

Lightweight aggregates —

Part 1: Lightweight aggregates for concrete, mortar and grout

The European Standard EN 13055-1:2002 has the status of a
British Standard

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National foreword

This British Standard is the official English language version of EN 13055-1:2002, which is included in a package of new European Standards being prepared by CEN/TC 154 relating to aggregates. Although the English text versions of these European Standards will be adopted as British Standards as they become available, the existing British Standards for aggregates will be retained, but only until such time that the completed package of European Standards becomes available. The original group of British Standards will then be withdrawn and this will be noted in *BSI Update Standards*. It supersedes BS 3797:1990 which will be withdrawn, if the package of European Standards is complete, in June 2004.

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

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

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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This British Standard, having been prepared under the direction of the Building and Civil Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 28 May 2002

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This European Standard was approved by CEN on 21 March 2002.

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 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 Management Centre has the same status as the official versions.

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Foreword

This document EN 13055-1:2002 has been prepared by Technical Committee CEN/TC 154 "Aggregates", the secretariat of which is held by BSI.

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 November 2002, and conflicting national standards shall be withdrawn at the latest by June 2004.

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 European Standard forms part of a series of standards for lightweight aggregates, the other part being:

Part 2: Lightweight aggregates for bituminous mixtures and surface treatments and for unbound and bound applications excluding concrete, mortar and grout

Requirements for other types of aggregates will be specified in the following European Standards:

prEN 12620, *Aggregates for concrete*.

prEN 13043, *Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas*.

prEN 13139, *Aggregates for mortar*.

prEN 13242, *Aggregates for unbound and hydraulic bound materials for use in civil engineering work and road construction*.

EN 13383-1, *Armourstone - Part 1: Specification*.

prEN 13450, *Aggregates for railway ballast*.

The annexes A, B, C and F are normative, the annexes D and E are informative.

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

1 Scope

This European Standard specifies the properties of lightweight aggregates and lightweight filler aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in concrete, mortar and grout in buildings, roads and civil engineering works.

This European Standard covers lightweight aggregates of mineral origin having particle densities not exceeding $2\,000\text{ kg/m}^3$ ($2,00\text{ Mg/m}^3$) or loose bulk densities not exceeding $1\,200\text{ kg/m}^3$ ($1,20\text{ Mg/m}^3$) including:

- a) natural aggregates;
- b) aggregates manufactured from natural materials and/or from by-products of industrial processes;
- c) by-products of industrial processes;
- d) recycled aggregates.

It provides for the evaluation of conformity of the products to this European Standard.

The requirements specified in this standard may not be relevant to all types of lightweight aggregates. For particular applications the requirements and tolerances may be adapted for the end use.

NOTE The requirements in this European Standard are based upon experience with aggregate types with an established pattern of use. Care should be taken when considering the use of aggregates from sources with no such pattern of use, e.g., recycled aggregates and aggregates arising from certain industrial by-products. Such aggregates, which should comply with all the requirements of this European Standard, could have other characteristics not included in Mandate M 125 that do not apply to the generality of aggregate types with an established pattern of use and when required, provisions valid at the place of use can be used to assess their suitability.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

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

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

EN 932-5, *Tests for general properties of aggregates — Part 5: Common equipment and calibration.*

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

EN 933-2, *Tests for geometrical properties of aggregates — Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures.*

EN 933-5, *Tests for geometrical properties of aggregates — Part 5: Determination of percentage of crushed and broken surfaces in coarse aggregate particles.*

EN 933-10, *Tests for geometrical properties of aggregates — Part 10: Assessment of fines — Grading of fillers (air jet sieving).*

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 1744-1:1998, *Tests for chemical properties of aggregates — Part 1: Chemical analysis.*

ISO 3310-1, *Test sieves - Technical requirements and testing — Part 1: Test sieves of metal wire cloth.*

ISO 3310-2, *Test sieves - Technical requirements and testing — Part 2: Test sieves of perforated metal plate.*

3 Terms and definitions

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

3.1

aggregate

granular material used in construction. Aggregate may be natural, manufactured, by-product or recycled

3.2

lightweight aggregate

aggregate of mineral origin having a particle density not exceeding $2\,000\text{ kg/m}^3$ ($2,00\text{ Mg/m}^3$) or a loose bulk density not exceeding $1\,200\text{ kg/m}^3$ ($1,20\text{ Mg/m}^3$)

3.3

natural aggregate

aggregate from mineral sources which has been subjected to nothing more than mechanical processing

3.4

manufactured aggregate

aggregate of mineral origin resulting from an industrial process involving thermal or other modification

3.5

by-product aggregate

aggregate of mineral origin from an industrial process which subsequently has been subjected to nothing more than mechanical processing

3.6

recycled aggregate

aggregate resulting from processing of inorganic material previously used in construction

3.7

finer

particle size fraction of an aggregate which passes the $0,063\text{ mm}$ sieve

3.8

filler aggregate

aggregate, most of which passes a $0,063\text{ mm}$ sieve, which can be added to construction materials to provide certain properties

3.9

grading

particle size distribution expressed as the percentage by mass passing a specified number of sieves

4 Physical requirements

4.1 General

The necessity for testing and declaring all properties specified in this clause shall be limited according to the particular application at end use or origin of the aggregate. When required, the tests specified shall be carried out to determine appropriate physical properties.

4.2 Density

4.2.1 Loose bulk density

Loose bulk density shall be declared and determined in accordance with EN 1097-3. It shall be in the range of $\pm 15\%$ with a maximum of $\pm 100 \text{ kg/m}^3$ ($0,10 \text{ Mg/m}^3$) of the declared value.

NOTE The container should be filled using a standard scoop held centrally over the container and without touching it.

4.2.2 Particle density

When required the particle density shall be determined in accordance with EN 1097-6:2000, annex C. It shall be in the range of $\pm 15\%$ with a maximum of $\pm 150 \text{ kg/m}^3$ ($0,15 \text{ Mg/m}^3$) of the declared value.

4.3 Aggregate size

4.3.1 General

Aggregate sizes shall be designated using a pair of sieve sizes selected from the basic set, or the basic set plus set 1, or the basic set plus set 2 in Table 1.

NOTE This designation accepts the presence of some particles which are retained on the upper sieve (oversize) and some which pass the lower sieve (undersize).

Table 1 — Sieve sizes for specifying aggregate product sizes

Basic set mm	Basic set plus set 1 mm	Basic set plus set 2 mm
0	0	0
0,25	0,25	0,25
0,5	0,5	0,5
1	1	1
2	2	2
-	2,8 (3)	3,15 (3)
4	4	4
-	5,6 (5)	-
-	-	6,3 (6)
8	8	8
-	-	10
-	11,2 (11)	-
-	-	12,5 (12)
-	-	14
16	16	16
-	-	20
-	22,4 (22)	-
31,5 (32)	31,5 (32)	31,5 (32)
-	-	40
-	45	-
63	63	63

NOTE Rounded sizes shown in parentheses can be used as simplified descriptions of aggregate sizes.

4.3.2 Undersize

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

4.3.3 Oversize

The quantity of the oversize shall not exceed 10 % by mass. When required, the sieve which 100 % material passes shall be declared.

4.4 Grading

Particle size distribution shall be determined in accordance with EN 933-1 by dry sieving and the results declared.

NOTE Care should be taken with friable aggregates to prevent degradation.

4.5 Particle shape

When required, particle shape shall be described and declared.

NOTE Test methods for normal weight aggregates are not applicable.

4.6 Fines

When required, the content of fines in lightweight aggregates shall be determined in accordance with EN 933-1 and the results declared.

NOTE Care should be taken with friable aggregates to prevent degradation.

