

**Thermal insulation  
products for  
buildings —  
In-situ thermal  
insulation formed  
from exfoliated  
vermiculite (EV)  
products —**

**Part 1: Specification for bonded and  
loose-fill products before installation**

The European Standard EN 14317-1:2004 has the status of a  
British Standard

ICS 91.100.60

## National foreword

This British Standard is the official English language version of EN 14317-1:2004.

The UK participation in its preparation was entrusted by Technical Committee B/502, Aggregates, to Subcommittee B/502/5, Lightweight aggregates, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

### Cross-references

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Wärmedämmstoffe für Gebäude - An der Verwendungsstelle hergestellte Wärmedämmung mit Produkten aus expandiertem Vermiculite (EV) - Teil 1: Spezifikation für gebundene und Schüttdämmstoffe vor dem Einbau

This European Standard was approved by CEN on 10 June 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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## Foreword

This document (EN 14317-1:2004) 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of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

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 EU Directives.

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

This standard consists of two parts. The first part, which is the harmonised part satisfying the mandate, the CPD and is the basis for the CE marking, covers the products, which are placed on the market. The second part, which is the non-harmonised part, covers the specification for the installed products.

This European Standard is one of a series for mineral wool, expanded clay, expanded perlite, exfoliated vermiculite, polyurethane/polyisocyanurate, cellulose and urea formaldehyde in-situ formed insulation products used in buildings, but this standard may be used in other areas where appropriate.

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

## 1 Scope

This document specifies the requirements for the four types of exfoliated vermiculite products Vermiculite Aggregate (EVA), Coated Vermiculite (EVC), Hydrophobic Vermiculite (EVH) and Premixed Vermiculite (EVM), containing less than 1 % organic material as defined by Annex D for in-situ insulation of roofs, ceilings, walls and floors.

This document is a specification for the insulation products before installation.

This document describes the product characteristics and includes procedures for testing, evaluation of conformity, marking and labelling.

This document 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.

This document does not cover factory made insulation products of formed shapes and boards made with exfoliated vermiculite or in-situ products intended to be used for the insulation of building equipment and industrial installations.

This document does not specify performance requirements for airborne sound insulation and for acoustic absorption applications.

## 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 932-1, *Tests for general properties of aggregates — Part 1: Methods for sampling.*

EN 932-2, *Tests for general properties of aggregates — Part 2: Methods for reducing laboratory samples.*

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method.*

EN 1097-3, *Tests for mechanical and physical properties of aggregates — Part 3: Determination of loose bulk density and voids.*

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 13055-1, *Lightweight aggregates — Lightweight aggregates for concrete, mortar and grout.*

EN 13055-2, *Lightweight aggregates — Part 2: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications excluding concrete, mortar and grout.*

EN 13172:2001, *Thermal insulating products — Evaluation of conformity.*

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

### 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

##### **exfoliated vermiculite**

insulation material which results from expanding or exfoliating a natural micaceous mineral by heating

[prEN ISO 9229:1997]

##### 3.1.2

##### **vermiculite aggregate**

exfoliated vermiculite with no treatment or surface coating, used either as a loose insulation in the cavities of walls and roofs and loose placement on ceilings, or for site mixing to specified mix proportions with bonding materials when applied as a surface layer

##### 3.1.3

##### **coated vermiculite**

exfoliated vermiculite which has a coating

##### 3.1.4

##### **hydrophobic vermiculite**

exfoliated vermiculite which is treated to give specific hydrophobic properties and used where moisture or water repellency is required

##### 3.1.5

##### **premixed vermiculite**

exfoliated vermiculite premixed with binders, which will require the site addition of water or other material, to enable the insulation product to be bonded, both to itself and the surface of the roof, ceiling, wall or floor

##### 3.1.6

##### **settlement**

decrease of installed insulation thickness with time, expressed as a percentage of the initial installed thickness (after compaction if prescribed)

##### 3.1.7

##### **level**

given value which is the upper or lower limit of requirement, where the level is given by the declared value of the characteristic concerned

##### 3.1.8

##### **class**

combination of two levels of the same property between which the performance shall fall, where the level is given by the declared value of the characteristic concerned

