



SLOVENSKI STANDARD
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Lahki agregati za beton, malto, injekcijsko malto, bitumenske zmesi, površinske prevleke ter za uporabo v nevezanih in vezanih mešanicah

Lightweight aggregates for concrete, mortar, grout, bituminous mixtures, surface treatments and for unbound and bound applications

Leichte Gesteinskörnungen für Beton, Mörtel, Einpressmörtel, bitumengebundene Mischungen, Oberflächenbehandlungen und für ungebundene und gebundene Anwendungen

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Granulats légers pour bétons, mortiers, mélanges hydrocarbonés, enduits superficiels et pour utilisation en couches traitées et non traitées

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
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Will supersede EN 13055-1:2002, EN 13055-2:2004

English Version

Lightweight aggregates for concrete, mortar, grout, bituminous mixtures, surface treatments and for unbound and bound applications

Granulats légers pour bétons, mortiers, mélanges hydrocarbonés, enduits superficiels et pour utilisation en couches traitées et non traitées

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 154.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN 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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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (prEN 13055:2012) has been prepared by Technical Committee CEN/TC 154 "Aggregates", the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13055-1:2002, EN 13055-2:2004.

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.

Annexes A, B and C are normative. Annexes D, E and F are informative.

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

EN 12620, *Aggregates for concrete*,

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

EN 13139, *Aggregates for mortar*, (standards.iteh.ai)

EN 13242, *Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction*,

EN 13383-1, *Armourstone - Part 1: Specification*, <https://standards.iteh.ai/catalog/standards/sist/184e1772-20a8-4719-8b7a-99f2d23bf58/osist-pren-13055-2012>

EN 13383-2, *Armourstones - Part 2: Test methods*,

EN 13450, *Aggregates for railway ballast*.

1 Scope

This European Standard specifies the properties of lightweight aggregates and fillers derived thereof obtained by processing natural or manufactured materials and mixtures of these aggregates for concrete, mortar and grout, bituminous mixtures and surface treatments and for unbound and hydraulically bound applications for construction works.

This European Standard covers lightweight aggregates of mineral origin having particle densities not exceeding 2000 kg/m^3 ($2,000 \text{ Mg/m}^3$) or loose bulk densities not exceeding 1200 kg/m^3 ($1,200 \text{ Mg/m}^3$) including:

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

A list of the source materials that have been considered and are within the scope of this standard is given in Annex A (normative).

NOTE 1 Recycled aggregates from construction and demolition waste and Municipal Solid Waste Incinerator Bottom Ash (MIBA) are covered by standards EN 12620, EN 13043, EN 13139 and EN 13242.

Some lightweight aggregates for specific applications are covered in separate European product standards (Annex B, normative).

This standard incorporates a general requirement that aggregates 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.

NOTE 2 Requirements for the declaration of the potential of aggregates to release regulated dangerous substances are currently under development. Until such time as these are finalised attention should be paid to requirements at the place of use.

This standard also specifies that a quality control system is in place for use in factory production control and it provides for the evaluation of conformity of the products to this European Standard.

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

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.

prEN 1367-x, *Tests for thermal and weathering properties of aggregates – Part X: Determination of resistance to freezing and thawing of lightweight aggregates.*

prEN 1097-y, *Tests for mechanical and physical properties of aggregates – Part Y: Determination of compressibility and confined compressive strength of lightweight aggregates.*

prEN 1367-z, *Tests for thermal and weathering properties of aggregates – Part Z : Determination of resistance to disintegration of lightweight aggregates.*

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 filler aggregates (air jet sieving).*

EN 1097-1, *Tests for mechanical and physical properties of aggregates — Part 1: Determination of the resistance to wear (micro-Deval)*

EN 1097-2, *Tests for mechanical and physical properties of aggregates — Part 2: Methods for the determination of resistance to fragmentation*

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

EN 1097-4, *Tests for mechanical and physical properties of aggregates — Part 4: Determination of the voids of dry compacted filler.*

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 1097-6:2011, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption.*

EN 1097-8, *Tests for mechanical and physical properties of aggregates — Part 8: Determination of the polished stone value.*

EN 1097-9, *Tests for mechanical and physical properties of aggregates — Part 9: Determination of the resistance to wear by abrasion from studded tyres — Nordic test.*

EN 1097-10, *Tests for mechanical and physical properties of aggregates — Part 10: Determination of water suction height.*

EN 1367-5, *Tests for thermal and weathering properties of aggregates — Part 5: Determination of resistance to thermal shock.*

EN 1744-1:2009, *Tests for chemical properties of aggregates — Part 1: Chemical analysis.*

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EN 1744-3, *Tests for chemical properties of aggregates — Part 3: Preparation of eluates by leaching of aggregates.*

EN 12664, *Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products of medium and low thermal resistance.*

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

EN 12697-11, *Bituminous mixtures - Test methods for hot mix asphalt - Part 11: Determination of the affinity between aggregate and bitumen.*

EN 13179-1, *Tests for filler aggregate used in bituminous mixtures - Part 1: Delta ring and ball test.*

