

SLOVENSKI STANDARD

SIST EN 13043:2013

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SIST EN 13043:2002

SIST EN 13043:2002/AC:2004

Agregati za bitumenske zmesi in površinske prevleke za ceste, letališča in druge prometne površine

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

Gesteinskörnungen für Asphalt und Oberflächenbehandlung für Straßen, Flugplätze und andere Verkehrsflächen

Granulats pour mélanges hydrocarbonés et pour enduits superficiels utilisés dans la construction des chaussées, aérodromes et d'autres zones de circulation

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

Granulats pour mélanges bitumineux et pour enduits superficiels utilisés dans la construction des chaussées, aérodromes et autres zones de circulation

Gesteinskörnungen für Asphalt und Oberflächenbehandlungen für Straßen, Flugplätze und andere Verkehrsflächen

This European Standard was approved by CEN on 24 August 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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EN 13043:2013 (E)**Foreword**

This European Standard (EN 13043:2013) 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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by February 2015.

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

This European Standard supersedes EN 13043:2002.

The main changes compared to the previous edition are:

- a) Description of evaluation of conformity of aggregates - initial type testing and factory production control in a separate new standard EN 16236;
- b) Implementing recycling aggregates;
- c) Implementing general sentences on dangerous substances and adding a new normative Annex A dealing with all source materials considered;
- d) Unification of categories which are common across the four main aggregate standards: EN 12620, EN 13043, EN 13139 and EN 13242;
- e) Unification of definitions which are common across the four main aggregate standards: EN 12620, EN 13043, EN 13139 and EN 13242, i. e. for coarse, fine, all-in aggregates and natural graded 0/8 aggregates;
- f) Adding requirements for the sand equivalent value for fines quality;
- g) Implementation of new methylene blue values for fines quality;
- h) Slight modifications of flakiness/shape indices and Los Angeles-, Micro Deval- and Nordic Abrasion values;
- i) Reorganisation of chemical requirements;
- j) Reorganisation of durability including a new requirement for the resistance to freezing and thawing in the presence of salt (extreme conditions);
- k) Precision of carbonate content of filler aggregate and calcium carbonate content of limestone filler aggregate;
- l) Deletion of the old Annexes A and B.

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.

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

- EN 12620, *Aggregates for concrete*;
- EN 13055 (all parts), *Lightweight aggregates*;
- EN 13139, *Aggregates for mortar*;
- 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*;
- EN 13450, *Aggregates for railway ballast*.

Requirements for evaluation of conformity are specified in EN 16236.

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

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EN 13043:2013 (E)**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 bituminous mixtures and surface treatments for roads, airfields and other trafficked areas. This standard does not cover the use of reclaimed bituminous mixtures³. It also covers recycled aggregate with densities between 1,50 Mg/m³ (1 500 kg/m³) and 2,00 Mg/m³ (2 000 kg/m³) with appropriate caveats and recycled fine aggregate with appropriate caveats.

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

Requirements for the evaluation of conformity of the products to this European Standard are given in EN 16236.

It 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.

The tables in this standard include categories which are common across the four main aggregate standards: EN 12620, EN 13043, EN 13139 and EN 13242. Not all of these categories are appropriate for aggregates for use for bituminous mixtures.

Categories, notes, comments etc., which are grey shaded, should not be used for aggregates for bituminous mixtures.

Aggregates used in construction should comply with all the requirements of the relevant European Standards. These standards include comprehensive and specific requirements for natural aggregates, iron and steel making slag and recycled aggregates, dealing with, for example, the stability of certain basalts, the expansion of certain slags and the constitution of recycled aggregates.

For materials from some other secondary sources, however, work is ongoing and the requirements are incomplete. In the meantime, such materials, when placed on the market as aggregates, should conform fully to this standard but may also be required to conform to specific relevant additional requirements at the place of 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.

NOTE 1 Requirements for lightweight aggregates are specified in EN 13055.

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.

