BS EN 13450:2013

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Aggregates for railway ballast

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/502, Aggregates.

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

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ISBN 978 0 580 77483 6

ICS 91.100.15; 93.100

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

Amendments issued since publication

Date	Text affected

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13450

May 2013

ICS 91.100.15; 93.100

Supersedes EN 13450:2002

English Version

Aggregates for railway ballast

Granulats pour ballasts de voies ferrées

Gesteinskörnungen für Gleisschotter

This European Standard was approved by CEN on 22 December 2012.

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Ref. No. EN 13450:2013: E

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Foreword

This document (EN 13450:2013) 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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by February 2015.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 document supersedes EN 13450:2002.

The main changes compared to the previous edition are:

1) Updating of the normative references (deletion of the reference to EN 932-5, updating of the references to EN 1367-1:2007 and EN 1367-2:2009 and addition of the references to EN 1367-6 and EN 16236-2013).

2) Modification of the definition to "recycled railway ballast".

3) Addition of note 3 in Clause 4.

4) Modification of Tables 1, 2, 3, 4, 5, 6, 7, 8 and 9 due to changes in the category names.

5) Addition of new sub-clauses 7.3 "Freeze-thaw resistance" and 7.4 "Electrical conductivity".

6) Modification of sub-clause 7.5 "Sonnenbrand".

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 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 13055, *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*.

Considering evaluation of conformity see EN 16236, Evaluation of Conformity.

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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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1 Scope

This European Standard specifies the properties of aggregates obtained by processing natural, manufactured or recycled crushed unbound aggregates for use in construction of the upper layer of railway track. For the purposes of this standard, the aggregate is referred to as railway ballast.

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

NOTE Reused railway ballast: railway ballast resulting of previously used railway ballast on site and without putting it on the market is not covered by this European Standard.

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.

It incorporates a general requirement that railway ballast should 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.

Railway ballast used in construction should comply with all the requirements of this European Standard. The standard includes comprehensive and specific requirements for natural aggregates and recycled ballast, dealing with, for example, the stability of certain basalts.

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 railway ballast, 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.

Requirements for the declaration of the potential of railway ballast 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.

2 Normative references

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

EN 932-1:1996, *Tests for general properties of aggregates — Part 1: Methods for sampling*

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

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

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

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

EN 1367-2:2009, *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 1367-6, *Tests for thermal and weathering properties of aggregates — Part 6: Determination of resistance to freezing and thawing in the presence of salt (NaCl)*

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

3 Terms and definitions

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

3.1
aggregate
granular material used in construction

Note 1 to entry: Aggregates may be natural, manufactured or recycled.

3.2
railway ballast
aggregate where 100 % of the surface of the particles can be described as totally crushed used in the construction of the upper layer of railway track, with sizes e. g. 22/40 mm, 31,5/50 mm or 31,5/63 mm

3.3
natural railway ballast
aggregate for railway ballast from mineral sources which have been subjected to nothing more than mechanical processing

Note 1 to entry: Natural railway ballast should be produced without blending material from different geological sources.

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

3.5
recycled railway ballast
railway ballast resulting from the processing of inorganic or mineral material previously used in construction

3.6
category
level of a property of railway ballast expressed as a range of values or a limiting value

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

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3.7
railway ballast size
designation of railway ballast 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)

3.8
fine particles
particle size fraction of railway ballast which passes the 0,5 mm sieve

3.9
fines
particle size fraction of railway ballast which passes the 0,063 mm sieve

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 railway ballast. When required, the tests in Clause 4 specified shall be carried out to determine appropriate 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. in Table 4 a value of say 40 for the flakiness index corresponds to FI_{RB40} *(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 railway ballast.

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).

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

NOTE 4 Advice on sampling from a wagon or the track at the laying site is given in Annex A.

NOTE 5 Guidance on interpretation of results when samples of railway ballast have been taken from railway wagon or out of track is given in Annex B.

4.2 Railway ballast size

Railway ballast size shall be specified using a pair of sieve sizes in millimetre with *d* as the lower limit designation sieve and *D* as the upper limit designation sieve between which most of the particle size distribution lies.

4.3 Grading

The grading of the railway ballast shall be determined in accordance with EN 933-1 and the results declared in accordance with the relevant category specified in Table 1.