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

EN ISO 10456, *Building materials and products – Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values.*

3 Terms and definitions

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

- 3.1 aggregate**
granular material used in construction. Aggregate can be natural, manufactured, by-product or recycled
- 3.2 lightweight aggregate**
aggregate of mineral origin having a particle density not exceeding 2000 kg/m^3 ($2,000 \text{ Mg/m}^3$) or a loose bulk density not exceeding 1200 kg/m^3 ($1,200 \text{ Mg/m}^3$)
- 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 fine lightweight aggregate**
designation given to the smaller aggregate size with d equal to or greater than 0 mm and D less than or equal to 4 mm

3.8**coarse lightweight aggregate**

designation given to the larger aggregate size with d equal to or greater than 2 mm and D greater than 4 mm

3.9**all in lightweight aggregate**

designation given to the aggregate size with d equal to or greater than 0 mm and D greater than 4 mm

3.10**lightweight filler aggregate**

filler derived from lightweight aggregate, from which most passes a 0,063 mm sieve and 100 % passes a 0,125 mm sieve

3.11**grading**

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

3.12**aggregate size**

designation of aggregate in terms of lower sieve (d) and upper sieve (D) sizes expressed as d/D

Note 1 to entry: The designation accepts the presence of some particles which are retained on the upper sieve (oversize) and some particles which pass the lower sieve (undersize).

3.13**constant mass**

successive weighings after drying and conditioning at least 1 h apart not differing by more than 0,1 %

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4 Symbols and abbreviations

d	lower sieve	https://standards.iteh.ai/catalog/standards/sist/184e1772-20a8-4719-8b7a-f99f2d23bf58/osist-pren-13055-2012
D	upper sieve	
LWA	lightweight aggregate(s)	
PSV	polished stone value	

5 Requirements**5.1 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 properties.

5.2 Density**5.2.1 Loose bulk density**

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

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

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5.2.2 Particle density

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

5.3 Aggregate size

5.3.1 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 specified in Table 1.

NOTE This designation accepts the presence of some particles which will be retained on the upper sieve (sometimes referred to as (D)) and some which will pass the lower sieve (sometimes referred to as (d)).

Table 1 — Sieve sizes for specifying aggregate 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)	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 Figures in parenthesis can be used to provide simplified descriptions of aggregate sizes.

5.3.2 Undersize

The quantity of the undersize passing the lower sieve (d) shall not exceed 15 % by mass.

5.3.3 Oversize

The quantity of the oversize retained on the upper sieve (D) shall not exceed 10 % by mass. When required the sieve through which 100 % of the aggregate passes shall be declared.

5.4 Grading

The particle size distribution shall be determined in accordance with EN 933-1 without washing.

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

5.5 Fines content in LWA

When required the content of fines in LWA shall be determined in accordance with EN 933-1 without washing.

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

5.6 Grading of lightweight filler aggregate

When required the particle size distribution of lightweight filler aggregate shall be determined in accordance with EN 933-10.

5.7 Particle shape

When required particle shape shall be described.

NOTE Test methods for normal weight aggregates are not applicable.

5.8 Water content

When required the water content of the LWA shall be determined in accordance with EN 1097-5.

NOTE In many cases constant mass can be achieved after a test portion has been dried for a pre-determined period in a specified oven at $(110 \pm 5) ^\circ\text{C}$. Test laboratories can determine the time required to achieve constant mass for specific types and sizes of sample dependent upon the drying capacity of the oven used.

5.9 Water absorption

When required the water absorption of coarse LWA shall be determined in accordance with EN 1097-6 Annex C and E

5.10 Bulk crushing resistance

When required the bulk crushing resistance of LWA shall be determined in accordance with Annex C.

NOTE 1 There is no simple relationship between the bulk crushing resistance of LWA and the properties at its end use.

NOTE 2 The bulk crushing resistance is intended only for factory production control and quality documentation.

5.11 Percentage of crushed particles

When required the percentage of crushed particles of LWA shall be determined in accordance with EN 933-5.

NOTE This test method may not be applicable to all LWA having a bulk density of less than 150 kg/m^3 ($0,150 \text{ Mg/m}^3$).

prEN 13055:2012 (E)**5.12 Resistance to disintegration**

When required the resistance to disintegration for LWA shall be determined in accordance with prEN 1367-z.

NOTE This test method may not be applicable to all LWA having a bulk density of less than 150 kg/m^3 ($0,150 \text{ Mg/m}^3$).

5.13 Freezing and thawing resistance

When required the resistance to freezing and thawing of LWA used in exposed hydraulically and unbound applications having a particle size of not less than 4 mm and a bulk density of not less than 150 kg/m^3 ($0,150 \text{ Mg/m}^3$) shall be determined in accordance with prEN 1367-x.

When the resistance to freezing and thawing of aggregates of 4 mm or less (e.g. fine LWA or LWA fillers) or a density of less than 150 kg/m^3 ($0,150 \text{ Mg/m}^3$) 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.

