BS EN 15732:2012

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of EN 15732:2012.

The UK committee voted against the approval of EN 15732 due to duplication of content covered in BS EN 13055-2. Both standards cover the requirements for all types of lightweight aggregate, including expanded clay and for all loose-fill construction applications including civil engineering applications.

The user's attention is also drawn to several inconsistencies found by UK experts:

- Clause 4.3.2, the reference to EN 14063-1 for the method to determine the thermal conductivity of expanded clay lightweight aggregate is incorrect, however, users are advised to refer to EN 12664. There is also limited guidance given on how to obtain design thermal values from such measurement results.
- Clause 4.3.3, the direction to use EN ISO 10456 to determine specific heat capacity implies that the standard contains a test or calculation method whereas it only gives tabulated values of specific heat.
- Clause 4.3.8, contains test requirements for loading, which are at variance with those in Annex C to which it refers.
- Clause 4.3.10, contains test requirements for loading, which are at variance with those in Annex B to which it refers.
- Annex E, the table in Annex E gives $\lambda_{10,dry}$ values which are inappropriate for the application. Used below ground, the expanded clay is unlikely to be dry so the values given are too low to be used as design values and therefore, cannot be considered safe.

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.

Published by BSI Standards Limited 2013

ISBN 978 0 580 77384 6

ICS 91.100.60

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2013.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15732

October 2012

ICS 91.100.60

English Version

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

Matériaux de remplissage légers et produits isolants thermiques pour les applications du génie civil - Produits à base de granulats légers d'argile expansée

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

This European Standard was approved by CEN on 9 September 2012.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 15732:2012: E

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Foreword

This document (EN 15732:2012) 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 April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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

This document 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).

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

This standard 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.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

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

This 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 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.

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

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

EN 932-2, *Tests for general properties of aggregates — Part 2: Method 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 1097-5, *Tests for mechanical and physical properties of aggregates — Part 5: Determination of the water content by drying in a ventilated oven*

EN 1097-6:2000, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption*

EN 13055-1:2002, *Lightweight aggregates — Part 1: Lightweight aggregates for concrete, mortar and grout*

EN 13055-2:2004, *Lightweight aggregates — Part 2: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications*

EN 13172:2012, *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 data from reaction to fire test*

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

EN 14063-1, *Thermal insulation products for buildings — In-situ formed expanded clay lightweight aggregate products — Part 1: Specification for the loose-fill products before installation*

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

EN ISO 10456:2007*, Building materials and products — Hygrothermal properties —Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)*

3 Terms definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 9229:2007, and the following apply.

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
is given as the tangent to the load-deformation curve and is related to the level of deformation

3.1.5
compressive creep (CC)
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 falls, 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 **L**ight**w**eight **A**ggregate

ITT is **I**nitial **T**ype **T**est

CEA is **C**ivil **E**ngineering **A**pplications

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 in steps of 5 kg/m^3 up to a density of 400 kg/m^3 and thereafter in steps of 10 kg/m^3. It shall be in the range of ± 15 % of the manufacturers declared value with a maximum of ± 100 kg /m^3 .The value shall be expressed in kg/m^3.

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 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 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.

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 thermo-processed to form 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 (4.3.2) 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.

NOTE For light weight fill applications without specific thermal insulation requirements tabulated thermal values in accordance with Annex E may be used.

4.3.3 Specific heat capacity

Specific heat capacity shall be determined in accordance with EN ISO 10456.

NOTE In accordance with EN ISO 10456:2007, Table 4, a typical value for specific heat capacity of 1000J/(kg K) can be used.

4.3.4 Particle density

The particle density of the grains shall be determined in accordance with EN 1097-6:2000, Annex C. It shall be in the range of ± 15 % with a maximum of ± 150 kg/m^3 of the declared value.

NOTE EN 1097-6:2000, Annex C is only applicable to aggregate particles larger than 4 mm.

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 after an immersion time of 28 days shall be determined in accordance with EN 1097-6:2000, Annex C.

NOTE EN 1097-6:2000, Annex C is only applicable to aggregate particles larger than 4 mm.

4.3.7 Compressibility and confined 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 13055-2:2004, Annex A. The stiffness modulus shall be given as the tangent to the stress-strain relationship curve and related to the level of deformation.

NOTE The compressive strength at 10 % strain 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 strain 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 50 N/mm^2 from 50 N/mm^2 and upwards.

4.3.9 Shear strength – static loading

The shear strength properties shall be determined in accordance with Annex A.

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 50 N/mm^2 from 50 N/mm^2 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 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 ISO 10456, a typical water vapour 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 13055-2:2004, Annex B.

4.3.16 Release of dangerous substances

Expanded Clay LWA shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material or permitted in the national regulations of the member state of destination.

4.4 Other requirements

4.4.1 Crushing resistance

The crushing resistance shall be measured in accordance with EN 13055-1:2002, Annex A.

NOTE The crushing resistance is entirely to be used for quality documentation and factory production control. There is no correlation between the crushing resistance and relevant properties for the end use conditions.

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 according to EN 1097-5 (at 110 ± 5 ºC).

5.3 Testing

5.3.1 General

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

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 EN 14063-1		
4.3.4	Particle density	EN 1097-6:2000, Annex C	2	
4.3.5	Water content	EN 1097-5	3	Not applicable for ITT
4.3.6	Water absorption	EN 1097-6:2000, Annex C	2	
4.3.7	Compressibility and confined compressive strength	Compressibility and confined compressive strength (EN13055-2:2004, Annex A)	3	
4.3.8	Compressive creep	Annex C	3	
0	Shear strength –static loading	Annex A	3	
0	Cyclic compression	Annex B	2	
0	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 13055-2:2004, Annex B	3	
4.3.16	Release of dangerous substances	Test method not yet available	-	
4.4.1	Crushing resistance	EN 13055-1:2002, 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	EN 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 EN 15732 – LD250 – PS(8-20)

7 Evaluation of conformity

7.1 General

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

— initial type testing,

— factory production control by the manufacturer, including product assessment

The evaluation of conformity shall be carried out in accordance with EN 13172.

7.2 Initial type testing

ITT shall be carried out in accordance with EN 13172 for all characteristics declared.

7.3 Factory production control

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 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.

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^3.

NOTE For CE marking and labelling see ZA.3.