4.7 Grading of fillers

When required, the particle size distribution of fillers shall be determined in accordance with EN 933-10 and the results declared.

4.8 Water absorption

When required, the water absorption of lightweight aggregate shall be determined in accordance with EN 1097-6:2000, annex C and the results declared.

4.9 Water content

When required the water content of the lightweight aggregate shall be determined in accordance with EN 1097-5 and the results declared.

4.10 Crushing resistance

When required, the crushing resistance of lightweight aggregates shall be determined in accordance with annex A and the results declared.

NOTE There is no simple relationship between the crushing resistance of lightweight aggregate and the properties at its end use.

4.11 Percentage of crushed particles

When required, the percentage of crushed particles of lightweight aggregate with a bulk density of not less than 150 kg/m^3 ($0,15 \text{ Mg/m}^3$) shall be determined in accordance with EN 933-5 and the results declared.

NOTE For manufactured lightweight aggregates having a bulk density less than 150 kg/m^3 ($0,15 \text{ Mg/m}^3$), the test specified in EN 933-5 can be used where appropriate.

4.12 Resistance to disintegration

When required, the resistance to disintegration shall be determined in accordance with annex B and declared.

NOTE This test is suitable for aggregate with bulk density above 150 kg/m^3 ($0,15 \text{ Mg/m}^3$).

4.13 Freezing and thawing resistance

If frost resistant aggregates are required for use in concrete, mortar or grout in an environment subject to freezing and thawing, the freeze/thaw resistance of aggregates having a particle size of not less than 4 mm and a density not less than 150 kg/m^3 ($0,15 \text{ Mg/m}^3$) shall be determined in accordance with annex C and declared.

When the resistance to freezing and thawing of aggregates of 4 mm or less and a density less than 150 kg/m^3 ($0,15 \text{ Mg/m}^3$) is required in the end use situation, it shall be derived from a freeze-thaw test on the final product in accordance with the provisions valid at the place of use and the results declared.

NOTE Alternatively aggregates can be assessed on the basis of satisfactory service record of performance or test on the final product.

5 Chemical requirements

5.1 General

The necessity for testing and declaring all properties in this clause is limited to the particular application at end use or origin of the aggregate. When required the tests specified in clause 5 shall be carried out to determine the appropriate chemical content by mass. If comparing a determination to a limiting value the chemical content by mass shall be converted to a comparison value in accordance with the following equation:

$$V_c = V_m \cdot \frac{\text{Loose bulk density}}{1500}$$

where

- V_c is the comparison value;
 V_m is the value measured in accordance with EN 1744-1;
 1 500 is the assumed nominal loose bulk density of normal weight aggregate.

NOTE 1 Further guidance is given in annex D.

NOTE 2 Guidance on the effect of chemical constituents in lightweight aggregates, including alkali-silica reactivity, related to the durability, appearance and surface properties of the concrete, mortar and grout in which they are incorporated is given in annex E.

5.2 Chloride

The water-soluble chloride ion content of lightweight aggregates shall be provided and determined in accordance with EN 1744-1:1998, clause 7, and declared.

NOTE Further guidance is given in annex E.

5.3 Sulfur containing compounds

5.3.1 Acid-soluble sulfate

Acid-soluble sulfate content shall be determined in accordance with EN 1744-1:1998, clause 12, and declared.

5.3.2 Total sulfur

Total sulfur content shall be determined in accordance with EN 1744-1:1998, clause 11, and declared.

5.4 Loss on ignition (for ashes only)

Loss on ignition shall be determined in accordance with EN 1744-1:1998, clause 17, and declared.

5.5 Organic contaminants

Harmful components in natural lightweight aggregates i.e., those which alter the rate of setting and hardening of concrete, mortar and grout shall be determined in accordance with EN 1744-1:1998, 15.3, and declared.

NOTE Further guidance is given in annex E.

5.6 Alkali-silica reactivity of natural lightweight aggregates

When required, the alkali-silica reactivity of natural lightweight aggregates shall be assessed in accordance with the provisions valid in the place of use and the results declared.

NOTE Guidance on the effects of alkali-silica reactivity, is given in annex E.

6 Testing

6.1 Sampling

Sampling shall be carried out as specified in EN 932-1.

NOTE To ensure a representative sample care should be taken to avoid segregation.

6.2 Quantity of test portions

The test portion quantity specified in test methods shall, if not taken into account by the test method, be corrected on the basis of loose bulk density in order to have a volume equivalent to an aggregate with a loose bulk density of $1\,500\text{ kg/m}^3$ ($1,50\text{ Mg/m}^3$).

6.3 Preparation of test specimens

6.3.1 Drying

Test specimens shall be dried in accordance with EN 1097-5.

6.3.2 Conditioning after drying

Test specimens shall be allowed to cool to room temperature. For some lightweight aggregates the test specimens shall be allowed to condition to moisture equilibrium at $(23 \pm 5)^\circ\text{C}$ and $(50 \pm 10)\%$ RH.

7 Evaluation of conformity

7.1 General

The producer shall undertake initial type tests (see 7.2) and factory production control (see 7.3) to ensure that the product conforms to this European Standard and to declared values as appropriate.

7.2 Initial type tests

Initial type tests relevant to the intended end use shall be carried out to check compliance with specified requirements in the following circumstances:

- a) a new source of aggregates is to be used;
- b) there is a major change in the nature of the raw materials or in the processing conditions which may affect the properties of the aggregates.

The results of the initial tests shall be documented as the starting point of the factory production control for that material. This shall particularly include the identification of any components likely to emit radiation above normal background levels, any components likely to release polyaromatic carbons or other dangerous substances. If the content of any of these components exceeds the limits in force according to the provisions valid in the place of use of the aggregate, the results of the initial tests shall be declared.

7.3 Factory production control

The producer shall have in place a system of factory production control that complies with the requirements of annex F.

The records held by the producer shall indicate what control procedures are in operation during the production of the aggregate.

NOTE The form of control applied to any aggregate depends upon its intended use and the regulations relating to that use.

8 Designation

8.1 Designation and description

Lightweight aggregate shall be identified in the following terms:

- a) the name and address of the producer or trademark;
- b) the size;
- c) the loose bulk density or particle density;
- d) reference to this standard;
- e) any additional information needed to identify the particular lightweight aggregate.

8.2 Supply

8.2.1 The supply of material shall be by volume or mass.

8.2.2 All the material shall be protected against contamination.

8.3 Marking and labelling

Every consignment of lightweight aggregates shall be identified by a numbered delivery note containing at least the following information:

- a) designation in accordance with 8.1;
- b) the source or place of manufacture;
- c) date of dispatch from the producer's works;
- d) the quantity of lightweight aggregates;
- e) the customer's name and address.

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

Annex A

(normative)

Determination of crushing resistance

A.1 Principle

A prepared sample of lightweight aggregate is placed in a specified steel cylinder and compacted by vibration. A piston is then forced under pressure into the cylinder for a given distance, and the force required is measured and expressed as the resistance to crushing.

Two test procedures are specified. Procedure 1 is normally applicable to lightweight aggregate in the size range 4 mm to 22 mm and with a bulk density above 150 kg/m^3 ($0,15 \text{ Mg/m}^3$). Procedure 2 is normally applicable to a lightweight aggregate with a bulk density of 150 kg/m^3 ($0,15 \text{ Mg/m}^3$) and below.

A.2 Apparatus

A.2.1 All apparatus, unless otherwise stated, shall conform to the general requirements of EN 932-5.

A.2.2 Steel test cylinder and piston, as shown in Figure A.1 for procedure 1 and Figure A.2 for procedure 2.

A.2.3 Hydraulic press, or similar device capable of providing sufficient pressure for the test and measuring the pressure to an accuracy of $\pm 5 \%$.