NOTE 2 Requirements for reclaimed asphalt for use as a constituent of asphalt mixtures are specified in EN 13108-8 and are not therefore covered in detail in this standard. EN 13108-8 does however call up the general requirements of EN 13043 for the aggregate component of reclaimed asphalt.

2 Normative references

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

EN 196-2, *Methods of testing cement — Part 2: Chemical analysis of cement*

EN 196-6, *Methods of testing cement — Part 6: Determination of fineness*

EN 459-2, *Building lime — Part 2: Test methods*

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

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

EN 933-6, *Tests for geometrical properties of aggregates — Part 6: Assessment of surface characteristics — Flow coefficient of 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 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, *Tests for mechanical and physical properties of aggregates — Part 6: Determination of particle density and water absorption*

EN 1097-7, *Tests for mechanical and physical properties of aggregates — Part 7: Determination of the particle density of filler — Pyknometer method*

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

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

EN 1367-3, *Tests for thermal and weathering properties of aggregates — Part 3: Boiling test for “Sonnenbrand basalt”*

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

EN 1367-6, *Tests for thermal and weathering properties of aggregates — Part 6: Determination of resistance to freezing and thawing in the presence of salt (NaCl)*

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

EN 1744-4, *Tests for chemical properties of aggregates — Part 4: Determination of water susceptibility of fillers for bituminous mixtures*

EN 16236:2013, *Evaluation of conformity of aggregates — Initial Type Testing and Factory Production Control*

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 13179-2, *Tests for filler aggregate used in bituminous mixtures — Part 2: Bitumen number*

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

ISO 9277, *Determination of the specific surface area of solids by gas adsorption — BET method*

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3 Terms and definitions

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

3.1**aggregate**

granular material of natural, manufactured or recycled origin used in construction

3.2**natural aggregate**

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

3.3**manufactured aggregate**

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

3.4**recycled aggregate**

aggregate resulting from the processing of inorganic or mineral material previously used in construction

3.5**category**

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

Note 1 to entry: There is no relationship between the categories of different properties.

3.6**aggregate size**

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

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

3.7**grading**

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

Note 1 to entry: In this standard grading categories are used and expressed as G_nX/Y in which:

n = type of grading defined below

C = coarse

CA = coarse for asphalt only

G = Grit ($D \leq 4$ and $d \geq 1$)

F = fine

NG = natural graded

A = all-in

X = lower limit passing D

Y = upper limit passing d

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3.8**fines**

particle size fraction of an aggregate that passes the 0,063 mm sieve

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3.9**coarse aggregate**

designation given to the larger aggregate sizes with D greater than 4 mm and d greater than or equal to 1 mm

Note 1 to entry: Aggregates that do not fit the definitions for fine or coarse (like 1/3, 1/4 or 2/4) are treated as coarse aggregate.

3.10**fine aggregate**

designation given to the smaller aggregate sizes with D less than or equal to 4 mm and $d = 0$

Note 1 to entry: 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 aggregates.

3.11**all-in aggregate**

aggregate consisting of a mixture of coarse and fine aggregates with D greater than 4 mm and $d = 0$

Note 1 to entry: It can be produced without separating into coarse and fine fractions or it can be produced by combining coarse and fine aggregates.

3.12**filler aggregate**

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

EN 13043:2013 (E)**3.13****added filler**

filler aggregate of mineral origin, that has been produced separately

3.14**mixed filler**

filler aggregate of mineral origin, which has been mixed with calcium hydroxide

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 aggregates shall be tested as specified in Clause 4 to determine the relevant geometrical properties.

When the value of a property is required but not defined by specified limits the value should be declared as an *XX*Declared category, e.g., a value of, say, 55 for the flakiness index corresponds to *FI*₅₅ (Declared value).

NOTE 1 When a property is not required, a “No requirement” category can be used.

NOTE 2 Guidance on selection of appropriate categories for specific applications can be found in national provisions in the place of use of the aggregate.