Annex A
(normative)

Test for mechanical and physical properties of expanded clay LWA – Static Triaxial Compression Test for determination of shear strength properties

A.1 General

This test description specifies a triaxial test method for determination of strength and deformation properties of expanded clay LWA.In a drained triaxial test an axial deviator stress and a static confining cell pressure are imposed on a cylindrical specimen. The test procedure shall simulate relevant conditions and stress states for these materials.

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

The test results are used to interpret the strength properties (friction angle ϕ and cohesion c) of the expanded clay LWA aggregate. The method could be used to investigate 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.

NOTE A European Standard on triaxial testing is currently under preparation based on CEN ISO/TS 17892-9.

A.2 Definitions, symbols and abbreviations

For the purposes of this test description, the following definitions and symbols in Table A.1 apply.

Table A.1 — Symbols and definitions

Symbol	Definition	Explanation and equations	Unit
σ	Normal stress		N/mm^2
σ_i and σ_i'	Major total and effective stress, respectively		N/mm^2
$\sigma_3 = \sigma_2$ and $\sigma_3' = \sigma_2'$	Minor total and effective radial stress respectively	i.e. the applied confining pressure in the triaxial chamber or the vacuum inside the specimen when no triaxial chamber is used	N/mm^2
σ_d	Deviatoric stress	i.e. difference between total major and minor stress	N/mm^2
P	Mean normal stress	$p = (\sigma_1 + 2 * \sigma_3)/3$	N/mm^2
ε	Engineering strain	$\Delta h / H_0$, H_0 = initial total height or the gage length	%
ε_1^p	Permanent axial strain		%
$\varepsilon_3^p = \varepsilon_2^p$	Permanent radial strain		%
$d\varepsilon_1$	Change in linear strain		%
Dt	Change in time		s
ϕ	Friction angle		
c	Apparent cohesion		kN/m^2
ρ_d	Dry density		kg/m^3

A.3 Test principle

The drained triaxial test is used to determine the stress-strain relationship and effective stress path of expanded clay LWA prepared in the form of cylindrical specimen under isotropic or anisotropic stress in drained conditions. The specimen has to be tested at known density and moisture condition.

The axial load is increased monotonically until failure takes place in the specimen. If no clear failure is observed the test is interrupted when 10 % axial strain level is reached.

This method applies in principle to all unbound mixtures in which the specimen diameter is at least five times maximum particle size and height from 1,85 to 2,25 times the diameter.

Apparatus

A.3.1 Triaxial apparatus

The triaxial apparatus capable for testing of expanded clay LWA are similar to most standard triaxial apparatus, except that they are somewhat larger to facilitate larger samples. An example of a triaxial test apparatus and the corresponding terminology is given in Figure A1. Figure A2 shows an apparatus using internal partial vacuum to provide the confining pressure.

Air, water or silicon oil may be used as the chamber fluid. Water is suitable only if the electrical cables and connections of the instrumentation are fully sealed.

The chamber pressure may alternatively be replaced using a partial vacuum applied inside the specimen.

NOTE For vacuum systems the practical limit for confining pressure is about 80 N/mm^2 dependent on the equipment.

A.3.2 Loading device

The external loading device may be any device capable of providing monotonic increasing loads up to the failure load of the specimen. These devices range from simple mechanical motor driven devices to closed-loop electro-hydraulic or electro-pneumatic systems. The loading is done under strain control at constant strain rate. The axial strain rate is defined as the ratio between the axial strain and the corresponding time increment ($d\varepsilon_1/dt$). When the press is set to advance at a certain strain rate, the actual rate should not deviate more than ±10 % from the required value. The movement of the press shall be smooth without fluctuations and vibrations.

The load is measured with an electronic load cell or similar between the specimen top cap and the loading piston. The device for measurement of the piston load shall be sufficiently accurate to permit the load to be known within ± 3 % or 1 N.

Internal load cells shall be insensitive to horizontal forces, eccentricities in axial load and uninfluenced by the magnitude of the total cell pressure.

For specimen sizes up to 150 mm in diameter, the loading device should be capable of providing axial loads up to 20 kN -25 kN. For 300 mm specimens, the load needed may reach 100 kN.

A.3.3 Confining pressure and vacuum-control device

The confining pressure regulator shall be capable of applying and controlling cell pressures constant within ± 2 %. The vacuum-control device shall be capable of applying and controlling partial vacuums to within ± 2 %. Pressures below 25 N/mm^2 shall be kept constant within an accuracy of ± 0,5 N/mm^2.

A.3.4 Displacement transducers

A.3.4.1 General

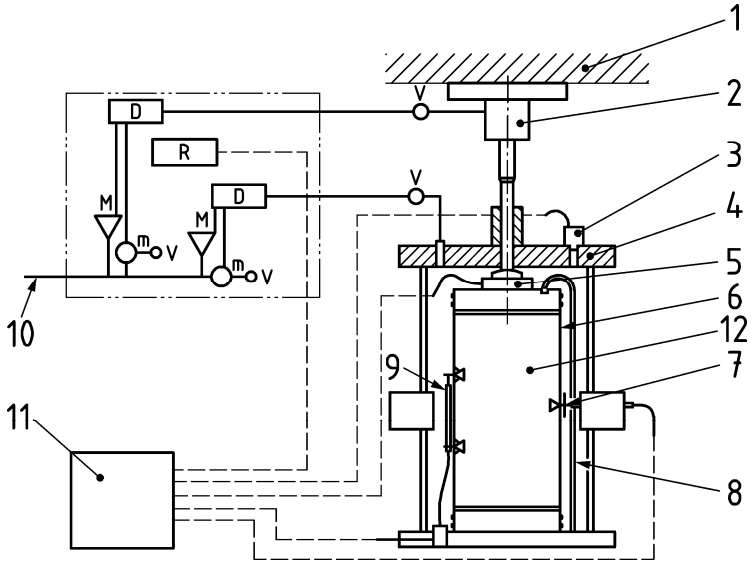
Axial deformations are measured with one to three displacement transducers

If the radial deformation is measured two to three displacement transducers should be used (optional).

The axial displacement of the specimen is usually determined by the distance the piston travels during the test. This distance shall be measured with accuracy better than ± 0,02 % of the initial specimen height. Possible false displacement due to changes in cell pressure shall be accounted for.