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Table 1 — Categories for grading

Sieve size mm	Railway ballast size 31,5 mm to 50 mm	Railway ballast size 31,5 mm to 63 mm			Railway ballast size 22 mm to 40 mm
	Percentage passing by mass				
	Grading category				
	G_C RB A	G_C RB B	G_C RB C	G_C RB D	G_C RB E
80	100	100	100	100	-
63	100	95 to 100	95 to 100	93 to 100	-
50	70 to 99	65 to 99	55 to 99	45 to 70	100
40	30 to 65	30 to 65	25 to 75	15 to 40	90 to 100
31,5	1 to 25	1 to 25	1 to 25	0 to 7	60 to 98
22,4	0 to 3	0 to 3	0 to 3	0 to 7	15 to 60
16	-	-	-	-	0 to 15
8	-	-	-	-	0 to 2
31,5 to 50	≥ 50	-	-	-	-
31,5 to 63	-	≥ 50	≥ 50	≥ 85	-

NOTE The requirement for passing the 22,4 mm sieve applies to railway ballast sampled at the place of production.

In certain circumstances a 25 mm sieve may be used as an alternative to the 22,4 mm sieve, when a tolerance of 0 to 5 would apply.

When assessing production within a system of FPC, at least 90 % of gradings, taken on different batches within a maximum period of 6 months, shall fall within the limits specified in Table 1.

4.4 Content of fine particles

The content of fine particles shall be determined in accordance with EN 933-1 and the results declared in accordance with the relevant category specified in Table 2.

Table 2 — Categories for fine particles content

Sieve size mm	Maximum percentage passing by mass			
	Fine particle category			
	G_F RB A	G_F RB B	G_F RB Declared	G_F RB C
0,5	0,6	1,0	> 1,0	No requirement

NOTE The requirement applies to railway ballast sampled at the place of production.

4.5 Fines content

The fines content shall be determined in accordance with EN 933-1 and the results declared in accordance with the relevant category specified in Table 3.

When required, cleanliness shall be assessed from the fines content. Fines shall be considered non-harmful if the total fines content is less than the relevant category specified in Table 3 in accordance with the provisions valid in the place of use of the aggregate.

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Table 3 — Categories for fines content

Sieve size	Maximum percentage passing by mass				
	Fines content category				
mm	f_{RB} A	f_{RB} B	f_{RB} C	f_{RB} Declared	f_{RB} D
0,063	0,5	1,0	1,5	> 1,5	No requirement
NOTE The requirement applies to railway ballast sampled at the place of production.					

4.6 Particle shape - Flakiness index and shape index

When required, the shape of railway ballast shall be determined in accordance with EN 933-3 in terms of the flakiness index and the results declared in accordance with the relevant category specified in Table 4.

The flakiness index shall be the reference test for the determination of the shape.

Table 4 — Categories for maximum values of flakiness index

Flakiness Index	Category FI_{RB}
≤ 15	FI_{RB} 15
≤ 20	FI_{RB} 20
≤ 25	FI_{RB} 25
4 to 25	FI_{RB} 4/25
> 25	FI_{RB} Declared
No requirement	FI_{RB} NR

When required, the shape index of railway ballast shall be determined in accordance with EN 933-4 and the results declared in accordance with the relevant category specified in Table 5.

Table 5 — Categories for maximum values of shape index

Shape Index	Category SI_{RB}
≤ 10	SI_{RB} 10
≤ 20	SI_{RB} 20
≤ 30	SI_{RB} 30
5 to 30	SI_{RB} 5/30
> 30	SI_{RB} Declared
No requirement	SI_{RB} NR

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4.7 Particle length

Particle length of railway ballast shall be assessed by measuring with an appropriate gauge or callipers.

Limits should be selected from the specified range until such a time as there is more data available on railway ballast properties related to performance.

When required, the particle length of railway ballast shall be determined and the results declared in accordance with the relevant category specified in Table 6.

Table 6 — Categories for maximum values of particle length

Percentage by mass with length ≥ 100 mm in a greater than 40 kg sample					
Particle length category					
L_{RB} A	L_{RB} B	L_{RB} C	L_{RB} D	L_{RB} Declared	L_{RB} E
≤ 4	≤ 6	≤ 8	≤ 12	> 12	No requirement

5 Physical 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 railway ballast. When required, the tests specified in Clause 5 shall be carried out to determine appropriate physical 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. in Table 7 a Los Angeles coefficient of say 30 corresponds to LA_{RB} 30*(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 railway ballast.

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).

5.2 Resistance to fragmentation

5.2.1 Los Angeles

When required, the resistance to fragmentation of railway ballast shall be determined in terms of the Los Angeles coefficient as specified in EN 1097-2, using the conditions as specified in Annex A, and the results declared in accordance with the relevant category specified in Table 7.

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