##### 3.1.9

##### **internal direct measurements**

measurements carried out by the manufacturer using the method detailed for a requirement

##### 3.1.10

##### **internal indirect measurements**

measurements carried out by the manufacturer using the manufacturer's own test method

**3.1.11**

**external direct measurements**

measurements carried out by a third party using the method detailed for a requirement

**3.2 Symbols and abbreviations**

Symbols and units used in this document:

|                   |   |                     |
|-------------------|---|---------------------|
| $d_N$             | is the thickness of the product   | m                   |
| $K$               | is the factor related to number of test results                                   | —                   |
| $\lambda$         | is the thermal conductivity   | W/(m·K)             |
| $\lambda_D$       | is the declared thermal conductivity  | W/(m·K)             |
| $\lambda_i$       | is one test result of thermal conductivity  | W/(m·K)             |
| $\lambda_{90/90}$ | is the 90 % fractile with a confidence level of 90 % for the thermal conductivity | W/(m·K)             |
| $\lambda_{mean}$  | is the mean thermal conductivity  | W/(m·K)             |
| $\mu$             | 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 |
| $R_{90/90}$       | is the 90 % fractile with a confidence level of 90 % for 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)             |

|    |   |
|----|---|
| CR | is the symbol of the declared value for crushing resistance |
| LD | is the symbol of the declared value for loose bulk density  |
| PS | is the symbol of the declared particle size                 |
| WR | is the symbol for water repellency                          |

Abbreviated terms used in this document:

|     |  |
|-----|--|
| EVA | is vermiculite aggregate as defined in 3.1.2   |
| EVC | is coated vermiculite as defined in 3.1.3      |
| EVH | is hydrophobic vermiculite as defined in 3.1.4 |
| EVM | is premixed vermiculite as defined in 3.1.5    |
| ITT | is initial type testing                        |

**4 Requirements**

**4.1 General**

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

One test result for a product property is the average of the measured values on the number of test specimens given in Table 1.

**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.



The thermal conductivity shall be determined in accordance with Annex A 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;
- the declared thermal values shall be given as limit values representing at least 90 % of the production, determined with a confidence level of 90 %;
- the declared thermal resistance,  $R_D$ , shall be calculated from the thickness,  $d_N$ , and the corresponding declared thermal conductivity value,  $\lambda_D$ , where  $R_D = d_N/\lambda$  (see NOTE 3);
- 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 value of the declared thermal resistance,  $R_D$ , shall be rounded downwards to the nearest 0,05 m<sup>2</sup>·K/W, and declared in levels with steps of 0,05 m<sup>2</sup>·K/W;

An example of the determination of the declared value of thermal conductivity is given in the Annex F.

NOTE 1  $\lambda$  for exfoliated vermiculite is normally in the range 0,05 to 0,08 W/(m·K).

NOTE 2 A correlation between thermal conductivity and any other property specific to the manufacturer's product can be used for indirect testing.

NOTE 3 The declaration of the installed thermal resistance is described in prEN 14317-2.

#### 4.2.2 Loose bulk density

Loose bulk density shall be determined in accordance with EN 1097-3. However the container should be filled using a flat bottomed scoop held centrally over the container without touching it, and be no more than 50 mm above the rim. The value shall be expressed as kg/m<sup>3</sup> and declared by the manufacturer in steps of 1 kg/m<sup>3</sup>.

The loose bulk density shall be in the range of  $\pm 15$  % of the manufacturer's declared value.

NOTE Most exfoliated vermiculite products are in the range 50 kg/m<sup>3</sup> to 180 kg/m<sup>3</sup>.

#### 4.2.3 Particle size

##### 4.2.3.1 Particle size distribution

Particle size distribution shall be determined in accordance with EN 933-1 without washing and expressed as a percentage by mass, and shall be in accordance with the manufacturer's declared limits.

##### 4.2.3.2 Size designation

The particle size shall be designated by two sieve sizes between which the main proportion of the material lies and any undersize or oversize shall comply with 4.2.3.3 and 4.2.3.4.

The size in mm shall be selected from those specified in EN 13055-2.

NOTE The particle size will normally be in the range 0 mm to 32 mm.

