



# SLOVENSKI STANDARD

oSIST prEN 15732:2008

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## Toplotnoizolacijski in lahki polnilni proizvodi za inženirske objekte - Proizvodi iz ekspaniranega glinenega agregatnega proizvoda (LWA)

Light weight fill and thermal insulation products for civil engineering applications (CEA) - Expanded clay lightweight aggregate products (LWA)

Leichte Schütt- und Wärmedämmstoffe für bautechnische Anwendungen (CEA) - Produkte aus Blähton-Leichtzuschlagstoffen (LWA)

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English Version

Light weight fill and thermal insulation products for civil  
engineering applications (CEA) - Expanded clay lightweight  
aggregate products (LWA)

Leichte Schütt- und Wärmedämmstoffe für bautechnische  
Anwendungen (CEA) - Produkte aus Blähton-  
Leichtzuschlagstoffen (LWA)

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 88.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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## Foreword

This document (prEN 15732:2007) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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 Directive(s). This document has been progressed to CEN Enquiry even though a confirmation from the Commission that it can be considered as a candidate harmonized standard is outstanding. An answer is being expected before the formal vote procedure. An amendment to the answer to mandate M/103 is finalized.

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

## 1 Scope

This standard describes the product characteristics and includes procedures for testing, marking and labelling.

This European Standard specifies the requirements for loose-fill expanded clay lightweight aggregate (expanded clay LWA) products for Civil Engineering Applications excluding the use as thermal insulation in and under buildings which are covered by European Standard EN 14063-1. The standard covers the use of expanded clay LWA as lightweight fill and insulation materials in embankments for roads, railways and other trafficked areas and as lightweight backfill for structures.

<http://www.sist.org.uk/standards/standards.html>

This 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.

## 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, *Test for general properties of aggregates - Part 1: Methods for sampling*

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

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

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

EN 1097-5, *Test for mechanical and physical properties of aggregates - Part 5: Determination of water content by drying in a ventilated oven*

EN 1097-6, *Test for mechanical and physical properties of aggregates - Part 6: Determination of particle density and water absorption*

EN ISO 10456, *Thermal insulation building materials and products – Determination of declared and design values (ISO 10456:1999)*

EN 12524, *Building materials and products – Hygrothermal properties – Tabulated design values*

EN 13055-1, *Lightweight aggregates – Part 1: 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.*

EN 13172, *Thermal Insulation products - Evaluation of conformity*

EN 13286-4, *Unbound and hydraulically bound mixtures - Part 4: Test methods for laboratory reference density and water content - Vibrating hammer.*

EN 13286-5, *Unbound and hydraulically bound mixtures - Part 5: Test methods for laboratory reference density and water content - Vibrating table.*

EN 13286-7, *Unbound and hydraulically bound mixtures - Part 7: Cyclic load triaxial test for unbound mixtures*

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

EN 13820, *Thermal insulation materials for building applications - Determination of organic content*

EN 14063-1, *Thermal insulation materials and products – In-situ formed expanded clay lightweight aggregate products (LWA) – Part 1: Specification for the loose-fill products before installation*

prEN ISO 9229, *Thermal insulation – Definitions of terms (ISO/DIS 9229:2005)*

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

#### 3.1 Terms and definitions

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For the purposes of this document, the following terms and definitions apply. Other terms used for insulation products are given in prEN ISO 9229.

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##### 3.1.1

#### expanded clay lightweight aggregate

Insulation material or product composed of lightweight granular material having a cellular structure formed by expanding clay minerals by heat.

##### 3.1.2

#### compressibility

Deformation at a certain load of a vibrated specimen, given as a load-deformation curve

##### 3.1.3

#### compressive strength, CS(10)

The load where the deformation of a vibrated specimen is 10%

##### 3.1.4

#### stiffness modulus

The stiffness modulus is given as the tangent to the load-deformation curve and shall be related to the level of deformation.

##### 3.1.5

#### compressive creep (CC)

Compressive creep is the deformation at a constant load in a specified time.

