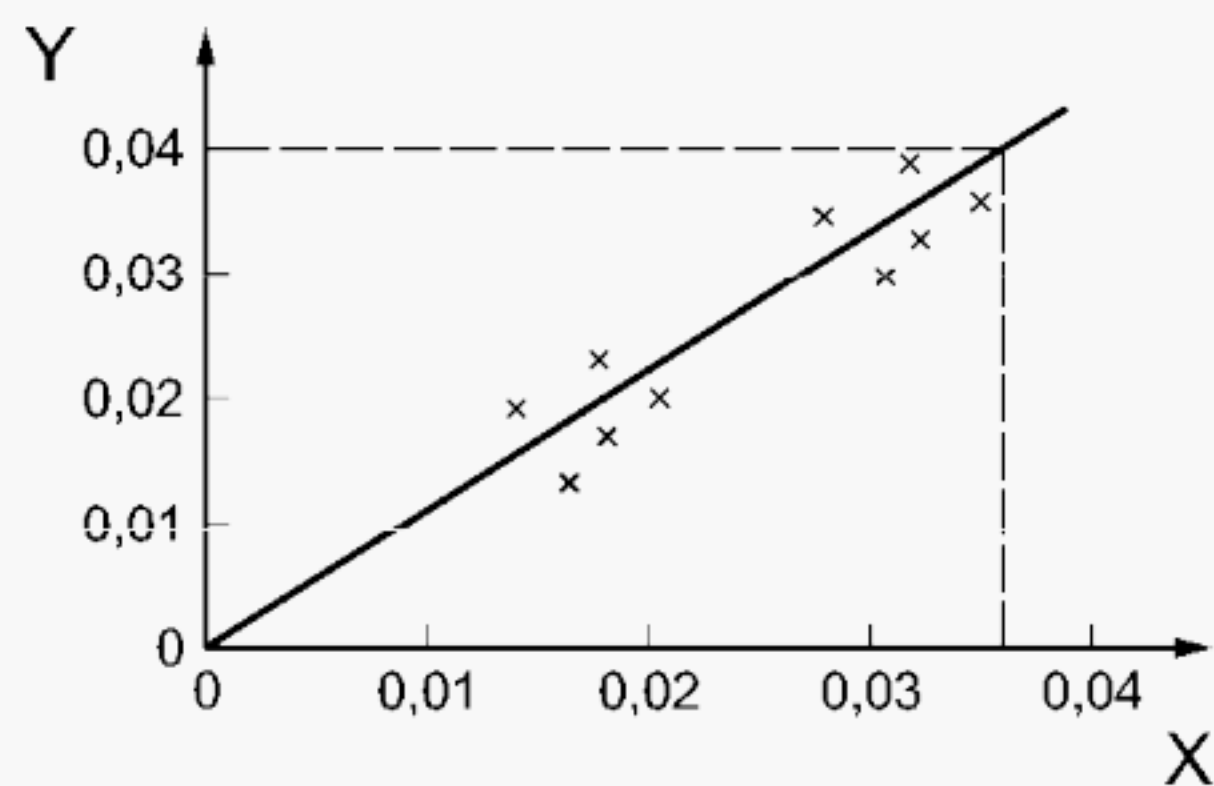
During measurement of  $\lambda$ , precautions shall be taken to avoid moisture absorption by the specimen. It is acceptable, for instance, to put the test specimen into a thin plastic bag.

The relative change in weight of the specimen, before and after measurement of  $\lambda$ , shall not exceed 0,1 %, when weighed with an accuracy of 0,5 g.

The determination of  $a$  and  $u_{23,50}$  shall be made only once, except in the case where noticeable change of product properties occurs.

Thermal properties shall be measured directly at the nominal thickness of the test specimen. In the event that this is not possible they shall be determined by measurements on other thicknesses of the material providing that:

- the material is of similar chemical and physical characteristics and is produced on the same production line;
- and it can be demonstrated that  $\lambda$  does not vary more than 2 % over the range of thicknesses where the calculation is applied.