A.2.4 Vibrating table, operating at approximately 3 000 oscillations per minute and amplitude 0,5 without load.

A.2.5 Steel straightedge, of a suitable length.

A.2.6 Scoop, of suitable size to fill the test cylinder.

A.2.7 Thermostatically controlled ventilated drying oven, capable of maintaining a temperature of $(110 \pm 5) ^\circ\text{C}$.

A.3 Preparation of test specimens

Samples shall be taken in accordance with EN 932-1 and reduced in accordance with EN 932-2. Prepare three representative test specimens of suitable size and remove undersize and oversize.

A.4 Procedure

A.4.1 Procedure 1

Place the cylinder on the vibrating table and gently fill to overflowing by discharging the test lightweight aggregate using a scoop, all around the cylinder, taking care to avoid segregation of the lightweight aggregate. Vibrate the cylinder for 3 s to 60 s and refill.

Vibrate the cylinder for a further 3 s to 60 s and level the surface of the lightweight aggregate using the straightedge.

Position the top rail on the cylinder and place the piston gently on top of the compacted lightweight aggregate. Adjust the distance between the contact ring and the top rail to 20 mm and place the test assembly in the hydraulic press.

Increase the force on the piston to reach a compression of 20 mm in approximately 100 s, and record the force in newtons. Repeat the procedure with the remaining two test specimens.

A.4.2 Procedure 2

Place the cylinder on the vibrating table and gently fill to overflowing by discharging the test lightweight aggregate using a scoop, taking care to avoid segregation of the lightweight aggregate.

Vibrate the cylinder for 3 s and fit the flanged collar on the test cylinder. Add additional lightweight aggregate to fill the collar and vibrate for a further 3 s.

Remove the collar and level the lightweight aggregate and place the test assembly in the hydraulic press.

Increase the force on the piston to reach a compression of 50 mm in approximately 100 s, and record the force in newtons.

Repeat the procedure with the remaining two test specimens.

A.5 Calculation and expression of results

Calculate the crushing resistance (C_a or C_b) for each test specimen using the following equation:

$$C_a \text{ or } C_b = \frac{L + F}{A} \text{ N/mm}^2$$

where

C_a is the crushing resistance, in newtons per square millimetre, determined in accordance with procedure 1;

C_b is the crushing resistance, in newtons per square millimetre, determined in accordance with procedure 2;

L is the force exerted by the piston in newtons;

F is the compression force in newtons;

A is the area of the piston in square millimetres.

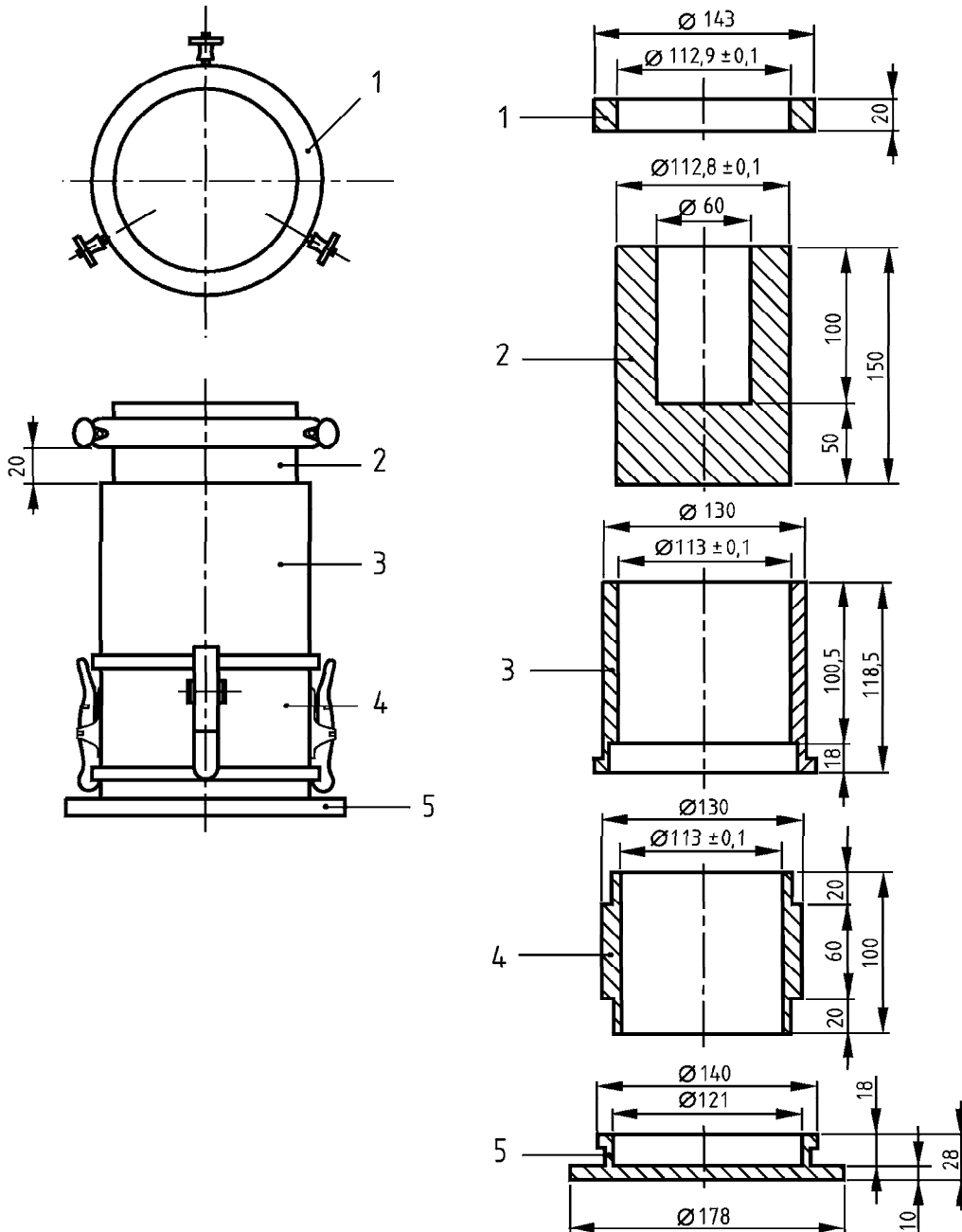
Calculate the mean value of the three results.

A.6 Test report

The test report shall include the following information:

- a) reference to this European Standard;
- b) test carried out in accordance with procedure 1 or procedure 2;
- c) identification of the test specimen;
- d) identification of the test laboratory;
- e) date of test;
- f) mean crushing resistance (C_a or C_b);
- g) range of the three test results;
- h) period of vibration.