### 3.1.6 compaction

Mechanical compression (e.g. by vibrator) of the installed insulation layer, expressed as a percentage of the initial untreated layer thickness.

### 3.1.7 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.

### 3.1.8 class

Combination of two levels of the same property, between which the performance shall fall, where the levels are given by the declared value of the characteristic concerned.

## 3.2 Symbols, units and abbreviated terms

Symbols and units used in this standard:

- LD is the symbol of the declared level for loose bulk density
- PS is the symbol of the declared level for aggregate size (mm)
- CS(10) is the symbol of the declared level for compressive strength at 10 % deformation
- CC is the symbol of the declared level for compressive creep

Abbreviated terms used in this standard:

- LWA is Lightweight Aggregate [oSIST prEN 15732:2008](https://standards.iteh.ai/catalog/standards/sist/067456d7-c6b8-4512-bac1-c799f8a81f4a/osist-pren-15732-2008)
- ITT is Initial Type Test
- CEA is Civil Engineering Applications

## 4 Requirements

### 4.1 General

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

Sampling of expanded clay LWA shall be performed according to EN 932-1 and splitting of samples according to EN 932-2.

One test result on 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 Loose bulk density

Loose bulk density shall be declared and determined in accordance with EN 1097-3. The dry loose bulk density shall be declared by the manufacturer with steps of 5 kg/m<sup>3</sup> up to a density of 400 kg/m<sup>3</sup> and thereafter with steps of 10 kg/m<sup>3</sup>. It shall be in the range of ±15% of the manufacturers declared value with a maximum of ± 100 kg/m<sup>3</sup>. The value shall be expressed in kg/m<sup>3</sup>.

NOTE The value of the density used for design purposes will be influenced by compaction and water content

## 4.2.2 Particle size distribution

### 4.2.2.1 General

Particle size distribution shall be measured in accordance with EN 933-1, without washing, and shall be declared in % by mass.

### 4.2.2.2 Aggregate size

The pair of sieve sizes between which the main proportion of the particles lies shall designate the size and any undersize or oversize shall comply with clauses 4.2.2.3 and 4.2.2.4.

The sieve sizes in mm shall be selected from the specifications in EN 13055-2.

NOTE Normally the aggregate size for expanded clay LWA products will be in the range 0 mm - 32 mm.

### 4.2.2.3 Undersize

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

### 4.2.2.4 Oversize

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

## 4.2.3 Reaction to fire

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

NOTE Expanded clay LWA described in clause 3.1.1 of the standard is classified, without testing, as a class A1 product in accordance with Commission Decision 96/603/EC as amended by decision 2000/605/EC as it is demonstrated that the product has an organic content less than 1%, determined by EN 13820.

## 4.2.4 Durability characteristics

### 4.2.4.1 General

The appropriate durability characteristics have been considered and are covered in 4.2.4.2 to 4.2.4.6.

Note: The product is a clay mineral product burnt to clinkers in a stable structure.

### 4.2.4.2 Durability of reaction to fire against ageing/degradation

The reaction to fire performance of expanded clay LWA does not change with time.

### 4.2.4.3 Durability of thermal resistance against ageing/degradation

The thermal conductivity (4.3.3) of the product does not change with time.

### 4.2.4.4 Durability of compressive strength against ageing/degradation

The compressive strength of expanded clay does not change with time.

### 4.2.4.5 Durability of resistance to dynamic loads against ageing/degradation

The resistance to dynamic loads does not change with time.

### 4.2.4.6 Durability against chemicals and biological attack

The expanded clay LWA is a ceramic material and is durable against chemicals and biological attack.



### 4.3 For specific applications

#### 4.3.1 General

If there is no requirement for a property, described in 4.3.2 – 4.3.16, for a product in use, then the property need not to be determined and declared by the manufacturer.

#### 4.3.2 Thermal resistance and thermal conductivity

The thermal conductivity and thermal resistance shall be determined in accordance with EN 14063-1.