##### 4.2.3.3 Undersize

The content of the undersize shall not exceed 15 % by mass.

#### **4.2.3.4 Oversize**

The content of oversize shall not exceed 10 % by mass.

#### **4.2.4 Reaction to fire**

This property is not measured since exfoliated vermiculite products described by this document are classified without testing as class A1 products.

NOTE 1 The products are classified without testing as class A1 products in accordance with commission decision 96/603/EC as amended by decision 2000/605/EC.

NOTE 2 Products with an organic content greater than 1 % are outside the scope of this standard.

#### **4.2.5 Durability characteristics**

##### **4.2.5.1 General**

The appropriate durability characteristics have been considered and are covered in 4.2.5.2, 4.2.5.3 and 4.2.5.4.

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

The fire performance of exfoliated vermiculite does not change with time (see 4.2.4).

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

The thermal conductivity (4.2.1) of the product does not change with time and neither does the insulation thickness since any settlement (4.3.5) is negligible.

##### **4.2.5.4 Durability of compression strength against ageing/degradation**

The compressive strength of exfoliated vermiculite does not change with time. Exfoliated vermiculite is a stable laminar structure.

#### **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 Water repellency**

The water repellence of EVH shall be determined in accordance with Annex E, and shall not be less than 175 ml.

##### **4.3.3 Crushing resistance**

In load bearing applications the crushing resistance shall be determined in accordance with EN 13055-1 and expressed in N/mm<sup>2</sup>.

NOTE Crushing resistance is a measure of the strength of the material but it does not necessarily relate directly to load bearing capacity.

#### 4.3.4 Water vapour transmission

This property is not measured because the open structure of the final product itself offers no resistance to the free movement of water vapour.

NOTE  $\mu$ , for exfoliated vermiculite may be assumed to be 3.

#### 4.3.5 Settlement

Settlement for exfoliated vermiculite is negligible and needs no measurement.

#### 4.3.6 Release of dangerous substances

NOTE See Annex ZA.

### 5 Test methods

#### 5.1 Sampling

Sampling shall be carried out according to EN 932-1 and EN 932-2 using a procedure which gives a representative sample and avoids sampling bias.

#### 5.2 Conditioning

No special conditioning of the sample shall be used unless otherwise specified in the test method standards. In case of dispute the test samples shall be conditioned to moisture equilibrium at  $(23 \pm 5) ^\circ\text{C}$  and  $(50 \pm 10) \%$  relative humidity after drying at  $(110 \pm 5) ^\circ\text{C}$ .

#### 5.3 Testing

##### 5.3.1 General

Table 1 indicates the test procedure, the minimum number of measurements required to get one test result and any specific conditions which are necessary.

**Table 1 — Test methods, measurements and conditions**

| Clause |                      | Test method         | Minimum number of measurements to get one test result | Specific conditions |
|--------|----------------------|---------------------|---|---------------------|
| No.    | Title                |                     |   |                     |
| 4.2.1  | Thermal conductivity | EN 12667            | 1   | See Annex C         |
| 4.2.2  | Loose bulk density   | EN 1097-3           | 3   | See 4.2.2           |
| 4.2.3  | Particle size        | EN 933-1            | 1   | See 4.2.3           |
| 4.2.4  | Reaction to fire     | EN 13820 and AnnexD | 1   | None                |
| 4.3.2  | Water repellency     | See Annex E         | 1   | None                |
| 4.3.3  | Crushing resistance  | EN 13055-1          | 1   | None                |

##### 5.3.2 Thermal conductivity

Thermal conductivity shall be determined in accordance with EN 12667, under the following conditions:

- at a mean temperature of  $(10 \pm 0,3) ^\circ\text{C}$ ;
- after preparation in accordance with the procedure given in Annex C;

- after conditioning in accordance with 5.2;
- the thickness of the test specimen shall be at least 10 times as thick as the mean aggregate size in the sample. Specimen thickness of 5 times the mean aggregate size is permitted if it can be shown that the required accuracy of testing is obtained.

NOTE Thermal conductivity may also be measured at temperatures other than 10 °C and then converted to a value at 10 °C, providing that the accuracy of the relationship between temperature and thermal conductivity is sufficiently well documented.