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

5.14 Water suction height

When required the water suction height of LWA shall be determined in accordance with EN 1097-10.

5.15 Compressibility and confined compressive strength

When required the compressibility and confined compressive strength of LWA shall be determined in accordance with prEN 1097-y.

NOTE This test method developed for LWA having a bulk density of not less than 150 kg/m^3 ($0,150 \text{ Mg/m}^3$) has not been fully evaluated with all types of lightweight aggregates.

5.16 Resistance to cyclic compressive loading

When required the resistance to cyclic compressive loading of LWA shall be determined in accordance with EN 13286-7.

NOTE This test method may not be applicable to all LWA having a bulk density of less than 150 kg/m^3 ($0,150 \text{ Mg/m}^3$).

5.17 Stiffening properties

When required the stiffening properties of lightweight filler aggregate in bituminous mixtures shall be determined in accordance with EN 13179-1.

5.18 Voids of dry compacted lightweight filler aggregate

When required the voids of dry compacted lightweight filler aggregate shall be determined in accordance with EN 1097-4.

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.19 Resistance to thermal shock

When required the resistance to thermal shock of LWA shall be determined in accordance with EN 1367-5.

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.20 Resistance to polishing (PSV)

When required the polished stone value (PSV) of coarse LWA shall be determined in accordance with EN 1097-8.

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.21 Resistance to wear by abrasion from studded tyres of coarse LWA in surface treatments (Nordic test)

When required the resistance to abrasion from studded tyres (Nordic test) shall be determined in accordance with EN 1097-9.

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.22 Affinity between LWA and bitumen

When required the affinity between LWA and bitumen shall be determined in accordance with EN 12697-11.

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.23 Resistance to fragmentation (Los Angeles)

When required the resistance to fragmentation of coarse LWA shall be determined in accordance with EN 1097-2

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.24 Resistance to wear (micro Deval)

When required the resistance to wear of coarse LWA shall be determined in accordance with EN 1097-1.

NOTE The test method developed primarily for normal weight aggregates has not been evaluated for its suitability for LWA to establish a pattern of use.

5.25 Chemical requirements

5.25.1 General

The necessity for testing and declaring all properties in this clause is limited to particular application at end use or origin of the aggregate. When required the tests specified in this clause 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:

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

where:

V_c is the comparison value;

V_m is the value measured in accordance with EN 1744-1;

1500 is the assumed nominal loose bulk density of normal weight aggregate.

NOTE Further guidance is given in Annex D.

5.25.2 Water solubility

When required the water solubility of lightweight filler aggregate used in bituminous mixtures shall be determined in accordance with EN 1744-1.

5.25.3 Chloride

When required the water-soluble chloride ion content shall be determined in accordance with EN 1744-1.

NOTE Further guidance is given in Annex E.

5.25.4 Sulphur containing compounds**5.25.4.1 Acid-soluble sulphate**

When required the acid-soluble sulphate content shall be determined in accordance with EN 1744-1.

5.25.4.2 Total sulphur

When required the total sulphur content shall be determined in accordance with EN 1744-1.

5.25.5 Loss on ignition (for ashes only)

The loss on ignition shall be determined in accordance with EN 1744-1.

5.25.6 Water-soluble constituents

When required the water-soluble constituents shall be determined in accordance with EN 1744-3.

5.25.7 Organic contaminators

When required 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 1744-1:2009 (see 15.3).

NOTE Further guidance is given in Annex E.

5.25.8 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.

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

5.26 Thermal conductivity

5.26.1 General

When required the thermal conductivity of LWA (including air voids) shall be determined in the air dry condition in accordance with EN 12664 or EN 12667 in the case of dry LWA with a thermal conductivity value less than 0,15 W/(mK).

5.26.2 Correction for moisture

Design values shall be obtained by correcting measured values in accordance with EN ISO 10456.

6 Testing

6.1 Sampling and sample reduction

Sampling and sample reduction shall be carried out in accordance with EN 932-1, and if required in accordance with EN 932-2.

NOTE To ensure a representative sample care should be taken to minimize segregation and degradation.

6.2 Quantity of test specimens

The test specimen quantity specified in any test method shall, if not taken into account for LWA, be corrected on the basis of loose bulk density (see example in Annex D).

6.3 Preparation of test specimens for thermal conductivity testing

6.3.1 Drying

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

6.3.2 Conditioning after drying

Allow the test specimen to cool to room temperature. When required allow the test specimen to condition to moisture equilibrium at $(23 \pm 5)^\circ\text{C}$ and $(50 \pm 10) \%$ relative humidity.

6.3.3 Preparation of test specimens

Care shall be taken to avoid excessive segregation and crushing when placing material in the apparatus. The density of the specimen shall be determined and declared, based on the mass of the specimen and the dimensions of the specimen enclosure.

6.3.4 Thickness of test specimens

Test specimens shall be at least 10 times as thick as the mean aggregate size in the sample.

NOTE Test specimens with a thickness of five times the mean aggregate size are permitted if it can be shown that the required testing accuracy is obtained.