SLOVENSKI STANDARD
SIST EN 12620:2002+A1:2008

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Agregati za beton

Aggregates for concrete

Gesteinskörnungen für Beton

Granulats pour béton

Ta slovenski standard je istoveten z: **EN 12620:2002+A1:2008**

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Aggregates for concrete

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This European Standard was approved by CEN on 1 August 2002 and includes Corrigendum 1 issued by CEN on 26 May 2004 and Amendment 1 approved by CEN on 16 February 2008.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

Foreword

This document (EN 12620:2002+A1:2008) 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of an identical text or by endorsement, at the latest by October 2008 and conflicting national standards shall be withdrawn at the latest by October 2008.

This document includes Amendment 1, approved by CEN on 2008-02-16.

This document supersedes EN 12620:2002.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟦A1⟩ ⟨A1⟧.

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags ⟦AC⟩ ⟨AC⟧.

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.

⟦A1⟩ This amendment introduces clauses for recycled aggregates. The clauses call up new test methods, prEN 933-11, EN 1744-5, EN 1744-6 and EN 1367-4. These standards are at an advanced stage of preparation. ⟨A1⟧

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

This standard includes a Bibliography.

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

EN 13043	Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas
EN 13055-1	Lightweight aggregates - Part 1 : Lightweight aggregates for concrete, mortar and grout
prEN 13055-2	Lightweight aggregates - Part 2 : Lightweight aggregates for unbound and bound applications
EN 13139	Aggregates for mortar
prEN 13242	Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction
EN 13383-1	Armourstone - Part 1: Specification
prEN 13450	Aggregates for railway ballast

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

1 Scope

This European Standard specifies the properties of aggregates and filler aggregates obtained by processing natural, manufactured or recycled materials and mixtures of these aggregates for use in concrete. It covers aggregates having an oven dried particle density greater than 2,00 Mg/m^3 (2 000 kg/m^3) for all concrete, including concrete in conformity with EN 206-1 and concrete used in roads and other pavements and for use in precast concrete products. [A1] It also covers recycled aggregate with densities between 1,50 Mg/m^3 (1 500 kg/m^3) and 2,00 Mg/m^3 (2 000 kg/m^3) with appropriate caveats and recycled fine aggregate (4 mm) with appropriate caveats. [A1]

It 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.

This standard does not cover filler aggregates to be used as a constituent in cement or as other than inert filler aggregates for concrete.

[AC] NOTE 1 Aggregates used in construction should comply with all the requirements of this European Standard. As well as familiar and traditional natural and manufactured aggregates Mandate M/125 “Aggregates” included recycled aggregates and some materials from new or unfamiliar sources. Recycled aggregates are included in the standards and new test methods for them are at an advanced stage of preparation. For unfamiliar materials from secondary sources, however, the work on standardisation has only started recently and more time is needed to define clearly the origins and characteristics of these materials. In the meantime such unfamiliar materials when placed on the market as aggregates must comply fully with this standard and national regulations for dangerous substances (see Annex ZA of the standard) depending upon their intended use. Additional characteristics and requirements may be specified on a case by case basis depending upon experience of use of the product, and defined in specific contractual documents. [AC]

NOTE 2 Properties for lightweight aggregates are specified in [A1] EN 13055-1:2002 [A1].

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).

[A1] *deleted text* [A1]

[A1] EN 196-2:2005, *Methods of testing cement — Part 2: Chemical analysis of cement* [A1]

EN 932-3, *Tests for general properties of aggregates — Part 3: Procedure and terminology for simplified petrographic description*

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 933-3, *Tests for geometrical properties of aggregates — Part 3: Determination of particle shape — Flakiness index*

EN 933-4, *Tests for geometrical properties of aggregates — Part 4: Determination of particle shape — Shape index*

EN 933-7, *Tests for geometrical properties of aggregates — Part 7: Determination of shell content — Percentage of shells in coarse aggregates*

EN 933-8, *Tests for geometrical properties of aggregates — Part 8: Assessment of fines — Sand equivalent test*

EN 933-9, *Tests for geometrical properties of aggregates — Part 9: Assessment of fines — Methylene blue test*