## 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:

- Product abbreviation
- This EN standard number
- Loose bulk density Ldi
- Particle size PS(x-y)
- Water repellency (of hydrophobic products) Wri
- Crushing resistance (in load bearing products) Cri

where “i” shall be used to indicate the relevant class or level, and (x-y) indicates the upper and lower sieve size.

The designation code for an exfoliated vermiculite product is illustrated by the following example:

EVA EN 14317-1 — LD90 - PS(3-11)

## 7 Evaluation of conformity

The manufacturer or their authorised representative shall be responsible for the conformity of the product with the requirements of this document. The evaluation of conformity shall be carried out in accordance with EN 13172 and shall be demonstrated by:

- initial type testing (ITT);
- factory production control by the manufacturer, and tests on samples taken at the factory.

For initial type tests, samples shall be taken from four different production dates and combined together to form one representative sample for testing.

If a manufacturer decides to group their 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.

NOTE 1 The system of attestation of conformity for the CE marking of the product is chosen in accordance with Annex ZA of this document.

The manufacturer or their authorised representative shall make available, in response to a request, a declaration of conformity.

NOTE 2 For the EC declaration of conformity, see ZA.2.2.

## 8 Marking and labelling

Products complying with this standard shall be clearly marked, either on the package or on the delivery note, with at least the following information:

- product name or other identifying characteristic;
- name or identifying mark and address of the manufacturer or their authorised representative;
- year of manufacture (last two digits);
- production date and manufacturing plant or traceability code;
- reaction to fire class A1;
- declared thermal conductivity;
- designation code as given in Clause 6;
- quantity of material (m<sup>3</sup>).

NOTE For CE marking and labelling see ZA.3.

## Annex A (normative)

### Determination of the declared values of thermal conductivity

#### A.1 Introduction

It is the responsibility of the manufacturer to determine the declared values of thermal conductivity, and to demonstrate conformity of the product to its declared values. The declared values of thermal conductivity 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

##### A.2.1

The manufacturer shall have at least ten test results for thermal conductivity, obtained from internal or external measurements in order to calculate the declared value.

##### A.2.2

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

##### A.2.3

If the manufacturer has established a correlation according to A.4 and the direct tests comply with the correlation, the direct test results may be supplemented by indirect test results from the same period. A weighting factor giving the direct test results ten times the value of the indirect test results shall be used as shown in Annex F.

##### A.2.4

For new products a minimum of three direct thermal conductivity test results shall be carried out spread over a minimum period of ten days. If these test results comply with an already established correlation, the direct test results may be supplemented by indirect test results from the same period.

The declared values shall be calculated according to the method given in A.3 and shall be recalculated at intervals not exceeding twelve months of production using at least one additional new direct result, and acceptable indirect test results. For the purpose of this declaration, thermal conductivity test results from different production units may be considered as one product group as defined in EN 13172, provided that the same raw material is used, and production conditions are similar.

#### A.3 Declared values

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.

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 and A.2.

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

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

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

| Number of test results | $K$  |
|------------------------|------|
| 3                      | 4,26 |
| 5                      | 2,74 |
| 7                      | 2,33 |
| 10                     | 2,07 |
| 15                     | 1,87 |
| 20                     | 1,77 |
| 50                     | 1,56 |
| 100                    | 1,47 |
| 300                    | 1,39 |
| 500                    | 1,36 |
| 2 000                  | 1,32 |
| $\infty$               | 1,28 |

NOTE Linear interpolation is acceptable.

#### A.4 Acceptable indirect test results of thermal conductivity

Indirect test results can be accepted if the manufacturer can demonstrate a correlation between the direct measured  $\lambda$ , and one or more other properties, where the following conditions shall all be fulfilled:

- The correlation shall be based on test results from a period within which the product and the production conditions are within their specific parameters.
- The correlation shall be based on testing a minimum of ten samples.
- The correlation shall be established by regression analysis with a regression coefficient better than 0,9.
- The correlation shall be updated at least once a year by adding at least one new set of test results.
- If the raw material or expansion system change outside their specific parameters a new correlation shall be established.