Dimensions in millimetres

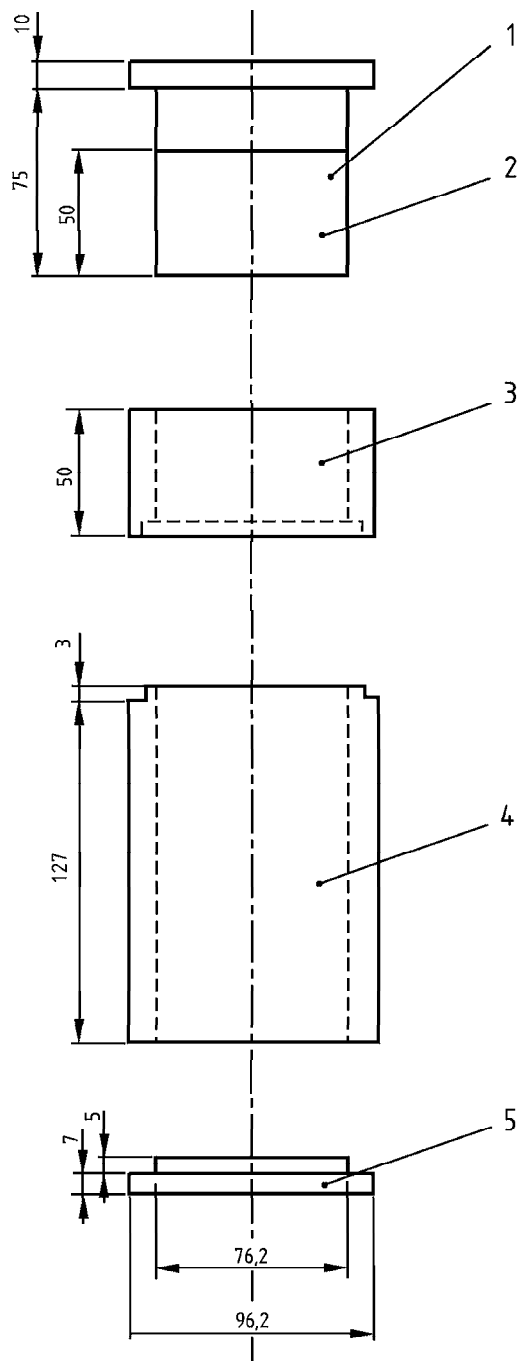


Key

- 1 Adjustable height ring
- 2 Piston
- 3 Upper cylinder
- 4 Lower cylinder
- 5 Base

Figure A.1 — Test apparatus for procedure 1

Dimensions in millimetres

**Key**

- 1 Mark 50 mm
- 2 Piston
- 3 Collar
- 4 Cylinder
- 5 Base

Figure A.2 — Test apparatus for procedure 2

Annex B

(normative)

Determination of resistance to disintegration

B.1 Principle

Two specimens of lightweight aggregate are stored in water for 3 days at ambient temperature, after which they are autoclaved for 3 h at a pressure of 2 MPa and a temperature of 215 °C, and then cooled to 30 °C.

After drying at 110 °C, and cooling, they are sieved on the next smaller sieve to that of the lower limiting sieve of the single size test grading.

The mass passing this test sieve is expressed as a percentage of the mass of each original dry test specimen.

The result is recorded as the mean of the results of two test specimens.

B.2 Apparatus

B.2.1 All apparatus, unless otherwise stated, shall conform to the general requirements of EN 932-5.

B.2.2 Thermostatically controlled saturated steam autoclave, of suitable capacity capable of raising the test specimens from 20 °C to (215 ± 5) °C in (60 ± 5) min and maintaining this temperature for (180 ± 10) min, at a pressure of $(2 \pm 0,2)$ MPa. In addition, the autoclave shall be capable of allowing the test specimens to cool to (30 ± 10) °C in (90 ± 10) min.

B.2.3 Test sieves, in accordance with ISO 3310-1 or ISO 3310-2.

B.2.4 Balance, of adequate capacity and with an accuracy of $\pm 0,1$ g.

B.2.5 Thermostatically controlled ventilated drying oven, capable of maintaining a temperature of (110 ± 5) °C.

B.2.6 Two metal containers, suitable for holding the lightweight aggregate in the autoclave.

B.3 Preparation of test specimens

Samples shall be taken in accordance with EN 932-1 and reduced in accordance with EN 932-2 and be large enough to give two test specimens as specified in Table B.1.

B.3.1 Dry the sample of lightweight aggregate in accordance with EN 1097-5.

B.3.2 Dry sieve the two test specimens, removing the oversize and undersize using the appropriate upper and lower sieves specified in Table B.1.

Table B.1 — Specimen size/sieve sizes

Lower and upper sieve sizes mm	Approximate volume ml	Next smaller sieve mm
4/8	500	2
8/16	1 000	4
16/22	2 000	8

B.4 Procedure

B.4.1 Soak the two test specimens in distilled water at ambient temperature for (72 ± 1) h, weighing the aggregate to ensure that it is below the surface of the water.

B.4.2 After soaking, strain the lightweight aggregate from the distilled water and allow the specimens to drain for about 15 min.

B.4.3 Place the drained specimens in the two metal containers and place these in the autoclave.

B.4.4 Raise the autoclave to a pressure of $(2 \pm 0,2)$ MPa and a temperature of (215 ± 5) °C in (90 ± 5) min, and maintain this pressure and temperature for (180 ± 5) min. Allow to cool to (30 ± 10) °C in (90 ± 5) min.

B.4.5 Transfer the containers and contents to the oven and dry at (110 ± 5) °C in accordance with EN 1097-5 and allow to cool.

B.4.6 Weigh each test specimen to the nearest 0,1 g (m_1).

B.4.7 Carefully screen each of the test specimens on the next smaller sieve indicated in Table B.1.

B.4.8 Weigh the material passing through this sieve to 0,1 g for each test specimen (m_2).

B.5 Calculation and expression of results

B.5.1 Calculate the percentage loss in mass M , for each of the two test specimens using the following equation:

$$M = \frac{m_2}{m_1} \times 100$$

where

M is the percentage loss in mass;

m_1 is the initial mass of the test specimen in grams;

m_2 is the mass of the material in grams which passes the appropriate lower size sieve after autoclaving.

B.5.2 The result shall be expressed as the mean value obtained from two specimens.

Annex C (normative)

Determination of resistance to freezing and thawing of lightweight aggregates

C.1 Introduction

The test method specified in this annex has been found to be suitable for lightweight aggregates with a particle size not less than 4 mm and a bulk density not less than 150 kg/m³ (0,15) Mg/m³.

NOTE The principle of this test deviates from the test method specified in EN 1367-1.

C.2 Principle

A test specimen of lightweight aggregates, after soaking in water at atmospheric pressure, is subjected to 20 freeze-thaw cycles. This involves cooling down to below -15 °C in air and then thawing in a water bath at about 20 °C. After completion of the freeze-thaw cycles, the lightweight aggregate is examined for any changes such as crack formation and/or loss in mass.

C.3 Apparatus

C.3.1 All apparatus, unless otherwise stated, shall conform to the general requirements of EN 932-5.

C.3.2 Ventilated drying oven, with forced circulation of adequate capacity. The oven shall be capable of being maintained at (110 ± 5) °C.

C.3.3 Balance, capable to weigh test samples up to 400 g. with an accuracy of $\pm 0,02$ g. and test samples above 400 g. with an accuracy of 0,05 g.

C.3.4 Low temperature cabinet, (upright or chest) with air circulation. The cabinet shall be capable of being maintained at $(-17,5 \pm 2,5)$ °C.

C.3.5 Containers, made from corrosion resistant sheet steel with a base area of approximate 0,02 m² and a height of not less than 100 mm.

C.3.6 Grid, of a suitable size and aperture to prevent the lightweight aggregates floating in the container specified in C.3.5.

C.3.7 Test sieves, conforming to EN 933-2 shall be used.

C.3.8 Water, distilled or demineralized.

C.4 Sampling

Sampling shall be carried out in accordance with EN 932-1.

C.5 Test specimens

C.5.1 Test specimens

Three individual test specimens shall be used. The test specimens shall be obtained in accordance with EN 932-2 by sample reduction from production single size aggregates from which oversize and undersize aggregates have been removed.

C.5.2 Size of test specimens

Any of the sizes listed in Table C.1 can be used. The quantities for each of the three individual test specimens are given in Table C.1 and deviations of $\pm 5\%$ are permissible.

Table C.1 — Test samples required for the freeze-thaw cyclic test

Maximum aggregate size mm	Volume of lightweight aggregates required ml
4 to 8	500
8 to 16	1 000
16 to 32	1 500

C.5.3 Preparation of test specimens

Wash the test specimens to remove adhering particles. Dry the test specimens as specified in EN 1097-5, allow to cool to ambient temperature and weigh.