For light weight fill applications without thermal insulation requirements it is permitted to declare tabulated thermal values in accordance with annex E.

#### 4.3.3 Specific heat capacity

A typical value of 1000 J/kgK can be used for the specific heat capacity of expanded clay LWA, in accordance with EN 12524.

#### 4.3.4 Particle density

The particle density of the grains shall be determined in accordance with EN 1097-6, Annex C. It shall be in the range of  $\pm 15\%$  with a maximum of  $\pm 150 \text{ kg/m}^3$  of the declared value.

#### 4.3.5 Water content

The water content shall be determined in accordance with EN 1097-5.

#### 4.3.6 Water absorption

The water absorption shall be determined in accordance with EN 1097-6, Annex C. Water absorption test should be performed also with an immersion time of 28 days.

#### 4.3.7 Compressibility and compressive strength

The compressibility, in terms of load-deformation curve, stiffness modulus, and the compressive strength CS(10) shall be determined in accordance with EN 13055-2, Annex A. The stiffness modulus shall be given as the tangent to the load-deformation curve and related to the level of deformation.

NOTE The compressive strength at 10% deformation is not a design value, it is used as a reference value for material characterisation only. For characterisation of material properties the stiffness modulus and the load at a deformation level at maximum 2% is more relevant.

#### 4.3.8 Compressive creep

The compressive creep, in terms of deformation in % of the height of a vibrated sample, shall be determined in accordance with Annex C. The load shall be applied in load steps corresponding to stress levels of 50kPa from 50 kPa and upwards.

#### 4.3.9 Shear strength – static loading

The shear strength properties shall be determined in accordance with Annex A. The method using the pressure cell, annex A6, shall be used as reference test method.

#### 4.3.10 Cyclic compression

The cyclic compression shall be determined in accordance with Annex B. The cyclic load shall be applied in load steps corresponding to stress levels of 50kPa from 50 kPa and upwards. The results shall be given as deformation in % related to the stress level.

#### 4.3.11 Shear strength – cyclic loading

The resilient modulus (elastic stiffness) and resistance to permanent deformations shall be determined by cyclic triaxial tests. Cyclic triaxial testing shall be performed in accordance with EN 13286-7. The multistage loading procedure (low stress level) shall be followed.

NOTE The development of permanent deformations is highly dependent on the stress history. This should be taken into consideration when the results from the test are used.

#### 4.3.12 Water permeability

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

NOTE Based on experience; the typical graded expanded clay LWA has a measured permeability greater than  $10^{-3}$  m/s.

#### 4.3.13 Water vapour transmission

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

Note According to EN 12524 a typical water vapour diffusion resistance factor is 2.

#### 4.3.14 Chemical content

The chemical content of the expanded clay LWA shall be determined in accordance with EN 13055-2.

#### 4.3.15 Freezing and thawing resistance

The freezing and thawing resistance of expanded clay LWA shall be determined in accordance with EN 13055-2 Annex B.

#### 4.3.16 Release of dangerous substances

NOTE See Annex ZA.1.

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### 4.4 Other requirements

#### 4.4.1 Crushing resistance

The crushing resistance shall be measured in accordance with EN 13055-1 Annex A. Each vibration time shall be 30 seconds and the result shall be expressed in  $N/mm^2$ , and in levels with steps of  $0,05 N/mm^2$  up to  $1,0 N/mm^2$  and thereafter with steps of  $0,1 N/mm^2$ .

NOTE The crushing resistance is not a design value, it is used for quality documentation and factory production control only.

## 5 Test methods

### 5.1 Sampling

Sampling shall be carried out according to the procedures given in EN 932-1.

### 5.2 Conditioning

If not otherwise prescribed in the test method, the test specimens shall be dried to constant mass at  $(110 \pm 5) ^\circ C$  according to EN 1097-5.

## 5.3 Testing

### 5.3.1 General

Table 1 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 conductivity

Thermal conductivity shall be determined in accordance with EN 14063-1.