**Key**

X Moisture content (kg/kg)

Y  $\frac{\lambda}{\lambda_{10,\text{dry}}} - 1$

**Figure C.1 — Example of a graphic representation of “a”**  
( $a = 0,04/0,037 = 1,08$  in this example)

## **Annex D** (normative)

### **Composite insulation boards**

#### **D.1 Description**

Composite insulation boards are made of two or three layers of thermal insulating products, factory laminated together with a bonding agent. These are composed of one layer or two layers of expanded perlite board, which conform to this European Standard, plus one layer of thermal insulating product which conforms to EN 13162 or EN 13163 or EN 13165 or EN 13166 (see Foreword).

#### **D.2 Requirements**

##### **D.2.1 General**

Requirements for short term water absorption and compressive strength or compressive strength shall be at least equal to the lowest corresponding level of each of the individual layers forming the composite insulation board.

Requirements for water vapour transmission and dimensional stability under specified temperature and humidity conditions shall be at least equal to the highest corresponding level of each of the individual layers forming the composite insulation board.

The additional requirements indicated in the following clauses apply only to the composite insulation boards.

##### **D.2.2 Length and width**

Length and width shall be determined in accordance with EN 822. Each layer of the composite insulation board shall have the same nominal length and width. Deviation from alignment of the edges of the individual layers shall not exceed 3 mm.

##### **D.2.3 Thickness**

Thickness shall be determined in accordance with EN 823, except for products used in floating floor application (see D.2.7). Unless otherwise agreed between parties, the tolerance in thickness shall not exceed the sum of the thickness tolerances of each layer.

##### **D.2.4 Thermal resistance**

The declared thermal resistance value of the composite insulation shall be given as the declared thermal resistance,  $R_D$ . The declared thermal resistance,  $R_D$ , of the composite insulation board shall be calculated from the sum of the declared thermal resistances of each of the layers.

##### **D.2.5 Dimensional stability at elevated temperature**

Dimensional stability at elevated temperature shall be determined in accordance with EN 1604. The test shall be carried out after 72 h exposure at a temperature of  $(50 \pm 2) ^\circ\text{C}$ . Unless otherwise agreed between parties, the relative deformation in length and width shall not exceed 1 %.

## D.2.6 Tensile strength perpendicular to faces

Tensile strength perpendicular to faces shall be determined in accordance with EN 1607. No test result shall be lower than the declared tensile strength perpendicular to faces of the individual layers forming the composite.

## D.2.7 Compressibility

### D.2.7.1 Thickness, $d_L$

Thickness,  $d_L$ , shall be determined in accordance with EN 12431 under a load of 250 Pa. No test result shall deviate from the nominal thickness,  $d_N$ , by more than the tolerances given in Table D.1 for the labelled class.

**Table D.1 — Classes for thickness tolerances**

Class	Tolerances	
T1	−5 % or −1 mm <sup>a</sup>	+15 % or +3 mm <sup>a</sup>
T2	0	+10 % or +2 mm <sup>a</sup>
<sup>a</sup> Whichever gives the greatest numerical tolerance.		

### D.2.7.2 Thickness $d_B$

Thickness,  $d_B$ , shall be determined in accordance with EN 12431 with a minimum pause of 120 s before measuring  $d_B$ .

### D.2.7.3 Compressibility

Compressibility,  $c$ , shall be determined as the difference between  $d_L$  and  $d_B$ . No test result shall exceed the values given in Table D.2 for the declared level.

**Table D.2 — Levels of compressibility**

Level	Imposed load on the screed kPa	Requirement mm	Tolerance mm
CP5	≤ 2	≤ 5	+2
CP4	≤ 3	≤ 4	
CP3	≤ 4	≤ 3	
CP2	≤ 5	≤ 2	+1

**NOTE** The levels of the imposed load on the screed is taken from ENV 1991-2-1, Eurocode 1 — Basis of design and actions on structures, Part 2-1: Actions on structures; densities, self-weight and imposed loads.

The levels CP3, CP4 and CP5 relate to the thickness tolerance class T1 and the level CP2 relates to the thickness tolerance class T2 (see D.2.7.1).

#### **D.2.7.4 Long term thickness reduction**

If the imposed load on the screed exceeds 5,0 kPa, only products having a declared level of compressibility CP2 may be used and their long term thickness reduction shall be determined.

The total thickness reduction,  $X_t = X_0 + X_{ct}$ , shall be determined after one hundred and twenty two days of testing at the imposed load plus the self-weight of the screed, in accordance with EN 1606 and extrapolated thirty times, corresponding to ten years. The ten years value shall not exceed the declared level of compressibility (see D.2.7.3).