## Annex B (normative)

### Factory production control

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

| Clause |                               | Minimum testing frequency <sup>a</sup> |                       |            |
|--------|-------------------------------|--|-----------------------|------------|
| No.    | Title                         | Direct testing                         | Indirect testing      |            |
|        |                               |  | Test method           | Frequency  |
| 4.2.1  | Thermal conductivity          | 1 per year                             | Manufacturer's method | 1 per week |
| 4.2.2  | Loose bulk density            | 1 per month                            | Manufacturer's method | 1 per day  |
| 4.2.3  | Particle size                 | 1 per month                            | —                     | —          |
| 4.3.2  | Water repellency <sup>b</sup> | 1 per month                            | —                     | —          |
| 4.3.6  | Dangerous substances          | <sup>c</sup>                           | —                     | —          |

<sup>a</sup> The minimum testing frequencies, shall be understood as the minimum for each production unit. 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.

<sup>b</sup> Hydrophobic materials only.

<sup>c</sup> Frequencies are not given, as test methods are not yet available (see Annex ZA).



## Annex C (normative)

### Preparation of the test specimens to measure thermal conductivity

#### C.1 General

The general conditions of EN 12667 shall be complied with, but in addition the following requirements shall be taken into account when conditioning and preparing specimens for thermal conductivity testing.

#### C.2 Products EVA, EVC and EVH used as loose fill insulation

Dry the specimen at  $(110 \pm 5) ^\circ\text{C}$  and then condition at  $(23 \pm 5) ^\circ\text{C}$  and  $(50 \pm 10) \% \text{RH}$ . Repeat until constant weight is obtained.

Transfer the specimen to the apparatus and commence the test without undue delay to avoid moisture uptake.

Test the specimen without compaction of the loose-fill material and do not vibrate, pack or tamp the material.

It is normal for the thermal conductivity test on exfoliated vermiculite to take several days to reach equilibrium. Treat with caution any apparent stability after only a few hours.

State in the test report details of conditioning, the time taken to reach equilibrium, and the density of the material in place in the apparatus.

#### C.3 Product EVM used as bonded insulation, also products EVA and EVC when used as site mixed bonded insulation

Refer to the manufacturer's instructions during the preparation stage and produce a specimen for testing which resembles the insulation product as installed in the building.

Prepare a specimen of the mixed insulation product in accordance with the manufacturer's instructions of a suitable size for the thermal conductivity test apparatus.

Dry the prepared specimen at a temperature appropriate to the coating or binder prior to conditioning in an atmosphere of  $(23 \pm 5) ^\circ\text{C}$  and  $(50 \pm 10) \% \text{RH}$ . Repeat until constant weight is obtained before carrying out the thermal conductivity test.

Transfer the specimen to the apparatus and commence the test without undue delay to avoid moisture uptake.

State in the test report details of conditioning, the time taken to reach equilibrium, and the density of the material in place in the apparatus.

## Annex D (normative)

### Special conditions to be used for the determination of organic content

#### D.1 Principle

This annex details the modifications required to enable the principles of EN 13820 to be used for testing the organic content of the thermal insulating product types EVC, EVH and EVM which contain exfoliated vermiculite. This contains water of hydration, and is therefore presently excluded from the scope of EN 13820.

The procedure given in EN 13820 is used, but a blank determination on a specimen of EVA which contains no added organic matter is run in parallel with the normal test specimen.

#### D.2 Apparatus

The apparatus as specified in EN 13820 shall be used with the exception of the aluminium tray given as an example of a test specimen container. This is not suitable and a stainless steel or silica tray should be used instead.

#### D.3 Procedure

The procedure as detailed in EN 13820 shall be followed, with the additional requirement of running a parallel blank determination using a specimen of EVA. This blank specimen should be taken from the same batch / lot of exfoliated vermiculite prior to the addition of any additives or coatings.

The blank determination will give the water of hydration of the exfoliated vermiculite and this can be deducted from the total weight loss of the test specimen.