**Table 1 —Test methods, test specimens and specific conditions**

Clause				
No.	Title	Test method	Minimum number of test specimens to get one test result	Specific conditions
4.2.1	Loose bulk density	EN 1097-3	3	
4.2.2	Particle size distribution	EN-933-1	1	
4.2.3	Reaction to fire (organic content)	EN 13820	See Annex ZA, reaction to fire class A1 without testing	
4.3.2	Thermal conductivity	In accordance with 14063-1		
4.3.4	Particle density	EN 1097-6, Annex C	2	
4.3.5	Water content	EN 1097-5	3	Not applicable for ITT
4.3.6	Water absorption	EN 1097-6, Annex C	2	
4.3.7	Compressibility and compressive strength	Compressibility and compressive strength (EN13055-2, Annex A)	3	
4.3.8	Compressive creep	Annex C	3	
4.3.9	Shear strength –static loading	Annex A	4	
4.3.10	Cyclic compression	Annex B	2	
4.3.11	Shear strength –cyclic loading	EN 13286-7	3	
4.3.14	Chemical content	EN 13055-2	1	
4.3.15	Freezing and thawing resistance	EN 13055-2, Annex B	3	
4.4.1	Crushing resistance	EN 13055-1, Annex A	3	

## 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:

	Abbreviated term
– Expanded clay LWA	Exp. clay LWA
– This EN standard number	prEN 15732
– Loose bulk density	LD “i”
– Particle size	PS “i”

The designation code according to this standard for an expanded clay lightweight aggregate product is illustrated by the following example:

**Exp. clay LWA prEN 15732 – LD250 – PS(8-20)**

## 7 Evaluation of conformity

The manufacturer or the authorised representative established in the EEA shall be responsible for the conformity of his product with the requirements of this document. 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 of samples taken from the factory.

ITT shall be carried out in accordance with EN 13172 for all characteristics declared, as listed in Table 1.

FPC shall be made for the characteristics listed in Annex D.

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 D, Table D.1. When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172.

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

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

## 8 Marking and labelling

Products conforming with this standard shall be clearly marked on the label on the packaging or on an accompanying document, with the following information:

- product name or other identifying characteristic;
- name or identifying mark and address of the manufacturer or his authorised representative;
- date of delivery, manufacturing plant and/or traceability code;
- reaction to fire class
- designation code as given in clause 6;
- quantity of material, in m<sup>3</sup>.

NOTE For CE marking and labelling see Annex ZA.3.

## Annex A (normative)

### Test for mechanical and physical properties of expanded clay LWA - Triaxial Test for determination of shear strength properties

#### Foreword

This draft of static triaxial test for expanded clay LWA is based on the Draft European Standard, which specifies a procedure for determining the behaviour of unbound mixtures of natural and artificial aggregates used in road structures.

#### A.1 Scope

This test description specifies a triaxial test method for determination of strength and deformation properties of expanded clay LWA and similar products. In a triaxial test an axial deviator stress and a static confining cell pressure are imposed on a cylindrical specimen of the material. The test procedure shall simulate relevant conditions and stress states for these materials, for example as found in layers beneath the surface of a pavement section or structure.

This method is applicable to specimens prepared by compaction in the laboratory, where various compaction methods may be used to obtain the wanted porosity. This method applies to mixtures, in which all particles have a maximum size of 1/5 of the specimen diameter.

The test methods provide stress paths and tables and plots of stress versus strain. The test results are used to interpret the strength properties (friction angle  $\phi$  and cohesion  $c$ ) of the expanded clay LWA aggregate under a variety of test conditions, such as different moisture and stress states. The properties determined with this procedure can be used with classical procedures of limit state soil mechanic to establish the stability or bearing capacity of the structure.

The resilient properties (Young's modulus and Poisson ratio) determined with this procedure can accordingly be used with currently established linear elastic layered system theories to calculate the structural responses of pavement structures.

The development of relationships to aid in interpreting and evaluating test results is left to the engineering or office requesting the test.