#### **D.2.8 Dynamic stiffness**

Dynamic stiffness,  $s'$ , shall be determined in accordance with EN 29052-1 (without any preloading). The value of dynamic stiffness shall be declared in levels with steps of 1 MN/m<sup>3</sup>. No test result shall exceed the declared level. If the imposed load on the screed exceeds 5,0 kPa (see D.2.7.3), the dynamic stiffness shall be determined under the imposed load plus the self-weight of the screed.

#### **D.2.9 Point load**

Point load at 2 mm deformation shall be determined in accordance with EN 12430 and declared in levels with steps of 50 N. No test result shall be less than the declared level.

#### **D.2.10 Reaction to fire**

Reaction to fire classification (Euroclasses) shall be determined in accordance with EN 13501-1.

#### **D.2.11 Release of dangerous substances**

NOTE See Annex ZA.

### **D.3 Test methods**

#### **D.3.1 Sampling and conditioning**

Test specimens shall be taken from the same sample consisting in at least one full board. Unless otherwise specified, the test specimens shall be conditioned at  $(23 \pm 2)$  °C and  $(50 \pm 5)$  % relative humidity until stabilisation. Stabilisation is obtained when the relative change in weight does not exceed 0,5 % between two consecutive weekly measurements.

#### **D.3.2 Testing**

Dimensions of the test specimens, minimum number of measurements required to get one result and any specific conditions are given in Table D.3 for dynamic stiffness, compressibility and point load. For other properties given in D.2, specifications of Table 6 apply.



**Table D.3 — Test methods, test specimens and conditions**

Clause	Property	Test method	Test specimen length and width <sup>a</sup> mm	Minimum number of measurements to get one test result	Specific conditions
D.2.7	Thickness Compressibility	EN 12431	200 × 200	8	Measured 120 s minimum after the load has been removed
D.2.8	Dynamic stiffness	EN 29052-1	200 × 200	1	
D.2.9	Point load	EN 12430	300 × 300	3	
<sup>a</sup> Always full-size product thickness.					

## D.4 Designation code

A designation code for the composite insulation shall be given by the manufacturer. The following shall be included except when there is no requirement for a property:

— Designation code of each of the layers	see clause 6 and D.1
— Thickness tolerance (for floating floor)	Ti
— Compressibility	CPi
— Dynamic stiffness	SDi
— Point load	PL(2)i

where “i” shall be used to indicate the relevant class or level.

## D.5 Factory production control

Factory production control shall be made in accordance with Table D.4.

**Table D.4 — Minimum product testing frequencies**

Clause		Minimum testing frequency <sup>a</sup>		
		Direct testing	Indirect testing	
No	Title		Test method	Frequency
D.2.2	Length and width	1 per 4 h	—	—
D.2.3	Thickness	1 per 2 h	—	—
D.2.5	Dimensional stability at elevated temperature	ITT <sup>b</sup>	—	—
D.2.6	Tensile strength perpendicular to faces	1 per 8 h	—	—
D.2.7	Thickness, $d_L$	1 per 2 h	—	—
	Compressibility	1 per day <sup>c</sup>		
D.2.7.3	Long term thickness reduction	ITT <sup>b</sup>	—	—
D.2.8	Dynamic stiffness	1 per month and indirect	Manufacturer's method	1 per day
D.2.9	Point load	ITT <sup>b</sup>	—	—
D.2.10	Reaction to fire	See Table B.2		
D.2.11	Release of dangerous substances <sup>d</sup>	—	—	—

<sup>a</sup> The minimum testing frequencies shall be understood as the minimum for each production unit/line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.  
For mechanical properties, the testing frequencies given are independent of the change of product. In addition the manufacturer shall establish internal rules for process adjustments related to these properties when changing the product.

<sup>b</sup> ITT, see EN 13172.

<sup>c</sup> Unless data from the thermal insulation layer(s) are available.

<sup>d</sup> When drafting this standard, no European harmonized test method was available.

## D.6 Evaluation of conformity

Clause 7 applies.