A.3.4.2 Lateral transducers (optional)

The lateral displacement transducers measure either the distance between the specimen surface to the ring or the opening of a hinged ring during the loading. This distance shall be measured with accuracy better than ± 0,02 % of the initial specimen diameter. The fixing method must allow relatively large deformations to occur during compression both in axial and radial direction without leading to errors in the measured deformation.



Key

1 load frame	7 radial displacement transducer (LVDT)
2 pneumatic jack	8 drainage tubes
3 pressure sensor	9 axial displacement transducer (LVDT)
4 triaxial cell	10 air (max. 10 bar)
5 load transducer	11 data acquisition and computer unit
6 rubber membrane	12 specimen

Figure A.1 — Triaxial apparatus with possibility of both constant and variable confining pressure

A.3.5 Calibration

In order to minimise errors in the stress and strain, the system should be calibrated periodically.

A new calibration may be carried out every third month or after 100 tests, depending on what comes first. In addition, the transducers should be checked if they are loaded up to or beyond their maximum capacity.

A.3.6 Top cap and pedestal

The specimen top cap and pedestal shall be designed to provide drainage from both ends of the specimen. They shall be constructed of a rigid, non-corrosive, impermeable material, and each shall, except for the drainage provision, have a circular plane surface in contact with the porous discs of circular cross section.

The diameter of the top cap and pedestal shall be equal to or larger than the initial diameter of the specimen. The specimen base shall be connected to the triaxial compression chamber or load frame (if no chamber is used) to prevent lateral motion or tilting. The top cap and the pedestal, and the connection between the top cap and the piston, shall be designed so that their deformations are negligible compared to the deformations of the soil specimen.

The top cap shall be designed so that the eccentricity of the loading, relative to the vertical axis of the specimen, does not exceed 1 % of the diameter of the specimen, *D.* The cylindrical surfaces of the pedestal and top cap, that form the contact and sealing surfaces for the membrane, shall be smooth and free of scratches.

A.3.7 Porous discs

A.3.7.1 General

The specimen shall be separated from the top cap and pedestal by rigid porous discs, having a diameter equal to or slightly smaller than the diameter of the specimen. The discs shall have plane and smooth surfaces, and their compressibility shall be negligible compared to the compressibility of the specimen. It is also possible to use smaller porous discs integrated in the top cap and pedestal to form an even surface.

The discs shall be regularly checked for clogging by passing pressurised air or water through them. If the discs are clogged, new discs should be used to ensure effective drainage of the specimen.

A.3.7.2 Semi-permeable filters or filter papers (optional)

These filters/filter papers are used to perform constant moisture tests in which the moisture/suction regime is controlled. Water - proof and air permeable filters (paper) are placed between the specimen and the top cap and pedestal. The diameter of the filters shall be equal to that of the specimen and the mass by unit area should be between 50 g/m^2 and 80 g/m^2. If semi-permeable filters are not used they must be replaced with filter paper discs.

A.3.7.3 Rubber membrane

The specimen shall be confined by a rubber/latex membrane which shall prevent the cell fluid from penetrating into the specimen.

To offer minimum restraint to the specimen, the unstretched membrane diameter shall be the same or slightly smaller than the diameter of the specimen.

It is recommended to use membranes with the following properties:

— The membrane thickness shall not exceed 1 % of the diameter of the specimen.

— The unstretched diameter should be between 95 % and 100 % of the specimen diameter.

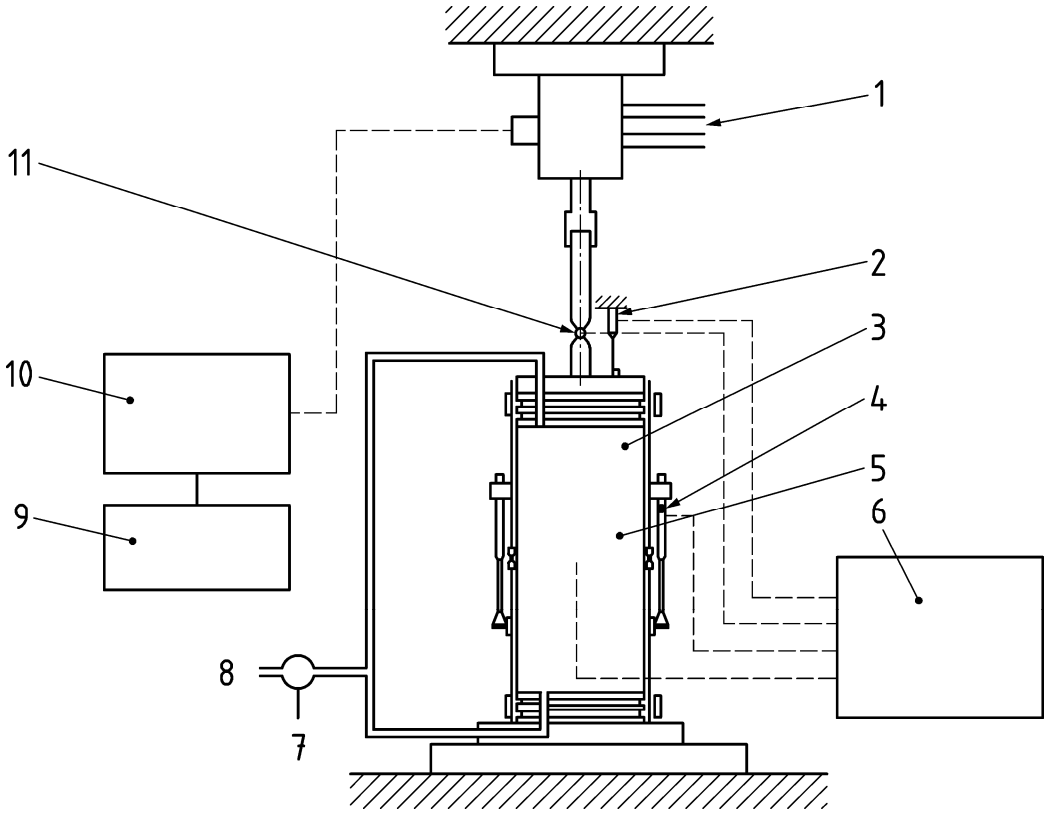
— The elastic modulus (in tension) should not exceed 1600 N/mm^2.

— The membrane shall be sealed to the specimen cap and base with suitable sized rubber O-rings or by other means that will provide a positive seal.