NOTE 3 Where conformity with a category is based on a value of a property being less than or equal to a given value, conformity with a more severe category (lower value) automatically confers conformity with all less severe categories (higher values). Similarly for categories based on the value of a property being greater than or equal to a given value, conformity with a more severe (higher value) automatically confers conformity with all less severe categories (lower values).

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The tables in this standard include categories which are common across the four main aggregates standards: EN 12620, EN 13043, EN 13139 and EN 13242.

Categories, notes, comments etc, which are shown grey shaded should not be used in bituminous mixtures.

4.2 Aggregate sizes

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

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	–
–	56	–
63	63	63
–	80	80
–	90	–
–	100	–
–	125	–
–	150	–
–	180	–
–	200	–
–	250	–
–	300	–
–	350	–
–	400	–
–	450	–
–	500	–
–	560	–
–	630	–
–	710	–
–	800	–
–	900	–
–	1000	–
–	1120	–
–	1250	–
–	1400	–
–	1600	–
–	1800	–
–	2000	–
–	2240	–
–	2500	–
–	2800	–
–	3150	–
–	3500	–
–	4000	–
–	4500	–
–	5000	–
–	5600	–
–	6300	–
–	7100	–
–	8000	–
–	9000	–
–	10000	–
–	11200	–
–	12500	–
–	14000	–
–	16000	–
–	18000	–
–	20000	–
–	22400	–
–	25000	–
–	28000	–
–	31500	–
–	35000	–
–	40000	–
–	45000	–
–	50000	–
–	56000	–
–	63000	–
–	71000	–
–	80000	–
–	90000	–
–	100000	–
–	112000	–
–	125000	–
–	140000	–
–	160000	–
–	180000	–
–	200000	–
–	224000	–
–	250000	–
–	280000	–
–	315000	–
–	350000	–
–	400000	–
–	450000	–
–	500000	–
–	560000	–
–	630000	–
–	710000	–
–	800000	–
–	900000	–
–	1000000	–
–	1120000	–
–	1250000	–
–	1400000	–
–	1600000	–
–	1800000	–
–	2000000	–
–	2240000	–
–	2500000	–
–	2800000	–
–	3150000	–
–	3500000	–
–	4000000	–
–	4500000	–
–	5000000	–
–	5600000	–
–	6300000	–
–	7100000	–
–	8000000	–
–	9000000	–
–	10000000	–
–	11200000	–
–	12500000	–
–	14000000	–
–	16000000	–
–	18000000	–
–	20000000	–
–	22400000	–
–	25000000	–
–	28000000	–
–	31500000	–
–	35000000	–
–	40000000	–
–	45000000	–
–	50000000	–
–	56000000	–
–	63000000	–
–	71000000	–
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–	224000000	–
–	250000000	–
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–	315000000	–
–	350000000	–
–	400000000	–
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–	500000000	–
–	560000000	–
–	630000000	–
–	710000000	–
–	800000000	–
–	900000000	–
–	1000000000	–
–	1120000000	–
–	1250000000	–
–	1400000000	–
–	1600000000	–
–	1800000000	–
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–	2240000000	–
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–	3150000000	–
–	3500000000	–
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–	12500000000000	–
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–	16000000000000	–
–	18000000000000	–
–	20000000000000	–
–	22400000000000	–
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Where the specification requires the use of sieves which are a fraction or a multiple of the upper sieve size (e.g. $D/2$ or $D/1,4$ or $1,4D$, $2D$) the sieve chosen shall be the next nearest from basic set plus set 1 or basic set plus set 2.

When a sieve size of the ISO 565 R20 series is closer to the calculated $d/2$, $D/1,4$, $D/2$, $1,4D$ or $2D$ size, the manufacturer may choose to use this R20 size.