## **D.7 Marking and labelling**

Products conforming with this European Standard shall be clearly marked, either on the product or on the label or on the packaging, with the following information:

- product name or other identifying characteristic;
- name or identifying mark and address of the manufacturer or his authorised representative
- year of manufacture (the last two digits);
- shift or time of production and manufacturing plant or traceability code;
- reaction to fire class;
- declared thermal resistance;
- nominal thickness;
- designation code as given in D.4;
- type of facing or coating, if any;
- nominal length, nominal width;
- number of pieces and area in the package, as appropriate.

NOTE For CE marking and labelling see ZA.3.

## Annex E (informative)

### Additional properties

#### E.1 General

The manufacturer may choose to give information on the following additional properties (see Table E.1). This information, where appropriate for the product and the application, should be given as limit values for each test result obtained from the referenced test method, sampling and conditioning, as given in Table E.1.

##### E.1.1 Apparent density

Apparent density is a useful identification parameter but it is not a basis for quality assessment.

The apparent density of EPB should be determined in accordance with EN 1602.

##### E.1.2 Mineral content

The mineral content of EPB should be determined according to the following procedure. Calculate the mineral content of the product, as a percentage by weight using the equation:

$$\text{mineral content} = 100 \times \frac{m}{m_0} \quad (\text{E.1})$$

where

$m_0$  is the initial mass of a specimen ( $50 \pm 5$ ) g with an accuracy better or equal to 0,1 g, after drying for 72 h at a temperature of  $(70 \pm 2)$  °C;

$m$  is the mass of the residue after combustion of the specimen for  $(30 \pm 1)$  min exposure at a temperature of  $(800 \pm 25)$  °C.

##### E.1.3 Behaviour under cyclic loading

Behaviour of EPB or composite insulation under cyclic loading should be determined in accordance with EN 13793, preferably under following conditions:

- the load should be chosen from 40 kPa to 250 kPa with steps of 30 kPa;
- the frequency of cycles should not exceed 1 Hz.

The maximum deformation corresponding to a given load and a given number of cycles should be agreed between parties.

NOTE For concentrated loads, partial loading of the specimens can be envisaged. Partial loading may be for example a load applied on a 100 mm × 100 mm area and centred at  $\pm 10$  mm on the test specimen having 300 mm × 300 mm dimensions.

### E.1.4 Resistance under load over non supported area

A suitable test method for determining the minimum thickness of board in relation to trough widths of metal decks may be agreed between parties. As a general rule, this consists of testing a full size board under a concentrated load (e.g. rectangle 300 mm × 70 mm), preferably not less than 1 200 N, applied either on the non supported edge, or in the middle of a free area with both edges supported.

### E.1.5 Sound absorption

The sound absorption coefficient should be determined according to EN ISO 354.

The sound absorption characteristics should be determined according to EN ISO 11654 with the values for practical sound absorption coefficients,  $\alpha_p$ , at the frequencies 125 Hz, 250 Hz, 500 Hz, 1 000 Hz, 2 000 Hz and 4 000 Hz, and the single number value for the weighted sound absorption coefficient,  $\alpha_w$ .

$\alpha_p$  and  $\alpha_w$  should be rounded to the nearest 0,05 ( $\alpha_p$  larger than 1 should be expressed as  $\alpha_p = 1$ ).

**Table E.1 — Test methods, test specimens, conditions and testing frequencies**

Dimensions in millimetres

Clause	Property	Test method	Test specimens		Conditions
			Size	Minimum number to get one test result	
E.1.1	Apparent density	EN 1602	300 × 300	3	—
E.1.2	Mineral content	—	—	3	Manufacturer method
E.1.3	Behaviour under cyclic loading	EN 13793	300 × 300	3	For partial loading: see note in E.1.3
E.1.4	Resistance under load over non supported area	See E.1.4	Full size	3	To be agreed
E.1.5	Sound absorption	EN ISO 354 EN ISO 11654	≥ 10 m <sup>2</sup>	1	To be reported

## E.2 Particular profiles

Boards may be supplied with particular profiles upon request. These may be double offset boards or tapered boards for example.

Specifications in dimensions and shape should be determined by agreement between parties.



## Annex ZA (informative)

### Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

#### ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/103<sup>2</sup> "Thermal insulation products" given to CEN by the European Commission and the European Free Trade Association.