Each membrane should be checked for leakage before being used.

A.3.7.4 Measurement of specimen size

Devices used to determine the height and diameter of the specimen shall measure the respective dimensions to an accuracy of 0,1 % of the total dimensions, and shall be designed so that their use will not disturb the specimen.



Key

1 hydraulic actuator
2 axial displacement transducer (top platten)
3 specimen, 300 mm x 600 mm
4 axial displacement transducer
5 radial displacement transducer of wheels
6 data acquisition system
7 valve
8 vacuum supply
9 waveform generator
10 control system
11 load transducer

Figure A.2 — Example of triaxial test apparatus using partial vacuum as confining pressure

A.3.7.5 Balance

The device used for weighing the specimen shall determine the mass of the specimen to an accuracy of 0.1 % or better.

A.3.7.6 Testing environment

The consolidation and shearing parts of the test shall be performed in an environment in which the temperature fluctuations are less than ±4 °C and where there is no direct sunlight.

A.4 Testing procedure

A.4.1 Number of test specimens

Required number of specimen for one test is given in Table 1.

A.4.2 Procedures for compaction of laboratory test specimens

The water content used in the test should be equal to the average service water content in the natural condition. In cases where the material is immersed all or part of the time the test should be carried out with moist specimens

After mixing the material with water, the sample shall be placed in a plastic bag and stored in an environment with at least 85 % relative humidity for at least 24 h. A complete sealing of the sample may be obtained by wrapping the sample using two or more impermeable plastic bags.

NOTE It has been shown that different methods of reconstituting specimens to the same density may result in significantly different deformation properties. Hence the preparation method is important.

A.4.3 Compaction using vibrations

Compact the specimen at required moisture content close to the optimum moisture content using a vibration process, such as vibrating table in EN 13286-5 or vibrating hammer in EN 13286-4.

A.4.4 Other means of compaction

A.4.4.1 General

The specimen can also be compacted with a vibration hammer or manually by stamping the specimen in layers into the mould. These methods are better suited for compaction of specimens reaching very high densities, in which the grains tend to crush and the material gradation changes.

A.4.4.2 Determination of strength properties

The determination of shear strength parameters shall be based on a series of three static compression tests with different cell pressure levels. The following cell pressure levels shall be used in the test series: 20, 40 and 80 N/mm^2.

During loading, readings shall be taken on all measuring devices at intervals so that the stress - strain curves and the stress paths can be obtained from the readings. These readings will usually include axial load, confining pressure and axial/radial deformations.

The loading stage shall be carried out in strain control at a constant rate of strain. The strain rate shall be adjusted to a correct strain rate of $d\varepsilon_1/dt$ = 1 %/min. Unless otherwise specified, the test may be stopped when the axial strain either reaches 10 % or exceeds, by 5 %, the strain at peak deviatoric stress.

A.5 Test report

The results from triaxial testing shall be presented in the form of figures (plots) and tables with information of all relevant parameters. Detailed data from specific tests shall be presented upon request. The laboratory report shall contain descriptions of the test equipment and test procedures.

Friction angle (ϕ) and apparent cohesion (c) shall be given based on deviatoric stress at 10 % deformation or at peak stress value. In addition interpreted friction angle (ϕ) corresponding to an apparent cohesion (c)=0 shall be given.

Annex B
(normative)

Test for mechanical and physical properties of expanded clay LWA — Determination of the resistance to cyclic compressive loading

B.1 General

This annex specifies the procedures for the determination of the compressive deformation of lightweight aggregates during a fatigue test carried out with cyclic compressive load. The method is applicable for expanded clay LWA with maximum particle size 32 mm.

B.2 Definitions

The resistance to cyclic compressive load is defined as the permanent deformation after $2 \cdot 10^6$ cycles of alternating compressive load applied according to a specific square wave.

The compaction is defined as the decrease in volume of a loose filled aggregate after vibrating

B.3 Sampling

At least four samples of 8 dm^3 ± 0,5 dm^3 each are required, two for the fatigue tests in water and two for dry tests. If only one alternative shall be tested, two 8 dm^3 ± 0,5 dm^3 samples shall be taken. Sampling and sample reducing procedure shall be carried out according to EN 932-1 and EN 932-2 respectively.

B.4 Test method

B.4.1 General

A sample of lightweight aggregates, placed in a container, is compacted by vibration and then subjected to a cyclic compressive load of constant amplitude. The compressive load is applied axially with a cyclic variation between two prescribed values and a frequency of 4 Hz. The load wave is almost square-shaped between two constant compression loads. The duration of the test is $2 \cdot 10^6$ cycles. At certain intervals the compressive deformation of the sample is measured while keeping the sample under a steady compressive load equal to 80 % of the maximum applied load. At the end of the test the total compressive deformation is measured and then divided by the initial height after vibrating of the sample to obtain the residual compressive deformation.

B.4.2 Principle

This is a uniaxial fatigue test carried out with a cyclic compressive load.

B.4.3 Equipment

Cylindrical test steel container with a diameter and height respectively of 200 mm ± 0,5 mm according to Figure B.2. Strain measurement sensors with accuracy within ± 0,1 mm and balance with accuracy within ± 0,1 g. Polyethylene bags with approximate dimensions 450 mm ± 50 mm for width, 700 mm ± 50 mm for height and at least 0,15 mm for thickness. Vibrating equipment with following characteristics, measured for the full-loaded table (i.e. loaded with test container, sample and load-distribution plate):

frequency 50 Hz ± 2 Hz

amplitude 0,4 mm ± 0,1 mm

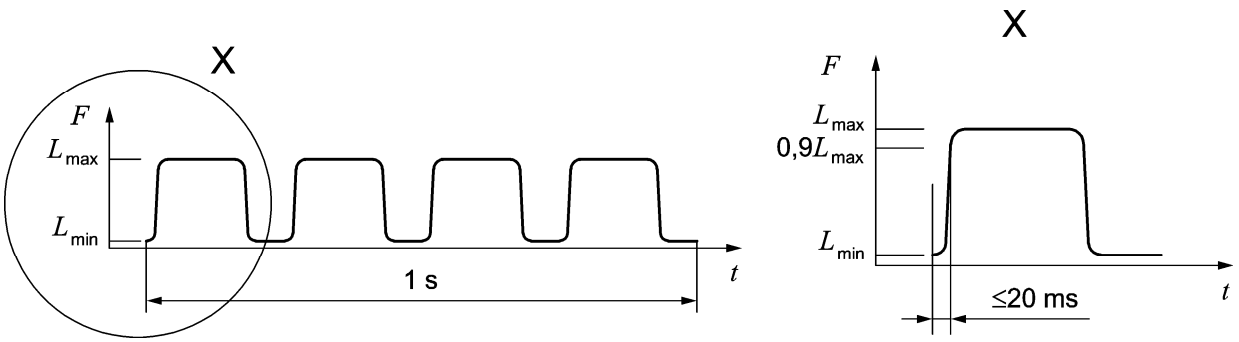
Strain measurement sensors with accuracy within ± 0,01 mm within the range of use for this test.
Load cell equipped hydraulic testing machine, with rigid construction, capable of applying cyclic loading according to the following requirements:

frequency of the cycle 1 Hz - 5 Hz

almost square-shaped loading wave, with a pulse-rise time ≤ 20 ms from the minimum up to 90 % of the maximum load; see Figure B.1;

force control within ± 1 % of the applied force.

see detail



Key

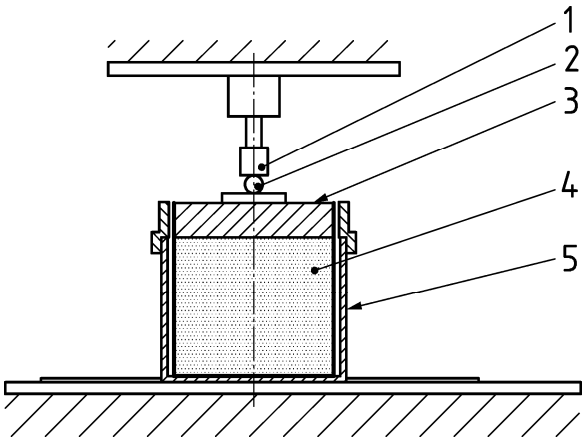
F load

t time

pulse-rise time = 20 ms from L_{min} to 0,9 L_{max} cyclic loading with frequency 4 Hz

Figure B.1 — Required load cycle during the fatigue test

The load shall be transferred to the specimen through a spherical coupling connected to the load cell, as shown in the schematic test set-up in Figure B.2.



Key

1 load cell
2 spherical seating
3 load-distribution steel plate supplying 120 N ± 1 N (Ø = 200 mm, *t* = 50 mm)
4 specimen
5 cylindrical test container

Figure B.2 — Schematic test set-up during the fatigue test

B.4.4 Preparation of test specimens

B.4.4.1 Dry specimens

Prepare 2 specimens according to EN 932-2. Dry the specimens at a temperature of 110°C ± 5 °C to reach constant weight and then store in closed plastic (polyethylene) bags at a laboratory temperature of 20°C ± 5 °C until testing. Let the material reach ambient temperature before filling in bags.

B.4.4.2 Wet specimens

Prepare 2 specimens according to EN 932-2, then store each specimen in closed plastic bags at a laboratory temperature of 20°C ± 5 °C. Before testing the specimens shall be water-cured for at least 1 week.

The plastic bag shall be filled with water of 20°C ± 5 °C and shall be kept closed, with the aggregates completely covered with water during the entire water-curing period. After completed water-curing the aggregates shall be drained by punching several small holes in the plastic bag. They shall then be poured into the test container shortly before the start of the tests.

B.4.5 Test procedure

The test specimen is first compacted on a vibrating table and is then subjected to the fatigue test carried out with cyclic compressive load. After vibration, the compaction is determined. During the fatigue test the vertical compressive deformation is measured. The detailed procedure is described below:

Place container on the vibrating table and fill carefully with aggregates. Follow this recommended practice for both dry and wet specimens:

— turn the plastic bag upside down very close to the container brim while holding the bag opening with one hand;

— insert the bag into the container, still holding the bag closed; when the bag opening reaches the bottom of the container release carefully to empty the bag;

— empty the bag while slowly lifting it by its bottom, to allow the aggregates to settle at random inside the container;

— fill the container abundantly and then remove aggregates in excess with a steel ruler;

— determine mass and the density of the specimen.

Check that the force supplied by the load-distribution steel plate is 120 N and place the plate carefully on top of the specimen. Measure the height of the specimen, l_0. Vibrate the specimen for 3 min and measure the height again, l_1.

For wet specimens only, fill the test container with water. Do not remove the load-distribution plate for this purpose but pour the water through one of the holes.

Move the container very carefully from the vibrating table to the machine for the fatigue test. Place the container centric in relation to the load axis to ensure a correctly centred application of the load. Place two dial micrometers to record the movements of the upper surface of the load-distribution plate in two diametrically opposed points A and B (see Figure B.3). Readings on the dial micrometers are the measure of the vertical deformation of the specimen.

The cyclic load shall be applied in load steps corresponding to stress levels of 40 N/mm^2 from 80 N/mm^2 and onwards.

Apply a steady compression load of 80 % of the maximum test load and measure the height of the specimen l_2 rounded to the nearest 1 mm. Read the deformation A_0 and B_0 shown by the dial micrometers in point A and B and record the values in mm with two decimals in the test report.

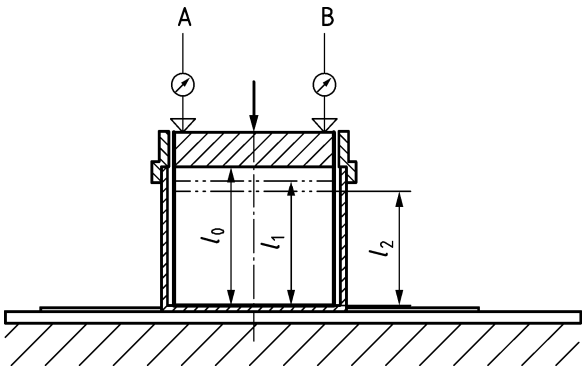
Start the cyclic loading as a uniaxial centric compression with constant amplitude and frequency (see Figure B.1). Required characteristics of the loading are:

— the compression alternates smoothly and without shock between required relevant minimum and maximum stress levels ± 1 %; minimum stress level shall be 5 N/mm^2;

— the frequency is 4 hz;

— the stress-time relationship is described by an almost square-shaped wave, with a pulse rise time ≤ 20 ms from the minimum compression level to 90 % of the maximum compression level (see Figure B.1).