NOTE For some lightweight aggregates, allow the test specimens to condition to moisture equilibrium at $(23 \pm 5) ^\circ\text{C}$ and $(50 \pm 10) \%$ relative humidity.

Weighing shall be carried out to the following accuracies:

- test specimens up to 400 g, to $\pm 0,04$ g;
- test specimens above 400 g, to $\pm 0,1$ g.

C.6 Procedure

C.6.1 Soaking

Store the test specimens at atmospheric pressure for $(4 \pm 0,2)$ h in the containers specified in C.3.5 at $(20 \pm 3) ^\circ\text{C}$ in distilled or demineralized water, ensuring that the water covers the test specimens by at least 10 mm for the full 4 h period of soaking. In order to prevent the test samples floating, the samples are kept submerged by the grids specified in C.3.6.

C.6.2 Exposure to freezing and thawing

Remove the test specimens from the containers and allow them to drain on a sieve for 1 min. Then place them in the containers spreading them out evenly.

Place the containers in the low temperature cabinet, ensuring that the heat is extracted as uniformly as possible from all sides of all test specimens. The distance between each container, and between the containers and the sidewalls of the cabinet, shall not be less than 50 mm. After placing the containers in the cabinet, hold the air temperature in the cabinet at $-20 ^\circ\text{C}$ and at no stage allow the air temperature to fall below $-22 ^\circ\text{C}$ or rise above $-15 ^\circ\text{C}$. If necessary the charge shall be matched to the cooling-capacity of the cabinet.

The containers with the test specimens shall remain in the cabinet for a minimum of 4 h.

After completion of the freezing cycle, store the containers with the test specimens for at least 1 h in water at a constant temperature of $(20 \pm 3) ^\circ\text{C}$.

After the water has been carefully poured off and the test specimens allowed to drain, the next freezing cycle shall be started; in total 20 freeze-thaw cycles shall be performed.

NOTE If it is necessary to interrupt the test during the freezing cycle, the test specimens shall remain in the cabinet at $(-17,5 \pm 2,5) ^\circ\text{C}$. A total interruption of up to 72 h is permitted.

C.6.3 Sieving and drying

On completion of the 20th cycle, pour the content of each container on to a sieve having an aperture size that is half the lower size sieve used to prepare the test specimen (e.g. in case of the 8 mm to 16 mm fraction, on to a test sieve of 4 mm aperture size). Wash and sieve the test specimen on the specified sieve by hand. Dry and weigh the residue remaining on the sieve in accordance with C.5.3.

C.7 Calculation and expression of results

C.7.1 Calculate the undersize by combining the residues from the three test specimens, weigh and express the mass obtained as a percentage of the mass of the combined test specimens.

C.7.2 Calculate the result of the freeze-thaw test in accordance with the following equation:

$$F = [(M_1 - M_2)/M_1] \times 100$$

where

M_1 is the initial dry mass of the three test specimens before cycling, in grams;

M_2 is the final dry mass of the three test specimens after cycling, which is retained on the specified sieve, in grams;

F is the percentage loss in mass of the three test samples after freeze-thaw cycling.

C.8 Test Report

The test report shall refer to this European Standard and contain the following information:

- a) sampling method if known, and marking, type and origin of the laboratory samples;
- b) shape, size, grading and number of laboratory samples;
- c) visual observations of the aggregate retained on the specified sieve;

NOTE Any unusual disintegration of the aggregate retained on the sieve should be reported.

- d) result of the freeze-thaw test, F expressed to the nearest 0,1% by mass;
- e) date of report and name of test laboratory.

Annex D (informative)

Guidance on how to convert quantities by mass to quantities by volume

D.1 Background

Limiting values of chemical contents are based on normal weight aggregates with a loose bulk density of approximately $1\,500\text{ kg/m}^3$ ($1,50\text{ Mg/m}^3$).

Chemical contents determined in accordance with EN 1744-1 are expressed as a percentage on a mass basis.

For lightweight aggregate such a test value needs to be corrected before comparing it with the limiting value to allow for the low loose bulk density of lightweight aggregate.

Thus, an aggregate with a loose bulk density of 750 kg/m^3 ($0,75\text{ Mg/m}^3$) could contain twice the amount of a specific material on a mass by mass basis than could an aggregate having a loose bulk density of $1\,500\text{ kg/m}^3$ ($1,50\text{ Mg/m}^3$) and still comply with the limiting value per cubic metre of concrete.

D.2 Example calculation

The limiting value for an application is 0,01% mass by mass.

The proposed aggregate has a loose bulk density of 750 kg/m^3 ($0,75\text{ Mg/m}^3$).

The chemical content measured according to EN 1744-1 (say C_n) is 0,018 % mass by mass.

The comparison value is then:

$$C_n = 0,018 \frac{750}{1500} = 0,009$$

The comparison value of 0,009% is less than the limit value of 0,01%.

The proposed aggregate is therefore suitable for its intended application.

Annex E

(informative)

Guidance on the effects of some chemical constituents of lightweight aggregates on the durability of concrete, mortar and grout in which they are incorporated

E.1 General

Lightweight aggregates should not contain substances in quantities and forms that adversely affect the suitability for their intended use.

E.2 Chlorides

Chlorides can be present in lightweight aggregates. To minimise the risk of corrosion of embedded metal it is usual to limit the amount of chlorides in concrete and mortar contributed from all constituents.

E.3 Organic components

E.3.1 Two screening tests for the presence of organic matter are in common use: the sodium hydroxide test and the fulvo acid test. If the supernatant liquid in these tests is lighter than the standard colours when determined in accordance with EN 1744-1:1998, 15.1 and/or 15.2, the aggregate can be considered to be free from organic matter (see E.3.5).

NOTE Some inorganic compounds which discolour the supernatant liquid in the sodium hydroxide test do not adversely affect the setting and hardening of concrete/mortar.

E.3.2 Aggregates that contain organic or other substances in proportions which alter the rate of setting and hardening of concrete/mortar should be quantitatively assessed for the presence of such materials. The effect on stiffening time and compressive strength should be determined in accordance with EN 1744-1:1998, 15.3.

The proportions of such materials should be such that compliance with E.3.2 and E.3.4 is ensured.

E.3.3 The increase of the stiffening time of concrete/mortar test specimens should not be more than 120 min.

E.3.4 The decrease of the compressive strength of concrete/mortar test specimen should not be more than 20 %.

E.3.5 Sugars do not affect the colour of the supernatant liquid in the sodium hydroxide test or the fulvo acid test. If it is suspected that sugars or sugar type materials are present, the aggregate should be tested using the concrete/mortar specimen test specified in EN 1744-1:1998, 15.3. The stiffening time and compressive strength requirements given in E.3.3 and E.3.4 should apply.

E.4 Alkali aggregate reaction

Certain aggregates can react with alkalis present in the pore fluids of concrete, mortar and grout. Under adverse conditions and in the presence of moisture this can lead to expansion and subsequent cracking or disruption of the concrete, mortar and grout. The most common form of reaction occurs between alkalis and certain form of silica (alkali-silica reaction). Another much less common form of reaction is alkali-carbonate reaction.

E.4.1 In the absence of previous long-term experience of a lack of disruptive reactivity of a particular combination of cement and aggregate, it may be necessary to take account of the following precautions:

- a) limit the total alkali content of the concrete/mortar mix;
- b) use a cement with a low effective alkali content;
- c) use a non-reactive aggregate combination;
- d) limit the degree of saturation of the concrete/mortar with water.