The clauses of this document, shown in the Table below, meet the requirements of the Mandate M/103 given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the factory made products of expanded perlite covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

**WARNING — Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the factory made products of expanded perlite falling within the scope of this European Standard.**

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through [http://ec.europa.eu/enterprise/construction/internal/dangsub/dangmain\\_en.htm](http://ec.europa.eu/enterprise/construction/internal/dangsub/dangmain_en.htm)).

This Annex establishes the conditions for the CE marking of the construction products intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable:

This Annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.

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<sup>2</sup> As amended by mandates M126, M130 and M367

**Table ZA.1 — Relevant clauses for expanded perlite and intended use**

Construction products: <b>Factory made products of expanded perlite (EPB) as covered by the scope of this standard<sup>a</sup></b>			
Intended use: <b>Thermal insulation for buildings</b>			
<b>Requirements/Characteristics from the mandate</b>	<b>Requirements clauses in this document</b>	<b>Levels and/or classes</b>	<b>Notes<sup>b</sup></b>
Reaction to fire, Euroclass characteristics	4.2.8, D.2.10 <sup>c</sup> Reaction to fire	Euroclasses	—
Water permeability	4.3.6.1, D.2.1 <sup>c</sup> Water absorption by partial immersion	—	Levels
Release of dangerous substances to the indoor environment	4.3.11, D.2.11 <sup>c</sup> Release of dangerous substances	—	—
Impact noise transmission index (for floors)	D.2.7.1 <sup>c</sup> Thickness, $d_L$	—	Classes
	D.2.7.3 <sup>c</sup> Compressibility	—	Levels
	D.2.8 <sup>c</sup> Dynamic stiffness	—	Levels
Continuous glowing combustion	4.3.12 Continuous glowing combustion	—	—
Thermal resistance	4.2.1 Thermal resistance – thermal conductivity	—	Levels of $\lambda$
	D.2.4 <sup>c</sup> Thermal resistance	—	Levels
	D.2.3 <sup>c</sup> Thickness	—	Levels
Water vapour permeability	4.3.10, D.2.1 <sup>c</sup> Water vapour transmission	—	Level
Compressive strength	4.3.3, D.2.1 <sup>c</sup> Compressive stress or compressive strength	—	Levels
	4.3.4 Deformation under specified load and temperature	—	Levels
	4.3.8, D.2.9 <sup>c</sup> Point load	—	Levels
Tensile/Flexural strength	4.2.6 Bending strength <sup>c, d</sup>	—	Limit value
	4.3.5 Tensile strength perpendicular to faces	—	Limit value
	D.2.6 Tensile strength perpendicular to faces <sup>d</sup>	—	Level
Durability of reaction to fire against heat, weathering, ageing/degradation	— <sup>e</sup>	—	—
Durability of thermal resistance against heat, weathering, ageing/degradation	4.2.1 Thermal resistance – thermal conductivity	—	f
	D.2.4 <sup>c</sup> Thermal resistance	—	f
	4.2.7 Dimensional stability	—	Level <sup>g</sup>
	4.2.9. Durability characteristics	—	Classes
	4.3.2, D.2.1 <sup>c</sup> Dimensional stability under specified temperature and humidity conditions	—	Level <sup>g</sup>
	D.2.5 <sup>c</sup> Dimensional stability at elevated temperature	—	Level <sup>g</sup>
Durability of compressive strength against ageing/degradation	4.3.9 Compressive creep	—	Levels
	D.2.7.4 <sup>c</sup> Long term thickness reduction	—	Levels

- a It includes EPB and composite insulation boards as mentioned in this table.
- b The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level (thermal resistance (thermal conductivity and thickness)).
- c For composite insulation boards.
- d This characteristic also covers handling and installation.
- e No change in durability for reaction to fire properties for expanded perlite products.
- f Thermal conductivity of expanded perlite products does not change with time, experience has shown the fibre structure to be stable and the porosity contains no other gases than atmospheric air.
- g For thickness only.

## ZA.2 Procedures for attestation of conformity of factory made expanded perlite products

### ZA.2.1 Systems of attestation of conformity

For products having more than one of the intended uses specified in the following families, the tasks for the approved body, derived from the relevant systems of attestation of conformity, are cumulative.