Take readings of the deformation sensors, A_i and B_i , at i = 10 cycles, i = 10.000 and as close as possible to 100.000, 300.000, 600.000, 1,5 million and 2 million cycles, while keeping the specimen under a steady compression load of 80 % of the maximum test load. Note the readings in mm with two decimals in the test report.



Key

A, B dial gauge micrometers
l_0 height before vibration
l_1 height after vibration
l_2 height under load 0,8 L_{max} before fatigue test

Figure B.3 — Height measurements to be carried out before the start of the fatigue test. An example of arrangement of the strain measurement sensors (A and B) for measurements of the compressive deformation during the fatigue test

B.4.6 Calculations

The relative compaction after vibration, C, is calculated according to the following formula:

$$C = 100\frac{l_0 - l_1}{l_0} \quad (\%)$$

NOTE A compaction of 8 % to 13 % is normally achieved.

The permanent compressive deformation at each test level is calculated according to the formula:

$$D_i = 100\ \frac{d_i - d_0}{l_2}\ (\%)$$

where: $d_0 = \frac{A_0 + B_0}{2}$ and $d_i = \frac{A_i + B_i}{2}$ (mm)

and i = actual number of cycles, when following the procedures described in B.4.5.

B.4.7 Expression of the test results

The compaction *C* and the permanent deformation *D* after i number of cycles shall be stated in % with 1 decimal. The resistance to cyclic compressive load is given by the residual deformation after $2 \cdot 10^6$ cycles. The permanent deformation shall be displayed even graphically by plotting the deformation versus the number of load cycles.

B.5 Report

Dry loose bulk density and dry density after compaction shall be stated in the report.

The test report shall include the following information, if relevant:

a) name and address of the testing laboratory;

b) identification number of the test report;

c) name and address of the organisation or the person who ordered the test;

d) the purpose of the test;

e) method of sampling and other circumstances (date and person responsible for the sampling);

f) name and address of the manufacturer or supplier of the tested object;

g) name or other identification of the object;

h) description of the tested object;

i) date of supply of the tested object;

j) date of the test;

k) test method;

m) any deviation from the test method;

n) test results;

o) any other information that could influence on the assessment of the test result;

s) uncertainty of the test result;

t) date and signature.

Annex C
(normative)

Test for mechanical and physical properties of expanded clay LWA — Determination of the compressive creep

C.1 General

This annex specifies the procedure for the determination of the deformation in a specified time at constant loading of expanded clay LWA. The test is applicable for aggregates up to a maximum size of 32 mm.

C.2 Principles

The specimen is placed in a steel container and then compacted by vibration. The load *F* shall be applied up to the predetermined level with a rate of 10 kN/min, and kept constant during 24 h. The deformation shall be registered during this period.

The compressive creep shall be determined for loads corresponding to stress levels of 100 N/mm^2, 150 N/mm^2 and 200 N/mm^2.

C.3 Equipment

Sampling and sampling reducing equipment according to EN 932-1 and EN 932-2 respectively.

Test equipment according to Annex B

— Plastic bag of app. 14 dm^3 for filling the test container with the specimen.

— Vibrating equipment

  Frequency 50 Hz ± 2 Hz

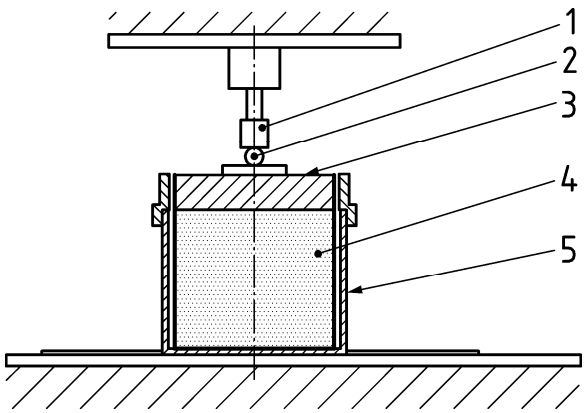
  Amplitude 0,5 ± 0,1 mm

  A weight similar to the moving parts including test cylinder and specimen shall be placed on the vibrating equipment when the amplitude is measured.

— Balance with accuracy 0,1 g

— Testing machine and a load cell with an accuracy of 1 %.

— Cylindrical test steel container with a diameter and height respectively of 200 mm ± 0,5 mm according to Figure C.1.

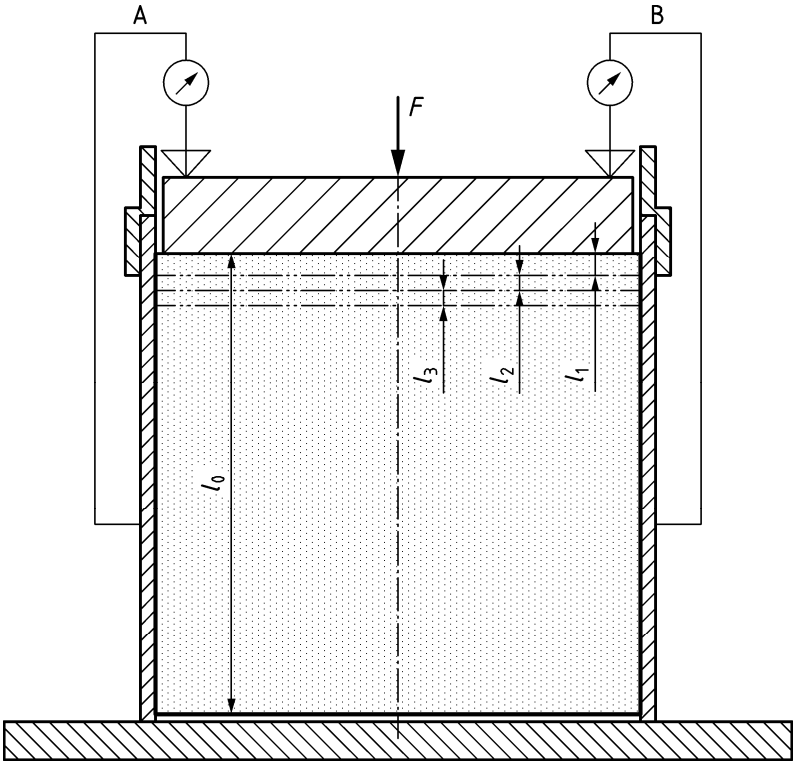


Key

1 load cell
2 spherical seating
3 load-distribution steel plate supplying 120 N ± 1 N (Ø = 200 mm, t = 50 mm)
4 specimen
5 cylindrical test container