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

[A1] prEN 933-11, *Tests for geometrical properties of aggregates — Part 11: Classification test for the constituents of coarse recycled aggregates* [A1]

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

EN 1097-2:1998, *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 1097-6, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption*

EN 1097-8:1999, *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*

[A1] EN 1367-1:2007 [A1], *Tests for thermal and weathering properties of aggregates — Part 1: Determination of resistance to freezing and thawing*

EN 1367-2, *Tests for thermal and weathering properties of aggregates — Part 2: Magnesium sulfate test*

EN 1367-4, *Tests for thermal and weathering properties of aggregates — Part 4: Determination of drying shrinkage*

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

[A1] EN 1744-5, *Tests for chemical properties of aggregates — Part 5: Determination of acid soluble chloride salts*

EN 1744-6, *Tests for chemical properties of aggregates — Part 6: Determination of the influence of recycled aggregate extract on the initial setting time of cement* [A1]

ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

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 or re-cycled

3.2
natural aggregate
aggregate from mineral sources which has been subjected to nothing more than mechanical processing

3.3
all-in aggregate
aggregate consisting of a mixture of coarse and fine aggregates

NOTE It can be produced without separating into coarse and fine fractions or it may be produced by combining coarse and fine aggregate.

3.4
manufactured aggregate
aggregate of mineral origin resulting from an industrial process involving thermal or other modification

3.5
recycled aggregate
aggregate resulting from the processing of inorganic material previously used in construction

3.6
filler aggregate
aggregate, most of which passes a 0,063 mm sieve, which can be added to construction materials to provide certain properties

NOTE See 3.12 for the definition of "fines".

3.7
aggregate size
designation of aggregate in terms of lower (*d*) and upper (*D*) sieve sizes expressed as *d*/*D*

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).

3.8
fine aggregate
designation given to the smaller aggregate sizes with *D* less than or equal to 4 mm

NOTE Fine aggregate can be produced from natural disintegration of rock or gravel and/or by the crushing of rock or gravel or processing of manufactured aggregate.

3.9
coarse aggregate
designation given to the larger aggregate sizes with *D* greater than or equal to 4 mm and *d* greater than or equal to 2 mm

3.10
natural graded 0/8 mm aggregate
designation given to natural aggregate of glacial and/or fluvial origin with *D* less than or equal to 8 mm

NOTE This aggregate can also be produced by blending processed aggregate.

3.11
batch
production quantity, a delivery quantity, a partial delivery quantity (railway wagon-load, lorry-load, ship's cargo) or a stockpile produced at one time under conditions that are presumed uniform

NOTE With a continuous process the quantity produced during a specified period should be treated as a batch.

3.12
fines
particle size fraction of an aggregate which passes the 0,063 mm sieve

3.13
category
level of a property of an aggregate expressed as a range of values or a limiting value

NOTE There is no relationship between the categories of different properties.

3.14
grading
particle size distribution expressed as the percentages by mass passing a specified set of sieves

4 Geometrical 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 in clause 4 shall be carried out to determine appropriate geometrical properties.

NOTE 1 When the value of a property is required but not defined by specified limits the value should be declared by the producer as an $XX_{Declared}$ category, e.g., in Table 8 a value of say 55 for the flakiness index corresponds to FI_{55} (Declared value).

NOTE 2 When a property is not required, a “No requirement” category can be used.

NOTE 3 Guidance on selection of approriate categories for specific applications can be found in national provisions in the place of use of the aggregate.

4.2 Aggregate sizes

All aggregates shall be described in terms of aggregate sizes using the designations *d*/*D* except for aggregates added as fillers which shall be specified as filler aggregate and shall comply with the grading requirements specified in 4.3.

Aggregate sizes shall be specified 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. A combination of sizes from set 1 and set 2 is not permissible.

Aggregate sizes shall have *D*/*d* not less than 1,4.

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
1	1	1
2	2	2
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 Grading

4.3.1 General

The grading of the aggregate, when determined in accordance with EN 933-1, shall comply with the requirements of 4.3.1 to 4.3.6 as appropriate to its aggregate size *d*/*D*.

NOTE When aggregates of significantly different density are blended caution is necessary to avoid segregation.