Table 2 — General grading requirements

Aggregate	Size mm	Percentage passing by mass					Category <i>G</i>
		$2D^a$	$1,4D$	D^b	d	$d/2$	
Coarse	$D > 4$ $d \geq 1$	100	100	90 to 99	0 to 10	0 to 2	$G_C90/10$
		100	98 to 100	90 to 99	0 to 15	0 to 5	$G_C90/15$
		100	98 to 100	85 to 99 ^c	0 to 15	0 to 5	$G_C85/15$
		100	98 to 100	85 to 99 ^c	0 to 20	0 to 5	$G_C85/20$
		100	98 to 100	80 to 99	0 to 20	0 to 5	$G_C80/20$
		100	98 to 100	85 to 99 ^c	0 to 15	0 to 2	$G_{CA}85/15$
	$d \geq 1$ $D \leq 4$	100	95 to 100	85 to 99	0 to 15	—	$G_G85/15$
		100	98 to 100	85 to 99	0 to 20	0 to 5	$G_G85/20$
Fine	$D \leq 4$ $d = 0$	100	95 to 100	85 to 99	—	—	G_F85
All-in	$D > 4$ $d = 0$	100	98 to 100	90 to 99	—	—	G_A90
		100	98 to 100	85 to 99	—	—	G_A85
		100	98 to 100	80 to 99	—	—	G_A80
		100	—	75 to 99	—	—	G_A75

^a For aggregate sizes where D is greater than 63 mm (e.g. 80 mm and 90 mm), only the oversize requirements related to the $1,4D$ sieve apply since there is no ISO 565/R20 series sieve above 125 mm.

^b If the percentage retained on D is $< 1\%$ by mass 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 2 intermediate between d and D .

^c For single size coarse aggregates d/D , where $D/d < 2$, of the categories $G_C85/15$, $G_C85/20$ and $G_{CA}85/15$, the value of the percentage passing by mass at D may be lowered by 5 % according to the particular application or end use.

4.3.2 Coarse aggregates

Coarse aggregates shall conform to the general grading requirements specified in Table 2 appropriate to their size designation d/D and grading category G_CX/Y .

When required, for graded aggregates, defined as those where $D/d \geq 2$, all gradings shall conform with the overall limits in Table 3 appropriate to their grading category. The typical grading passing the mid-size sieve shall be declared and the tolerances selected from Table 3 appropriate to the grading category shall be applied.

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
		Overall limits	Tolerances on manufacturer's declared typical grading	
< 4	$D/1,4$	25 to 80	± 15	$G_{25/15}$
		20 to 70	± 15	$G_{20/15}$
≥ 4	$D/2$	20 to 70	$\pm 17,5$	$G_{20/17,5}$
No requirement				G_{NR}

4.3.3 Fine aggregates

Fine aggregates shall conform to the general grading requirements of Table 2 appropriate to their upper sieve size D and grading category G_F85 .

When required, the typical grading, in terms of the percentages passing the 4 mm, 2 mm, 1 mm, 0,250 mm and 0,063 mm sieves shall be declared.

When required, the grading of the fine aggregates shall comply with the tolerances in Table 4 applied around the declared typical grading.

4.3.4 All-in aggregates

All-in aggregates shall conform to the general grading requirements of Table 2 appropriate to their upper sieve size D and grading category G_{AXY} .

When required, the typical grading passing the mid size sieve shall be declared and the tolerances selected from Table 4 appropriate to the grading category shall be applied.

Table 4 — Tolerances on declared typical grading for fine and all-in aggregates

Sieve size mm	D	$D/2$	0,250 ^b	0,063 ^a	Category G_{TC}
Tolerances Percentage passing by mass	± 5	$\pm 10^a$	± 20	± 3	$G_{TC}10$
	± 5	± 20	± 25	± 5	$G_{TC}20$
	$\pm 7,5$	± 25	± 25	± 5	$G_{TC}25$
	No requirement				$G_{TC}NR$

^a In all cases the upper limit determined by fines category takes preference.

^b Requirements on 0,250 mm sieve are only for fine aggregates.

4.3.5 Special use aggregates and declared grading categories

When special aggregates gradings are required for a particular end use, or to define a specific source special grading envelopes shall be defined using the appropriate sieves from Table 1. The general principles of Clause 4 shall be applied using appropriate requirements at $2D$, $1,4D$, D , d , $d/2$. The grading category shall be