Figure C.1 — Schematic test set-up

- 2 deformation sensors with an accuracy ± 0,05 mm



Key

A and B	dial gauge micrometers
l_0	height of the sample
l_1	vibration deformation
l_2	deformation at constant load 0 h
l_3	deformation (creep) after 24 h with constant load

Figure C.2 — Height and deformation measurements to be carried out before the start and during the test

C.4 Preparation of test specimens

Prepare 3 specimens of volume 8 dm^3 ± 0,5 dm^3 according to EN 932-2. Then, dry the specimen in 110 °C ± 5 °C to constant weight and then condition the specimen in 20 °C ± 5 °C for 24 h ± 2 h.

C.5 Testing

C.5.1 Test procedure

1. Place the specimen in a plastic bag and then place the opening in the bottom of the test container. Slowly lift the plastic bag and fill the container with the specimen. Level the surface with a ruler and measure the weight (m).

2. Place the top plate, 120 N (corresponding to 3,8 N/mm^2), on the upper surface of the specimen and measure the height of the specimen (l_0).

3. Then vibrate the specimen for 3 min and measure the vibration deformation (l_1).

4. Place the test container in the test machine and reset the dial gauges, and apply a load rate at 10 kN/min up to the predetermined constant load and measure the deformation, l_2.

5. Reset the dial gauges and keep the load constant during 24 h.

6. Deformations shall be registered continuously during the 24 h.

7. Measure the deformation l_3 of the specimen after 24 h.

8. The weight of the material shall be measured by completion of the test.

C.5.2 Calculations

The relative compaction after vibration (C) is calculated according to the following formula:

$$C = 100\frac{l_0 - l_1}{l_0} \qquad (\%)$$

The deformation (creep) after 24 h with constant load (d_F) is calculated according to the following formula:

$$d_F = 100\frac{l_3}{l_0 - (l_1 + l_2)} \qquad (\%)$$

The density of the specimen before and after the vibration, is calculated as:

$$\rho = \frac{m}{l \cdot A} \qquad (kg/m^3)$$

where l is the height of the specimen before(l_0) and after vibration (l_0-l_1) respectively and A is the internal bottom area of the test container.

C.5.3 Expression of results

The deformation after vibrating and deformation (creep) after constant load in 24 h shall be stated in % with 1 decimal

The density before and after vibration shall be stated in kg/m^3 without decimals.

C.6 Report

The test report shall include the following information, if relevant:

a) name and address of the testing laboratory;

b) identification number of the test report;

c) name and address of the organisation or the person who ordered the test;

d) the purpose of the test;

e) method of sampling and other circumstances (date and person responsible for the sampling);

f) name and address of manufacture or supplier of the tested object;

g) name or other identification of the object;

h) description of the tested object;

i) date of supply of the tested object;

j) date of the test;

k) test method;

l) applied load and corresponding stress levels;

m) any deviation from the test method;

n) test result;

o) any other information that could influence on the assessment of the test result;

s) uncertainty of the test result;

t) date and signature.

Annex D
(normative)

Factory production control

Table D.1 — Minimum product testing frequencies

Clause		Minimum testing frequency [a]
No	Title	
4.3.2	Thermal conductivity	According to EN 14063-1
4.2.1	Dry loose bulk density	1 per day or 1 per 1000 m^3
4.2.2	Particle size distribution	1 per week or 1 per 5000 m^3
4.2.3	Reaction to fire [b]	-
4.3.10	Cyclic compression	1 every 3 years
4.3.16	Dangerous substances [c]	-
4.4.1	Crushing resistance	1 per month or 1 per 20.000 m^3

[a] The minimum testing frequencies, expressed in the test results, 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 ITT and FPC, units using the same process in one factory are considered together (as one production line).

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.

[b] European Decision 96/603/EC: Materials to be considered as reaction to fire class A1 provided for in Decision 2000/147/EC without the need for testing (of reaction to fire characteristics).

[c] Frequencies are not given, as test methods are not yet available.

Annex E
(informative)

Tabulated $\lambda_{10,dry}$-values of expanded clay LWA in lightweight fill applications

Table E.1 — Tabulated thermal values for expanded clay LWA

Bulk density of the material (kg/m^3)	$\lambda_{10,dry}$ [W/m K]
200	0,10
300	0,12
400	0,14
500	0,16
600	0,18
700	0,20
800	0,22
NOTE The values given in Table E.1 are based on available information and are considered to be safe values	

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 a mandate M103 “Thermal insulation products” as amended by M138 given to CEN by the European Commission and the European Free Trade Association.[1)]

The clauses of this European Standard, shown in the table below, meet the requirements of the Mandate M103 as amended and given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the expanded clay aggregate 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 expanded clay LWA products falling within the scope of this European Standard.

NOTE 1 In addition to the 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/cpd-ds/).

This annex establishes the conditions for the CE marking of the expanded clay LWA intended for the uses indicated in Table(s) 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.

Table ZA.1 — Relevant clauses for expanded clay LWA for civil engineering applications

Construction Products: **Thermal insulation and light weight fill formed from expanded clay LWA products as covered by the scope of this standard** Intended uses: **Thermal insulation and light weight fill for roads, railways and other civil engineering applications**			
Requirement/Characteristic from the mandate	Requirement clauses in this European Standard	Levels and/or classes	Notes [a)]
Reaction to fire Euroclass characteristics	4.2.3 Reaction to fire	Euroclasses	-
Water permeability	4.3.12 Water permeability	-	Levels
Release of dangerous substances	4.3.16 Release of dangerous substances	-	-
Thermal resistance	4.3.2 Thermal conductivity 4.2.1 Loose bulk density 4.2.2.2 Aggregate size	- - -	Levels of λ Classes Classes
Water vapour transmission	4.3.13 Water vapour transmission	-	-
Compressive strength	4.3.7 Compressibility and confined compressive strength	-	-
Resistance to dynamic loads	4.3.10 Cyclic compression	-	-
Durability of reaction to fire against ageing/degradation	4.2.4.2 Durability characteristics	-	[b)]
Durability of thermal resistance against ageing/degradation	4.2.4.3 Durability characteristics	-	[c)]Levels
Durability of compressive strength against ageing/degradation	4.2.4.4 Durability characteristics	-	[d)]
Durability of resistance to dynamic loads against ageing/degradation	4.2.4.5 Durability characteristics	-	-
Durability against chemicals and biological attack	4.2.4.6 Durability characteristics	-	-

a) 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)).

b) The reaction to fire performance of expanded clay LWA does not change with time. The product is classified without testing as a class A1 product in accordance with EN 13501-1.

c) The thermal conductivity (4.3.2) of the product does not change with time and neither does the insulation thickness since any settlement is negligible.

d) The compressive strength of expanded clay LWA does not change with time. The product is a clay mineral burnt to clinkers in a stable structure.