E.4.2 The combination of aggregate and cement should be assessed using procedures described in regulations valid in the place of use only when compliance with one of the above procedures is not possible.

Annex F

(normative)

Factory production control

F.1 Introduction

This annex specifies a factory production control system for aggregates to ensure that they conform to the relevant requirements of this standard.

The performance of the factory production control system shall be assessed according to the principles used in this annex.

F.2 Organization

F.2.1 Responsibility and authority

The responsibility, authority and the interrelation between all personnel who manage, perform and check work affecting quality shall be defined, including personnel who need organizational freedom and authority to:

- a) initiate action to prevent the occurrence of product non-conformity;
- b) identify, record and deal with any product quality deviations.

F.2.2 Management representative for factory production control

For every aggregate producing plant the producer shall appoint a person with appropriate authority to ensure that the requirements given in this annex are implemented and maintained.

F.2.3 Management review

The factory production control system adopted to satisfy the requirements of this annex shall be audited and reviewed at appropriate intervals by management to ensure its continuing suitability and effectiveness. Records of such reviews shall be maintained.

F.3 Control procedures

The producer shall establish and maintain a factory production control manual setting out the procedures by which the requirements for factory production control are satisfied.

F.3.1 Document and data control

Document and data control shall include those documents and data that are relevant to the requirements of this standard covering purchasing, processing, inspection of materials and the factory production control system documents.

A procedure concerning the management of documents and data shall be documented in the production control manual covering procedures and responsibilities for approval, issue, distribution and administration of internal and external documentation and data; and the preparation, issue and recording of changes to documentation.

F.3.2 Sub-contract services

If any part of the operation is sub-contracted by the producer a means of control shall be established. The producer shall retain overall responsibility for any parts of the operation sub-contracted.

F.3.3 Knowledge of the raw material

There shall be documentation detailing the nature of the raw material, its source and where appropriate, one or more maps showing the location and extraction plan.

It is the producer's responsibility to ensure that if any dangerous substances are identified their content does not exceed the limits in force according to the provisions valid in the place of use of the aggregate.

NOTE Most of the dangerous substances defined in Council Directive 76/769/EEC are not usually present in most sources of aggregates of mineral origin. However Note in ZA. 1 is drawn to the attention of the aggregate producer.

F.4 Management of the production

The factory production control system shall fulfil the following requirements:

a) there shall be procedures to identify and control the materials;

NOTE These can include procedures for maintaining and adjusting processing equipment, inspection or testing material sampled during processing, modifying the process during bad weather, etc.

b) there shall be procedures to identify and control any hazardous materials identified in F.3.3 to ensure that they do not exceed the limits in force according to the provisions valid in the place of use of the aggregate;

c) there shall be procedures to ensure that material is put into stock in a controlled manner and the storage locations and their contents are identified;

d) there shall be procedures to ensure that material taken from stock has not deteriorated in such a way that its conformity is compromised;

e) the product shall be identifiable up to the point of sale as regards source and type.

F.5 Inspection and test

F.5.1 General

The producer shall make available all the necessary facilities, equipment and trained personnel to carry out the required inspections and tests.

F.5.2 Equipment

The producer shall be responsible for the control, calibration and maintenance of inspection, measuring and test equipment.

Accuracy and frequency of calibration shall be in accordance with EN 932-5.

Equipment shall be used in accordance with documented procedures.

Equipment shall be uniquely identified.

Calibration records shall be retained.

F.5.3 Frequency and location of inspection, sampling and tests

The production control document shall describe the frequency and nature of inspections. The frequency of sampling and the tests when required shall be carried out for the relevant characteristics as specified in Table F.1.

NOTE 1 Test frequencies are generally related to periods of production. A period of production is defined as a full week, month or year of production working days.

NOTE 2 The requirements for factory production control may introduce visual inspection. Any deviations indicated by these inspections can lead to increased test frequencies.

NOTE 3 When the measured value is close to a specified limit the frequency may need to be increased.

NOTE 4 Under special conditions the test frequencies can be decreased below those given in Table F.1. These conditions could be:

- a) highly automated production equipment;
- b) long-term experience with consistency of special properties;
- c) sources of high conformity;
- d) running a quality management system with exceptional measures for surveillance and monitoring of the production process.

The producer shall prepare a schedule of test frequencies taking into account the minimum requirements of Table F.1. Reasons for decreasing the test frequencies shall be stated in the factory production control document.

F.6 Records

The results of factory production control shall be recorded including sampling locations, dates and times and product tested with any other relevant information, e.g. weather conditions.

NOTE 1 Some characteristics can be shared by several products, in which case the producer, based on his experience, can find it possible to apply the results of one test to more than one product. This is particularly the case when a product is the combination of two or more different sizes. The particle size distribution or the cleanliness should be checked in case the intrinsic characteristics may have changed.

Where the product inspected or tested does not satisfy the declared value or if there is an indication that it shall not do so, a note shall be made in the records of the steps taken to deal with the situation (e.g. carrying out of a new test and/or measures to correct the production process).

The records required by all the clauses of this annex shall be included.

The records shall be kept for at least the statutory period.

NOTE 2 "Statutory period" is the period of time records are required to be kept in accordance with regulations applying at the place of production.

F.7 Control of non-conforming product

Following an inspection or test which indicates that a product does not conform the affected material shall be:

- a) reprocessed; or
- b) diverted to another application for which it is suitable; or
- c) rejected and marked as non-conforming.

All cases of non-conformity shall be recorded by the producer, investigated and if necessary corrective action shall be taken.

NOTE Corrective actions can include:

- a) investigation of the cause of non-conformity including an examination of the testing procedure and making any necessary adjustments;
- b) analysis of processes, operations, quality records, service reports and customer complaints to detect and eliminate potential causes of non-conformity;
- c) initiating preventive actions to deal with problems to a level corresponding to the risks

encountered;

d) applying controls to ensure that effective corrective actions are taken;

e) implementing and recording changes in procedures resulting from corrective action.

Table F.1 — Minimum test frequencies

Property		Clause	Notes	Test method	Minimum test frequencies ^a
1	Loose bulk density	4.2.1		EN 1097-3	1 per day or 1 per 1 000 m ³
2	Particle density	4.2.2		EN 1097-6:2000, annex C	1 per month or 1 per 20 000 m ³
3	Grading	4.4		EN 933-1	1 per week or 1 per 5 000 m ³
4	Fines	4.6		EN 933-1	1 per week or 1 per 5 000 m ³
5	Grading of fillers	4.7		EN 933-10	1 per week
6	Water absorption	4.8		EN 1097-6:2000, annex C	1 per month or 1 per 20 000 m ³
7	Water content	4.9		EN 1097-5	1 per day or 1 per 1 000 m ³
8	Crushing resistance	4.10		annex A	1 per month or 1 per 20 000 m ³
9	Percentage of crushed particles	4.11		EN 933-5	2 per year
10	Resistance to disintegration	4.12	Only to be determined in absence of long term experience	annex B	2 per year
11	Freezing and thawing resistance	4.13	Only be determined in the absence of long term experience	annex C	2 per year
12	Chloride	5.2		EN 1744-1:1998, clause 7	2 per year
13	Acid soluble sulfate	5.3.1		EN 1744-1:1998, clause 12	2 per year
14	Total sulfur	5.3.2		EN 1744-1:1998, clause 11	2 per year
15	Loss on ignition (for ashes only)	5.4		EN 1744-1:1998, clause 17	2 per year
16	Organic contaminants	5.5		EN 1744-1:1998, 15.3	2 per year
17	Alkali-silica reactivity	5.6		^b	When required and in case of doubt
18	Dangerous substances ^c In particular: Emission of radioactivity Release of heavy metals Release of polyaromatic carbons	F.3.3 F.4		^c	When required and in case of doubt

^a In accordance with the provisions valid in the place of use.