#### D.4 Calculation and expression of results

As shown in EN 13820, the apparent  $M_{OC}$ , is calculated for both the test specimen ( $M_{OCT}$ ) and the blank specimen ( $M_{OCB}$ ). The organic content is then calculated as follows :

$$M_{OC} = M_{OCT} - M_{OCB}$$

where

$M_{OC}$  is the organic content of the test sample ;

$M_{OCT}$  is the organic content in the presence of water of hydration ;

$M_{OCB}$  is the water of hydration.

#### D.5 Test report

In addition to the requirements laid down in EN 13820, the test report shall also include the results of the blank determination ( $M_{OCB}$ ).

## Annex E (normative)

### Determination of the water repellency of exfoliated vermiculite

#### E.1 Principle

This method covers the preparation of the specimen and determines the water repellence by applying a fixed amount of water to it and then determining the amount of water repelled by the specimen.

#### E.2 Apparatus

##### E.2.1

Rigid transparent plastic tube 50 mm internal diameter and 300 mm long with a 150 micrometre mesh firmly fastened to the bottom end. The tube shall be calibrated and marked at the 400 ml level.

##### E.2.2

250 ml graduated cylinder.

##### E.2.3

500 ml beaker.

##### E.2.4

Large rubber stopper.

#### E.3 Specimen preparation

Fill the tube in small increments, to a level slightly above the 400 ml level with the vermiculite product. Compact it in the tube, by dropping it from a height of approximately 75 mm onto a large rubber stopper, for a total of ten drops. As the specimen compacts to a level below the 400 ml mark add additional product so that after the tenth drop the level of the specimen reaches the 400 ml mark.

#### E.4 Procedure

Support the plastic tube in a vertical position with the mesh at the bottom and position the beaker under it. Pour 250 ml of cold tap water rapidly onto the product. Take care to pour the water onto the centre of the bed of vermiculite, ensuring that water does not merely run down the sides of the tube. Allow to drain for 3 minutes. Tilt the tube momentarily at approximately 45° to drain any water collected on the screen. Measure the amount of water collected. Using fresh product, repeat the test and obtain three values.

#### E.5 Expression of results

Obtain the mean volume of water collected from the three tests in millilitres.

## E.6 Test report

The test report shall include the following:

- a) the identity of the exfoliated vermiculite product;
- b) the number and date of this document;
- c) the mean volume of water collected and the three independent results in millilitres;
- d) the date of the test.

## Annex F (informative)

### Example of the determination of the declared value of thermal conductivity for a product or product group

It is assumed that three direct test results of the thermal conductivity are available for a product group obtained by direct measurements in accordance with 5.3.2, A.2.2 and Table B.1. Therefore these test results are supplemented by the number of available indirect test results (15) according to A.2.3, as exemplified in Table F.1:

**Table F.1 —  $\lambda$  test results**

| Test result number | Type of test result | $\lambda$<br>W/(m·K) | weighting factor | weighted $\lambda$ |
|--------------------|---------------------|----------------------|------------------|--------------------|
| 1                  | direct              | 0,063 4              | 10               | 0,634 0            |
| 2                  | direct              | 0,069 6              | 10               | 0,696 0            |
| 3                  | direct              | 0,064 7              | 10               | 0,647 0            |
| 4                  | indirect            | 0,067 1              | 1                | 0,067 1            |
| 5                  | indirect            | 0,065 4              | 1                | 0,065 4            |
| 6                  | indirect            | 0,063 9              | 1                | 0,063 9            |
| 7                  | indirect            | 0,063 8              | 1                | 0,063 8            |
| 8                  | indirect            | 0,064 5              | 1                | 0,064 5            |
| 9                  | indirect            | 0,065 2              | 1                | 0,065 2            |
| 10                 | indirect            | 0,067 1              | 1                | 0,067 1            |
| 11                 | indirect            | 0,065 1              | 1                | 0,065 1            |
| 12                 | indirect            | 0,063 8              | 1                | 0,063 8            |
| 13                 | indirect            | 0,068 8              | 1                | 0,068 8            |
| 14                 | indirect            | 0,069 7              | 1                | 0,069 7            |
| 15                 | indirect            | 0,064 6              | 1                | 0,064 6            |
|                    |                     | sum =                | 42               | 2,776 0            |
|                    |                     |                      | average =        | 0,065 86           |

Each of the indirect test results is derived from the correlation based on results of loose bulk density and particle size.