ZA.2 Procedures for attestation of conformity of loose fill expanded clay LWA 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 expanded clay LWA products 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 of 8 January 2001 as given in Annex III of the mandate M103 as amended by mandates M126, M130 and M138 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	For uses subject to regulations on reaction to fire	A1 [a], A2 [a], B [a], C [a] A1 [b], A2 [b], B [b], C [b], D, E (A1 to E) [c], F	1 3 3 (with 4 for RtF)
	Any	-	3
System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i), without audit testing of samples. System 3: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Second possibility. System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), Third possibility.			

[a] 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 retarders or a limiting of organic material)

[b] Products/materials not covered by footnote a

[c] 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 system of attestation of conformity for the CE marking of the product is defined in accordance with Annex ZA of this standard (see ZA.2.1).

The attestation of conformity of the Thermal insulation formed from expanded clay LWA 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.

Where more than one table applies for the product (i.e. because its intended use makes different characteristics relevant), Table ZA.2.1 has to be read in conjunction with subsequent tables in order to determine which characteristics assigned to the manufacturer in Table ZA.2.1 are type tested by a notified test lab (system 3) and which by the manufacturer (system 4).

Table ZA.2.1 — Assignment of evaluation of conformity tasks for products under system 1 for reaction to fire with system 3 for other characteristics

Tasks		Content of the task	Evaluation of conformity clauses of EN 13172 to apply in addition to Clause 7 of this standard
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 13172:2012. 7.3 of this standard
	Further testing of samples taken at factory	All relevant characteristics of Table ZA.1	Annex D of this standard
	Initial type testing	Those relevant characteristics of Table ZA.1 not tested by the notified laboratory and by the notified body	Clause 6 of EN 13172:2012. 7.2 of this standard
Tasks under responsibility of a notified laboratory	Initial type testing	- Thermal resistance - Release of dangerous substances a - Compressive strength (for load bearing applications) - Water permeability - resistance to dynamic load	Clause 6 of EN 13172:2012. 7.2 of this standard
Tasks under the responsibility of the product certification body	Initial type testing	Parameters related to EC of Table ZA.1, relevant for the intended use which is declared: reaction to fire. Documentation of the FPC.	Clause 6 of EN 13172:2012. 7.2 of this standard
	Initial inspection of factory and of FPC	Parameters related to EC of Table ZA.1, relevant for the intended use which is declared: reaction to fire. Documentation of the FPC.	Annex B and C of EN 13172:2012. 7.3 of this standard
	Continuous surveillance, assessment and approval of FPC.	Parameters related to EC of Table ZA.1, relevant for the intended use which is declared: reaction to fire. Documentation of the FPC.	Annex B and C of EN 13172:2012. 7.3 of this standard
a No test method available as yet			

Table ZA.2.2 — Assignment of evaluation of conformity tasks for products under system 3 and 3 (with 4 for RtF)

Tasks		**Content of the task**	**Evaluation of conformity clauses of EN 13172 to apply in addition to Clause 7 of this standard**
Tasks under the responsibility of the manufacturer	Factory production control (FPC)	Parameters related to all relevant characteristics of Table ZA.1	Annex D of this standard and Clauses 1 to 5 of EN 13172:2012 and: For system 3 Annex C of EN 13172:2012 For system 3 (with 4 for RtF) Annex C & D of EN 13172:2012. 7.3 of this standard
	Initial type testing by the manufacturer	"Those relevant characteristics of Table ZA.1 not tested by the notified body" including reaction to fire for system 3 & 4)	Clause 6 of EN 13172:2012. 7.2 of this standard
	Initial type testing by a notified test laboratory	- Reaction to fire (system 3) - Thermal resistance - Release of dangerous substances [a] - Compressive strength (for load bearing applications) - Water permeability - Resistance to dynamic load	Clause 6 of EN 13172:2012. 7.2 of this standard

[a] No test method available as yet

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 of 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, …);

— 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 and period of validity of the certificate, where applicable;

— name of, and position held by, the person empowered to sign the certificate.

In case of products under system 3 or (3 (with 4 for RtF)): 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, which entitles the manufacturer to affix of the CE marking. The declaration shall include:

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

NOTE 2 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, …) and a copy of the information accompanying the CE marking;

NOTE 3 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 of conformity on behalf of the manufacturer or his 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.

The validity of the declaration 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/EEC and shall be shown on the product (or when not possible it may be on the accompanying label ,the packaging or on the accompanying commercial documents e.g. a delivery note). 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 and intended use;

— information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as:

- declared values and, where relevant, level or class (including “pass” for pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in "Notes" in Table ZA.1,

- “No performance determined” for characteristics where this is relevant,

- as an alternative, a standard designation in combination with declared values as described in Clause 6 which shows some or all of the relevant characteristics (where the designation covers only some characteristics, it will need to be supplemented with declared values for other characteristics as above).

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 (for system of attestation of conformity 3).

CE marking for expanded clay lightweight aggregate products shall be accompanied by the information shown below:

CE	*CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.*
AnyCo Ltd, PO Box 21, B-1050 **12**	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed*
EN 15732 Expanded Clay LWA for civil engineering applications Reaction to fire – Class A1 Thermal conductivity 0,090 W/mK Compressibility and confined compressive strength: CS(10): 700 N/mm^2 Durability : Pass Exp. clay LWA EN 15732 – LD250 – PS(8-20)	*No. of European Standard* *Description of product* *and* *information on regulated characteristics* *Designation code (in accordance with Clause 6 of this standard for the relevant characteristics according to Table ZA.1)*

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

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