^b Where two test frequencies are mentioned, the minimum applies.

^c Unless otherwise specified, only when necessary for CE marking purposes (see annex ZA).

F.8 Handling, storage and conditioning in production areas

The producer shall make the necessary arrangements to maintain the quality of the product during handling and storage.

NOTE These arrangements should take account of the following:

- a) contamination of product;
- b) segregation;
- c) cleanliness of handling equipment and stocking areas.

F.9 Transport and packaging

F.9.1 Transport

The producer's factory production control system shall identify the extent of his responsibility in relation to storage and delivery.

NOTE When aggregates are transported in bulk it can be necessary to cover or contain aggregates to reduce contamination.

F.9.2 Packaging

If aggregates are packaged the methods and materials used shall not contaminate or degrade the aggregate to the extent that the properties are significantly changed before the aggregate is removed from the packaging. Any precautions necessary to achieve this during handling and storage of the packaged aggregate shall be marked on the packaging or accompanying documents.

F.10 Training of personnel

The producer shall establish and maintain procedures for the training of all personnel involved in the factory production system. Appropriate records of training shall be maintained.

Annex ZA (informative)

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

ZA.1 Scope and relevant characteristics

This European Standard and this annex ZA have been prepared under a mandate¹ given to CEN by the European Commission and the European Free Trade Association.

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

Compliance with these clauses confers a presumption of fitness of the aggregates and fillers covered by this European Standard for their 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 aggregates and fillers falling within the scope of this annex.

NOTE In addition to any specific clauses relating to dangerous substances contained in this standard there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive these requirements need also to be complied with when and where they apply. *Note: an informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (CREATE, accessed through <http://europa.eu.int>).*

Table ZA.1a – Scope and relevant requirement clauses

Product: Lightweight aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates as covered by the scope of this standard for use in concrete, mortar and grout Intended use(s): Buildings, roads and civil engineering works and the manufacturing of precast concrete products			
Essential Characteristics	Requirement clauses in this and/or another standard(s)	Level(s) and/or class(es):	Notes
Particle shape	4.5 Particle shape	None	Description
Particle size	4.4 Particle size distribution	None	Declared value
Loose bulk density	4.2.1 Loose bulk density	None	Declared value
Percentage of crushed particles	4.11 Percentage of crushed particles	None	Declared value
Cleanliness	5.5 Organic contaminants	None	Declared value
Resistance to fragmentation/crushing	4.10 Crushing resistance	None	Declared value
Composition/content	5.2 Chloride	None	Declared value
	5.3.1 Acid-soluble sulfate	None	Declared value
	5.3.2 Total sulfur	None	Declared value
Volume stability	4.12 Resistance to disintegration	None	Declared value
Water absorption	4.8 Water absorption	None	Declared value

¹ M125 "Aggregates", as amended

Table ZA.1a – Scope and relevant requirement clauses *(continued)*

Product: Lightweight aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates as covered by the scope of this standard for use in concrete, mortar and grout Intended use(s): Buildings, roads and civil engineering works and the manufacturing of precast concrete products			
Dangerous substances:			
Emission of radioactivity (for aggregates from radioactive sources intended for use in concrete in buildings) Release of heavy metals Release of polyaromatic carbons Release of other dangerous substances	NOTE in ZA.1 above F.3.3 Knowledge of the raw material F.4 Management of the production	None None	See third paragraph in ZA.3
Durability against freeze/thaw	4.13 Freezing and thawing resistance	None	Declared value
Durability against alkali-silica reactivity	5.6 alkali-silica reactivity	None	Declared value

Table ZA.1b – Scope and relevant requirement clauses

Product: Lightweight aggregate fillers obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates as covered by the scope of this standard for use in concrete, mortar and grout Intended use(s): Buildings, roads and civil engineering works			
Essential characteristics	Requirement clauses in this and/or another standard	Mandated level(s) or class(es):	Notes
Fineness/Particle size	4.7 Particle size distribution	None	Declared value
Loose bulk density	4.2.1 Loose bulk density	None	Declared value
Composition/content	5.2 Chloride	None	Declared value
	5.3.1 Acid-soluble sulfate	None	Declared value
	5.3.2 Total sulfur	None	Declared value
Cleanliness	5.5 Organic contaminants	None	Declared value
Soundness/Volume stability	4.12 Resistance to disintegration	None	Declared value
Loss on ignition (for ashes only)	5.4 Loss on ignition (for ashes only)	None	Declared value
Release of other dangerous substances	NOTE in ZA.1 above F.3.3 Knowledge of the raw material F.4 Management of the production	None None	See third paragraph in ZA.3
Durability against freeze/thaw	4.13 Freezing and thawing resistance	None	Declared value

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, producer s placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see clause ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedures for attestation of conformity of aggregates and fillers**ZA.2.1 System(s) of attestation of conformity**

The systems of attestation of conformity for the aggregates and fillers indicated in Table ZA.1a and Table ZA.1b, in accordance with the decision of the Commission 98/598/EC of 9 October 1998 as given in annex 3 of the mandate M125 "Aggregates", as amended, is shown in Tables ZA.2a and ZA.2b for the indicated intended use(s).

Table ZA.2a – System(s) of attestation of conformity for aggregates and fillers for uses with high safety requirements² (where third party intervention is required)

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Lightweight aggregates for concrete, mortar and grout	In buildings, roads and other civil engineering works	-	2+
Lightweight aggregates fillers for concrete mortar and grout	In buildings, the manufacturing of precast concrete products, for roads and other civil engineering works	-	2+
System 2+: See Directive 89/106/EEC (CPD) annex III.2.(ii), First possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control			

Table ZA.2b – System(s) of attestation of conformity for aggregates and fillers for uses without high safety requirements³ (where no third party intervention is required)

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Lightweight aggregates for concrete, mortar and grout	In buildings, roads and other civil engineering works	-	4
Lightweight aggregates fillers for concrete mortar and grout	In buildings, the manufacturing of precast concrete products, for roads and other civil engineering works	-	4
System 4: See Directive 89/106/EEC (CPD) annex III.2.(ii), Third possibility			

The attestation of conformity of the aggregates and fillers in Table ZA.1a and Table ZA.1b shall be based on the evaluation of conformity procedures indicated in Table(s) ZA 3a and Table ZA 3b resulting from application of the clauses of this European Standard indicated therein.

² Safety requirements are to be defined by Member States in their national laws, regulations and administrative provisions

³ Safety requirements are to be defined by Member States in their national laws, regulations and administrative provisions

**Table ZA.3a – Assignment of evaluation of conformity tasks
(for aggregates and fillers under system 2+)**

Tasks			Coverage of the task	Clauses to apply
Tasks for the producer	Factory production control (F.P.C)		Parameters related to all relevant characteristics of Table ZA.1a or Table ZA.1b	7.3
	Initial type testing		All relevant characteristics of Table ZA.1a or Table ZA.1b	7.2
Tasks for the notified body	Certification of F.P.C on the basis of	Initial inspection of factory and of F.P.C	Parameters related to all relevant characteristics of Table ZA.1a or Table ZA.1b	7.3
		Continuous surveillance, assessment and approval of F.P.C.	Parameters related to all relevant characteristics of Table ZA.1a or Table ZA.1b	7.3

**Table ZA.3b – Assignment of evaluation of conformity tasks
(for aggregates and fillers under system 4)**

Tasks			Coverage of the task	Clauses to apply
Tasks for the producer	Factory production control (F.P.C)		Parameters related to all relevant characteristics of Table ZA.1a or Table ZA.1b	7.3
	Initial type testing		All relevant characteristics of Table ZA.1a or Table ZA.1b	7.2

ZA.2.2 EC Declaration of conformity

For aggregates and fillers under system 2+: When compliance with the conditions of this annex is achieved, and once the notified body has drawn up the certificate mentioned below, the producer or his agent established in the EEA shall prepare and retain a declaration of conformity, which entitles the producer to affix the CE marking. This declaration shall include:

- name and address of the producer, or his authorised representative established in the EEA, and the place of production;
- description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (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 accompanying factory production control certificate;
- name of, and position held by, the person empowered to sign the declaration on behalf of the producer or his authorised representative.