The mean thermal conductivity is the arithmetical average of the forty-two weighted test results,  $\lambda_{\text{mean}} = 0,065\ 86\ \text{W}/(\text{m}\cdot\text{K})$

## EN 14317-1:2004 (E)

The estimate of the standard deviation of the thermal conductivity,  $s_{\lambda}$ , is determined using equation A.2 of Annex A:

$$s_{\lambda} = \sqrt{\frac{\sum_{i=1}^{15} (\lambda_i - 0,06586)^2}{15 - 1}} = 0,002152$$

The calculated thermal conductivity,  $\lambda_{90/90}$ , is determined using the equation A.1 of Annex A, where the factor  $k = 1,87$  corresponding to the 15 test results:

$$\lambda_{90/90} = 0,06586 + 1,87 \cdot 0,002152 = 0,0699 \text{ W/(m}\cdot\text{K)}$$

After rounding upwards to the nearest 0,001 W/(m·K) following the rounding rules in 4.2.1, the resulting thermal conductivity is 0,070 W/(m·K) using the step 0,001 W/(m·K); (a higher value may be declared).

## Annex ZA (informative)

### Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

#### ZA.1 Scope and relevant characteristics

This European Standard has been prepared under a mandate M103 “Thermal insulation products” given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard, shown in this annex, meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction product covered by this European Standard 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 exfoliated vermiculite products falling within the scope of this European Standard.

NOTE: 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. An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (CREATE, assessed through <http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm>).

This annex establishes the conditions for the CE marking of the exfoliated vermiculite intended for the uses indicated in Table(s) ZA.1 and shows the relevant clauses applicable:

The scope of this annex is defined by Table ZA.1.

Table ZA.1 — Relevant clauses

|   |  |                       |                     |
|---|--|-----------------------|---------------------|
| Construction Products:  | <b>In-situ thermal insulation formed from exfoliated vermiculite products as covered by the scope of this standard</b> |                       |                     |
| Intended uses:  | <b>Thermal insulation of roofs, ceilings, walls and floors of buildings</b>  |                       |                     |
| Requirement/Characteristic from the mandate                   | Requirement clauses in this European Standard  | Levels and/or classes | Notes <sup>a</sup>  |
| Reaction to fire<br>Euroclass characteristics                 | 4.2.4 Reaction to fire   | Euroclasses           | -                   |
| Water permeability  | 4.3.2 Water repellency   | -                     | Limit value         |
| Release of dangerous substances to the indoor environment     | 4.3.6 Release of dangerous substances  | -                     | -                   |
| Thermal resistance  | 4.2.1 Thermal conductivity and thermal resistance  | -                     | Levels of $\lambda$ |
|   | 4.2.2 Loose bulk density   | -                     | Classes             |
|   | 4.2.3 Particle size  | -                     | Classes             |
| Water vapour transmission                                     | 4.3.4 Water vapour transmission  | -                     | -                   |
| Compressive strength  | 4.3.3 Crushing resistance  | -                     | -                   |
| Durability of reaction to fire against ageing/degradation     | 4.2.5 Durability characteristics   | -                     | -                   |
| Durability of thermal resistance against ageing/degradation   | 4.2.5 Durability characteristics   | -                     | Levels              |
| Durability of compressive strength against ageing/degradation | 4.2.5 Durability characteristics   | -                     | -                   |

<sup>a</sup> 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, manufacturer's 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.



## ZA.2 Procedures for attestation of conformity of loose fill exfoliated vermiculite 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 exfoliated vermiculite products intended to be formed in-situ, indicated in Table ZA.1 in accordance with the decision of the European Commission 95/204/EC of 30.04.95 revised by decision 99/91/EC of 25.01.99 and by the Commission Decision 2001/596/EEC as given in Annex III of the mandate M103 as amended by mandates M126 and M130 is shown in Table ZA.2 for the indicated intended use(s).