The system of attestation of conformity for the factory made products of expanded perlite indicated in Table ZA.1 in accordance with the Decision of the European Commission 95/204/EC of 31.04.95 revised by decision 99/91/EC of 25.01.99 amended by the decision 01/596/EC of 8<sup>th</sup> January and as given in Annex III of the mandate M103 as amended by mandates M126, M130 and M367 is shown in Table ZA.2 for the indicated intended use(s).

**Table ZA.2 — Systems of attestation of conformity**

Product(s)	Intended use(s)	Level(s) or class(es) (reaction to fire)	Attestation of conformity system(s)
Thermal insulation products (Factory made products)	For uses subject to regulations on reaction to fire	(A1, A2, B, C) <sup>a</sup>	1
		(A1, A2, B, C) <sup>b</sup> , D, E	3
		(A1 to E) <sup>c</sup> , F	3 (with 4 for RtF)
	Any	—	3
System 1: See CPD Annex III.2.(i), without audit-testing of samples System 3: See CPD Annex III.2.(ii), Second possibility System 4: See CPD Annex III.2.(ii), Third possibility			
<sup>a</sup> Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material). <sup>b</sup> Products/materials not covered by footnote ( <sup>a</sup> ). <sup>c</sup> Products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of classes A1 according to Commission Decision 96/603/EC, as amended).			

The system of attestation of conformity for the CE marking of the product is defined in accordance with annex ZA (see ZA.2.1). For products of expanded perlite (EPB) the footnote <sup>a</sup> of Table ZA.2 applies except when it can be demonstrated to the notified body for a particular product that no stage in the production process will result in an improvement of the reaction to fire classification (see Table ZA.2, footnote <sup>b</sup>).

The attestation of conformity of the factory made products of expanded perlite in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Tables ZA.3 to ZA.4 resulting from application of the clauses of this or other European Standard indicated therein.

Where more than one Table applies for the product (i.e. because its intended use makes different characteristics relevant), Table ZA.3 has to be read in conjunction with subsequent tables in order to determine which characteristics assigned to the manufacturer in Table ZA.3 are type tested by a notified test lab (system 3) and which by the manufacturer (system 4).

**Table ZA.3 — Assignment of evaluation of conformity tasks for products under system 1**

<b>Tasks</b>		<b>Content of the task</b>	<b>Evaluation of conformity clauses to apply</b>
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all relevant characteristics of Table ZA.1	Clauses 1 to 5, Annexes B and C of EN 13172:2008  Clause 7 of this standard
	Further testing of samples taken at factory	All relevant characteristics of Table ZA.1	Annex B of this standard
	Initial type testing by the manufacturer	Those relevant characteristics of Table ZA.1 not tested by the notified body	Clause 6 of EN 13172:2008  Clause 7 of this standard
Tasks for the product certification body	Initial type testing	<ul style="list-style-type: none"> <li>— Reaction to fire</li> <li>— Thermal resistance</li> <li>— Release of dangerous substances<sup>a</sup></li> <li>— Compressive strength</li> <li>— Water Permeability</li> </ul>	Clause 6 of EN 13172:2008  Clause 7 of this standard
	Initial inspection of factory and of FPC	Parameters related to all relevant characteristics of Table ZA.1, in particular reaction to fire.	Annex B and C of EN 13172:2008  Clause 7 of this standard
	Continuous surveillance, assessment and approval of FPC	Parameters related to all relevant characteristics of Table ZA.1, in particular reaction to fire	Annex B and C of EN 13172:2008  Clause 7 of this standard
<sup>a</sup> When drafting this Standard, no European harmonized test method was available.			



**Table ZA.4 — Assignment of evaluation of conformity tasks for products under system 3 or system 3 combined with system 4 for reaction to fire**

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1 relevant for the intended use	Clause 7 of this standard and clauses 1 to 5 of EN 13172:2008 and: For system 3 Annex C of EN 13172:2008.  For system 3 (with 4 for RtF) Annex C and D of EN 13172:2008
	Initial type testing by the manufacturer	Those relevant characteristics of Table ZA.1 not tested by the notified test lab including reaction to fire for system 4	Clause 7 of this standard and Clause 6 of EN 13172:2008
	Initial type testing by a notified test laboratory	<ul style="list-style-type: none"> <li>— Reaction to fire (system 3)</li> <li>— Thermal resistance</li> <li>— Release of dangerous substances<sup>a</sup></li> <li>— Compressive strength (for load bearing applications)</li> <li>— Water Permeability</li> </ul>	Clause 7 of this standard and Clause 6 of EN 13172:2008
<sup>a</sup> When drafting this Standard, no European harmonized test method was available.			