The declaration shall be accompanied by a factory production control certificate, drawn up by the notified body, which shall contain, in addition to the information above, the following:

- name and address of the notified body;
- the number of the factory production control certificate;
- conditions and period of validity of the certificate, where applicable;
- name of, and position held by, the person empowered to sign the certificate.

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.

- **For aggregates and fillers under system 4:** When compliance with this annex is achieved, the producer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which authorises the affixing of the CE marking. This declaration shall include:
- name and address of the producer, or his authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- name of, and position held by, the person empowered to sign the declaration on behalf of the producer or of 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.

ZA.3 CE marking and labelling

The producer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the accompanying label, the packaging or on the accompanying commercial documents (e.g. a delivery note). The following information shall accompany the CE marking symbol:

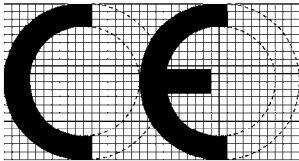
- identification number of the certification body (only for products under system 2+);
- name or identifying mark and registered address of the producer;
- the last two digits of the year in which the marking is affixed;
- number of the certificate of factory production control (only for products under system 2+);
- reference to this European Standard;
- description of the product: generic name, material, dimensions, ... and intended use;
- information on the relevant essential characteristics in Table ZA.1a or ZA.1b:
 - declared values and, where relevant, level or class/category (including "pass" for pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in "Notes" in Tables ZA.1a or ZA.1b; and
 - "no performance determined" for characteristics where this is relevant.

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

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

NOTE European legislation without national derogations need not be mentioned.

Figures ZA.1, ZA.2, ZA.3 and ZA.4 give examples of the information to be given on the label, packaging and/or commercial documents.

	
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0123-CPD-0456	
EN 13055-1	
Lightweight aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in concrete, mortar and grout	
Particle shape	Description
Particle size	Declared value (% passing)
Loose bulk density	Declared value (kg/m ³ /Mg/m ³)
Percentage of crushed particles	Declared value (% by mass)
Cleanliness	Declared value (% relative compressive strength)
Resistance to fragmentation/crushing	Declared value (N/mm ²)
Composition/content	
Chloride	Declared value (% Cl)
Acid-soluble sulfate	Declared value (% SO ₃)
Total sulfur	Declared value (% S)
Volume stability	Declared value (% loss in mass)
Water absorption	Declared value (% dry mass)
Emission of radioactivity	Declared values as requested
Release of heavy metals	} Threshold values valid in the place of use
Release of polyaromatic carbons	
Release of other dangerous substances	e.g. Substance X: 0,2 µm ³
Durability against freeze-thaw	Percentage loss in mass
Durability against alkali-silica reactivity	Declared value as requested

CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC

Identification number of the inspection body

Name or identifying mark and registered address of the producer

Last two digits of the year in which the marking was affixed

Number of the EC certificate

No. of European Standard

Description of product

and

information on product and on regulated characteristics

Figure ZA.1 — Example of CE marking information for lightweight aggregates for concrete, mortar and grout under system 2+

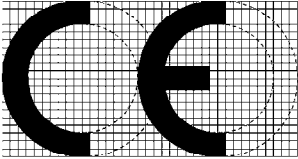
		CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC
01234		Identification number of the inspection body
Any Co Ltd, PO Box 21, B-1050		Name or identifying mark and registered address of the producer
02		Last two digits of the year in which the marking was affixed
0123-CPD-0456		Number of the EC certificate
EN 13305-1		No. of European Standard
Lightweight aggregate fillers obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in concrete, mortar and grout		Description of product
		and
		information on product and on regulated characteristics
Fineness/Particle size	Declared value	(% passing)
Loose bulk density	Declared value	(kg/m³/Mg/m³)
Composition/content		
Chloride	Declared value	(% Cl)
Acid-soluble sulfate	Declared value	(% SO₃)
Total sulfur	Declared value	(% S)
Cleanliness	Declared value	(% relative compressive strength)
Soundness/Volume stability	Declared value	(% loss in mass)
Loss on ignition (ashes only)	Pass/fail threshold value	(%)
Release of dangerous substances	e.g. Substance X: 0,2 µm³	
Durability against freeze-thaw	Declared value	(F or MS)

Figure ZA.2 — Example of CE marking information for lightweight aggregate fillers for concrete, mortar and grout under system 2+

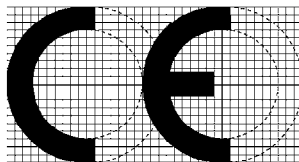
		CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC	
Any Co Ltd, PO Box 21, B-1050		Name or identifying mark and registered address of the producer	
02		Last two digits of the year in which the marking was affixed	
EN 13055-1		No. of European Standard	
Lightweight aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in concrete, mortar and grout		Description of product	
		and	
		information on product and on regulated characteristics	
Particle shape	Description		
Particle size	Declared value	(% passing)	
Loose bulk density	Declared value	(kg/m³/Mg/m³)	
Percentage of crushed particles	Declared value	(% by mass)	
Cleanliness	Declared value	(% relative compressive strength)	
Resistance to fragmentation/crushing	Declared value	(N/mm²)	
Composition/content			
Chloride	Declared value	(% Cl)	
Acid-soluble sulfate	Declared value	(% SO₃)	
Total sulfur	Declared value	(% S)	
Volume stability	Declared value	(% loss in mass)	
Water absorption	Declared value	(% dry mass)	
Emission of radioactivity	Declared values as requested		
Release of heavy metals	} Threshold values valid in the place of use		
Release of polyaromatic carbons			
Release of other dangerous substances	e.g. Substance X: 0,2 µm³		
Durability against freeze-thaw	Percentage loss in mass		
Durability against alkali-silica reactivity	Declared value as requested		

Figure ZA.3 — Example of CE marking information for lightweight aggregates for concrete, mortar and grout under system 4

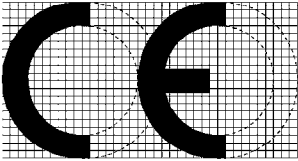
			CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC
Any Co Ltd, PO Box 21, B-1050			Name or identifying mark and registered address of the producer
02			Last two digits of the year in which the marking was affixed
EN 13305-1			No. of European Standard
Lightweight aggregate fillers obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in concrete, mortar and grout			Description of product
			and
			information on product and on regulated characteristics
Fineness/Particle size	Declared value	(% passing)	
Loose bulk density	Declared value	(kg/m ³ /Mg/m ³)	
Composition/content			
Chloride	Declared value	(% Cl)	
Acid-soluble sulfate	Declared value	(% SO ₃)	
Total sulfur	Declared value	(% S)	
Cleanliness	Declared value	(% relative compressive strength)	
Soundness/Volume stability	Declared value	(% loss in mass)	
Loss on ignition (ashes only)	Pass/fail threshold value	(%)	
Release of dangerous substances	e.g. Substance X: 0,2 µm ³		
Durability against freeze-thaw	Declared value	(F or MS)	

Figure ZA.4 — Example of CE marking information for lightweight aggregate fillers for concrete, mortar and grout under system 4

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