**Table ZA.2 — System(s) 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<br>(Products intended to be formed in-situ)  | For uses subject to regulations on reaction to fire | (A1 to E) <sup>1)</sup> , F              | Reaction to fire 4<br>Other characteristics 3 |
|  | Any other use                                       | -  | 3   |
| System 3: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility.<br>System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility.      |   |  |   |
| 1) Products/materials that do not require to be tested for reaction to fire e.g. (Products/materials of classes A1 according to the Decision 96/603/EC, as amended). |   |  |   |

The attestation of conformity of the In-situ thermal insulation formed from exfoliated vermiculite products in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Table(s) ZA.2.1 to ZA.2.2 resulting from application of the clauses of this or other European Standard indicated therein.

**Table ZA.2.1 — Assignment of evaluation of conformity tasks for products under system 3**

| Tasks                       |                                    | Content of the task   | Evaluation of conformity clauses to apply                             |
|-----------------------------|------------------------------------|---|---|
| Tasks for the manufacturer  | Factory production control (F.P.C) | Parameters related to all relevant characteristics of Table ZA.1  | Clause 7 and Annex B, and Clauses 1 to 5 and Annex C of EN 13172:2001 |
|                             | Initial type testing               | - Water permeability (hydrophobic products only)  | Clause 6 of EN 13172:2001   |
| Tasks for the notified body | Initial type testing               | - Thermal resistance<br>- Release of dangerous substances<br>- Compressive strength (for load bearing applications) | Clause 6 of EN 13172:2001   |

Table ZA.2.2 — Assignment of evaluation of conformity tasks for products under system 4

| Tasks                      |                                    | Content of the task  | Evaluation of conformity clauses to apply                             |
|----------------------------|------------------------------------|--|---|
| Tasks for the manufacturer | Factory production control (F.P.C) | Parameters related to all relevant characteristics of Table ZA.1 | Clause 7 and Annex B, and Clauses 1 to 5 and Annex D of EN 13172:2001 |
|                            | Initial type testing               | All relevant characteristics of Table ZA.1.                      | Clause 6 of EN 13172:2001   |

### ZA.2.2 EC declaration of conformity

When compliance with the conditions of this annex is achieved, the manufacturer or their 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 their authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (i.e. 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 their authorised representative.

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

### ZA.3 CE Marking and labelling

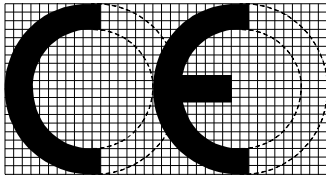
The manufacturer or their authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the product itself, on the accompanying label or on the packaging. The following information shall accompany the CE marking symbol:

- name or identifying mark and registered address of the producer;
- the last two digits of the year in which the marking is affixed;
- reference to this European Standard;
- description of the product, e.g. generic name;
- information on those relevant essential characteristics listed in Table ZA.1 which are to be declared 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.

CE marking for exfoliated vermiculite products shall be accompanied by the information shown below:

|   |  |
|---|--|
|    | <p><i>CE conformity marking, consisting of the “CE” symbol given in directive 93/68/EEC.</i></p>   |
| <p><b>AnyCo Ltd, PO Box 21, B-1050</b></p>  | <p><i>Name or identifying mark and registered address of the producer</i></p>  |
| <p><b>04</b></p>  | <p><i>Last two digits of the year in which the marking was affixed</i></p>   |
| <p><b>EN 14317-1</b></p> <p>Exfoliated vermiculite</p> <p>Reaction to fire – Class A1</p> <p>Thermal conductivity 0,070 W/(m·K)</p> <p>EVA EN 14317-1 — LD90 - PS(3-11)</p> | <p><i>No. of European Standard</i></p> <p><i>Description of product</i></p> <p><i>and</i></p> <p><i>information on regulated characteristics</i></p> <p><i>Designation code (in accordance with clause 6 for the relevant characteristics according to Table ZA.1)</i></p> |

**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 European legislation without national derogations need not be mentioned.

## Bibliography

prEN 14317-2, *Thermal insulating products for buildings — In-situ thermal insulation formed from exfoliated vermiculite (EV) products — Part 2: Specification for the installed products.*

prEN ISO 9229:1997, *Thermal insulation — Definitions of terms (ISO/DIS 9229:1997).*



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