When assessing aggregates within a system of factory production control at least 90 % of gradings, taken on different batches within a maximum period of 6 months, shall fall within the limits specified in 4.3.2 to 4.3.6 for tolerances on producers' declared typical gradings.

4.3.2 Coarse aggregates

All coarse aggregates shall comply with the general grading requirements specified in Table 2 appropriate to their size designation *d*/*D* and the selected categories from Table 2.

Table 2 — General grading requirements

Aggregate	Size	Percentage passing by mass					Category G^{d}
		2 *D*	1,4 *D* [a & b]	*D* [c]	*d* [b]	*d*/2 [a & b]	
Coarse	*D*/*d* ≤ 2 or *D* ≤ 11,2 mm	100 100	98 to 100 98 to 100	85 to 99 80 to 99	0 to 20 0 to 20	0 to 5 0 to 5	G_C85/20 G_C80/20
	D/*d* > 2 and *D* > 11,2 mm	100	98 to 100	90 to 99	0 to 15	0 to 5	G_C90/15
Fine	*D* ≤ 4 mm and *d* = 0	100	95 to 100	85 to 99	–	–	G_F85
Natural graded 0/8	*D* = 8 mm and *d* = 0	100	98 to 100	90 to 99	–	–	G_{NG}90
All-in	*D* ≤ 45 mm and *d* = 0	100 100	98 to 100 98 to 100	90 to 99 85 to 99	–	–	G_A90 G_A85

[a] Where the sieves calculated are not exact sieve numbers in the ISO 565:1990 R 20 series then the next nearest sieve size shall be adopted.
[b] For gap graded concrete or other special uses additional requirements may be specified.
[c] The percentage passing *D* may be greater than 99 % by mass but in such cases the producer shall document and declare the typical grading including the sieves *D*, *d*, *d*/2 and sieves in the basic set plus set 1 or basic set plus set 2 intermediate between *d* and *D*. Sieves with a ratio less than 1,4 times the next lower sieve may be excluded.
[d] Other aggregate product standards have different requirements for categories.

For graded coarse aggregates where:

a) *D* > 11,2 mm and *D*/*d* > 2; or

b) *D* ≤ 11,2 mm and *D*/*d* > 4,

the following additional requirements (i) and (ii) shall apply for the percentage passing the mid-size sieve:

i) all gradings shall comply with the overall limits given in Table 3;

ii) the producer shall document and, on request, declare the typical grading passing the mid-size sieve and tolerances selected from the categories in Table 3.

Table 3 — Overall limits and tolerances for coarse aggregate grading at mid-size sieves

D/*d*	Mid-size sieve mm	Overall limits and tolerances at mid-size sieves (percentage passing by mass)		Category G_T
		Overall limits	Tolerances on producer's declared typical grading	
< 4	*D*/1,4	25 to 70	± 15	G_T15
≥ 4	*D*/2	25 to 70	± 17,5	G_T17,5
Where the mid-size sieve calculated as above is not an exact sieve size in the ISO 565:1990/R20 series then the nearest sieve in the series shall be used. NOTE Overall limits and tolerances for the most common product sizes are illustrated in annex A.				

For single size coarse aggregates where:

a) $D > 11{,}2$ mm and $D/d \leq 2$; or

b) $D \leq 11{,}2$ mm and $D/d \leq 4$,

there shall be no requirements additional to those specified in Table 2.

4.3.3 Fine aggregate

Fine aggregates shall comply with the general grading requirements specified in Table 2 appropriate to their upper sieve size *D*.

The following additional requirements shall be applied to control the variability of the fine aggregate.

The producer shall document and, on request, declare the typical grading for each fine aggregate size produced. Typical grading is expressed as the percentage by mass of aggregate passing through the sieve sizes specified in Table 4.

NOTE Recommendations for the classification of coarseness of the fine aggregate are given in annex B (Tables B.1 and B.2)

Fine aggregates in regular satisfactory use for most applications shall comply with the requirements specified in Table 4. When specified for special uses and cases where the variability of grading is reduced, the grading tolerances shall be applied in accordance with annex C.