## ZA.2.2 EC certificate and declaration of conformity

(In case of products under system 1): When compliance with the conditions of this Annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix the CE marking. The certificate shall include:

- name, address and identification number of the certification body;
- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- description of the product (type, identification, use, etc.);



- provisions to which the product conforms (e.g. Annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- the number of the certificate;
- conditions of validity of the certificate, where applicable;
- name of, and position held by, the person empowered to sign the certificate.

In addition, the manufacturer shall draw up and retain a declaration of conformity (EC Declaration of conformity) including the following:

- name and address of the manufacturer, or his authorised representative established in the EEA;
- name and address of the certification body;
- description of the product (type, identification, use, etc.), and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- provisions to which the product conforms (e.g. Annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- number of the accompanying EC Certificate of conformity;
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

*(In case of products under system 3 or (3 and 4)):* When compliance with the conditions of this Annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 3 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- description of the product (type, identification, use, etc.), and a copy of the information accompanying the CE marking;

NOTE 4 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- provisions to which the product conforms (e.g. Annex ZA of this EN),
- particular conditions applicable to the use of the product, (e.g. provisions for use under certain conditions, etc);
- name and address of the notified laboratory(ies);

- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The above mentioned declaration and certificate shall be presented in the language or languages accepted in the Member State in which the product is to be used.

The validity of the declaration/certificate shall be verified at least once a year.

### **ZA.3 CE Marking and labelling**

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking.

The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the product itself, or on the accompanying label or on the packaging. The following information shall accompany the CE marking symbol:

- identification number of the certification body (only for products under systems 1),
- name or identifying mark and registered address of the manufacturer (see Note 1 in ZA.2.2),
- the last two digits of the year in which the marking is affixed,
- number of the EC Certificate of conformity (if relevant),
- reference to this European Standard,
- description of the product: generic name, material, dimensions, etc and intended use,
- information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as:
  - standard designation(s) in combination with declared values as described in Clause 8.,
  - “No performance determined” for characteristics where this is relevant,

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figure ZA.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.

<div>CE</div> <div>01234</div>	<div>CE conformity marking, consisting of the “CE”-symbol given in Directive 93/68/EEC.</div> <div>Identification number of the certification body (for products under system 1)</div>
<div>Any Co Ltd, PO Box 21, B-1050</div> <div>08</div> <div>01234-CPD-00234</div>	<div>Name or identifying mark and registered address of the producer</div> <div>Last two digits of the year in which the marking was affixed</div> <div>Certificate number (for products under system 1)</div>
<div>EN 13169:2008</div> <div>EPB, intended to be used as thermal insulation product in buildings</div> <div>Reaction to fire – Class A1</div> <div>Thermal resistance 2,5 m<sup>2</sup>·K/W</div> <div>Thermal conductivity 0,040 W/m·K</div> <div>Thickness 100 mm</div> <div>EPB EN 13169 — BS — DS(H) — DS(T+/50) — CS(10\Y)200 — DLT(3)5 — TR — WS — WS(T)4 — BS(250)700 — PL(2)300 — CC(2,5/2/10)80 — MU5</div>	<div>No. of dated version of European Standard</div> <div>Description of product</div> <div>Information on regulated characteristics</div> <div>Reaction to fire – Euroclass</div> <div>Declared thermal resistance</div> <div>Declared thermal conductivity</div> <div>Nominal thickness</div> <div>Designation code (in accordance with clause 6 of this standard for the relevant characteristics according to Table ZA.1)</div>

Figure ZA.1 — Example CE marking information

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation

NOTE 1 European legislation without national derogations need not be mentioned.

NOTE 2 Affixing the CE marking symbol means, if a product is subject to more than one directive, that it complies with all applicable directives.

## **Bibliography**

- [1] EN 13733, Products and systems for the protection and repair of concrete structures — Tests methods —  
- Determination of the durability of structural bonding agents