Table 4 — Tolerances on producer's declared typical grading for general use fine aggregates

Sieve size	Tolerances in percentages passing by mass		
mm	0/4	0/2	0/1
4	± 5 [a]	–	–
2	–	± 5 [a]	–
1	± 20	± 20	± 5 [a]
0,250	± 20	± 25	± 25
0,063 [b]	± 3	± 5	± 5

[a] Tolerances of ± 5 are further limited by the requirements for the percentage passing *D* in Table 2.

[b] In addition to the tolerances stated the maximum value of the fines content for the category selected from Table 11 applies for the percentage passing the 0,063 mm sieve.

4.3.4 Natural graded 0/8 mm aggregate

Natural graded 0/8 mm aggregate shall comply with the general grading requirements specified in Table 2.

The following additional requirements shall be applied to control the variability of natural graded 0/8 mm aggregate:

a) the producer shall document and, on request, declare the typical grading for each aggregate produced;

b) gradings shall comply with the tolerances given in Table 5.

Table 5 — Tolerances on producer's declared typical grading for natural graded 0/8 mm aggregate

Sieve size mm	Tolerances Percentages passing by mass
8	± 5
2	± 10
1	± 10
0,250	± 10
0,125	± 3
0,063	± 2

4.3.5 All-in aggregate

All-in aggregate shall be supplied as a mixture of coarse and fine aggregate with $D \leq 45$ mm and $d = 0$ and shall comply with the general grading requirements for the category selected from Table 2.

All-in aggregates shall also comply with the requirements for the percentage passing the two intermediate sieves specified in Table 6 appropriate to their aggregate size.

Table 6 — Grading requirements for all-in aggregates

Aggregate size mm		Overall limits of the sieves indicated below (Percentage passing by mass)	
Basic set plus set 1	**Basic set plus set 2**	**40 ± 20**	**70 ± 20**
		For the sieve mm	
-	0/6,3	1	4
0/8	0/8	1	4
-	0/10	1	4
0/11,2 (11)	-	2	5,6 (5)
-	0/12,5 (12)	2	6,3 (6)
-	0/14	2	8
0/16	0/16	2	8
-	0/20	2	10
0/22,4 (22)	-	2	11,2 (11)
0/31,5 (32)	0/31,5 (32)	4	16
-	0/40	4	20
0/45	-	4	22,4 (22)

NOTE Figures in parentheses can be used to provide simplified descriptions of aggregate sizes.

4.3.6 Filler aggregate

The grading of filler aggregate determined in accordance with EN 933-10 shall conform to the limits specified in Table 7.

Table 7 — Grading requirements for filler aggregate

Sieve size mm	Percentage passing by mass	
	Overall range for individual results	Producer's maximum declared range [a]
2 0,125 0,063	100 85 to 100 70 to 100	– 10 10
[a] Declared grading range on the basis of the last 20 values (see Table H.1, line 1). 90 % of the results shall be within this range, but all the results shall be within the overall grading range (see column 2 above).		

4.3.7 Special use aggregate

When special aggregate gradings are required for a particular end use of the concrete, special grading envelopes shall be defined using the R 20 series of sieves specified in ISO 565:1990 and incorporating the appropriate sieves from 0,063 mm; 0,125 mm; 0,250 mm; 0,500 mm; 1 mm; 2 mm; 4 mm; 8 mm; 16 mm; 31,5 mm and 63 mm.

4.4 Shape of coarse aggregate

When required the shape of coarse aggregates shall be determined in terms of the flakiness index, as specified in EN 933-3. The flakiness index shall be the reference test for the determination of the shape of coarse aggregates. The flakiness index shall be declared in accordance with the relevant category specified in Table 8 according to the particular application or end use.

Table 8 — Categories for maximum values of flakiness index

Flakiness Index	Category *FI*
≤ 15 ≤ 20 ≤ 35 ≤ 50 > 50	FI_{15} FI_{20} FI_{35} FI_{50} $FI_{Declared}$
No requirement	FI_{NR}

Where required, the shape index determined in accordance with EN 933-4, shall be declared in accordance with the relevant category specified in Table 9 according to the particular application or end use.

Table 9 — Categories for maximum values of shape index

Shape Index	Category *SI*
≤ 15 ≤ 20 ≤ 40 ≤ 55 > 55	SI_{15} SI_{20} SI_{40} SI_{55} $SI_{Declared}$
No requirement	SI_{NR}