SLOVENSKI STANDARD
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Preskusi geometričnih lastnosti agregatov - 11. del: Klasifikacija sestavin grobega recikliranega agregata

Tests for geometrical properties of aggregates - Part 11: Classification test for the constituents of coarse recycled aggregate

Prüfverfahren für geometrische Eigenschaften von Gesteinskörnungen - Teil 11: Einteilung der Bestandteile in grober recyclierter Gesteinskörnung

Essais pour déterminer les caractéristiques géométriques des granulats - Partie 11: Essai de classification des constituants de gravillons recyclés

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

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European foreword

This document (prEN 933-11:2021) 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 933-11:2009.

In comparison with the previous edition, the following technical modifications have been made:

a) The particle size fraction used for the reference test is changed from 4/63 mm to 8/63 mm.

b) Preparation of the test portion does not include sampling or reference to EN 932-1. The guidance table for minimum test portion mass has been revised. (Clause 6)

c) Procedure has been divided into 7.1 General, 7.2 Determination of the content of floating particles and 7.3 Visual sorting of non-floating particles. The guidance table with minimum masses for 1 000 particles has been revised. The table listing non-floating constituents has been extended. The flow chart describing the test procedure has been revised.

d) The formulae for calculation of the proportion of constituents have been revised (Clause 8).

e) The test data sheet in Annex B has been updated according to the revised procedure and formulae.

f) Three new informative annexes have been added: Annex C Guidance for testing of a 4/63 mm fraction, Annex D Classification test without the immersing procedure and Annex E Guidance on separate floating particles into organic and inorganic.

In addition, the whole document has been updated and clarified.

This document forms part of a series of tests for geometrical properties of aggregates. Test methods for other properties of aggregates are covered by the following European Standards:

— EN 932 (all parts), *Tests for general properties of aggregates*

— EN 1097 (all parts), *Tests for mechanical and physical properties of aggregates*

— EN 1367 (all parts), *Tests for thermal and weathering properties of aggregates*

— EN 1744 (all parts), *Tests for chemical properties of aggregates*

— EN 13179 (all parts), *Tests for filler aggregate used in bituminous mixtures*

The other parts of EN 933, *Tests for geometrical properties of aggregates* include:

— *Part 1: Determination of particle size distribution — Sieving method*

— *Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures*

— *Part 3: Determination of particle shape — Flakiness index*

— *Part 4: Determination of particle shape — Shape index*

— *Part 5: Determination of percentage of crushed particles in coarse and all-in natural aggregates*

— *Part 6: Assessment of surface characteristics — Flow coefficient of aggregates*

— *Part 7: Determination of shell content — Percentage of shells in coarse aggregates*

— *Part 8: Assessment of fines — Sand equivalent test*

— *Part 9: Assessment of fines — Methylene blue test*

— *Part 10: Assessment of fines — Grading of filler aggregates (air jet sieving)*

1 Scope

This document specifies the reference method for the examination of coarse recycled aggregates for the purpose of identifying and estimating the relative proportions of constituent materials. The reference method is used for type testing and in case of dispute. Other methods can be used for other purposes, such as factory production control, provided that an appropriate working relationship with the reference method has been established.

This method does not apply to lightweight aggregates covered by the EN 13055 series.

Annex A specifies an additive to the test procedure in Clause 7. It is suitable for test portions with low proportions of floating particles and is aimed at determining the proportion of floating particles with a higher precision level.

Annex B provides an example of a test data sheet.

Annex C specifies a procedure for testing a 4/63 mm fraction.

Annex D specifies a method where the content of floating particles is estimated on a visual basis, after the visual sorting, without the immersing procedure in 7.2.

Annex E describes an additive to the test procedure in order to separate floating particles into organic and inorganic.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
aggregate size
d/*D*
designation of aggregate in terms of lower (*d*) and upper (*D*) sieve sizes

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

3.2
particle size fraction
d_i/D_i
fraction of an aggregate passing the larger (D_i) of two sieves and retained on the smaller (d_i)

3.3
test portion
d_0/D_0
sample used as a whole in a single test

3.4
constant mass
mass determined by successive weighings during drying performed at least 1 h apart and not differing by more than 0,1 %

Note 1 to entry: 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 ± 5) °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.

3.5
floating particles
particles that float in water

4 Principle

The test consists of sorting particles from a test portion of coarse recycled aggregate into constituents. The sorting is performed in two steps: First, identification of the floating particles, then, visual sorting of the non-floating particles into constituents, based on their components.

The proportion of each constituent in the test portion is then determined and expressed as a percentage by mass, except for the proportion of floating particles which is expressed as a volume by mass.

5 Apparatus

Unless otherwise stated, all apparatus shall conform to the general requirements of EN 932-5.

5.1 Test sieves, 63 mm and 8 mm, conforming to EN 933-2.

5.2 Tightly fitting pan and lid, for the sieves.

5.3 Ventilated oven, thermostatically controlled to maintain a temperature of (40 ± 5) °C or (110 ± 5) °C.

5.4 Balance or scale, of suitable capacity and readable to 0,1 g.

5.5 Trays.

5.6 Brushes.

5.7 Sieve shaker, optional.

5.8 Watertight tank, of suitable capacity.

5.9 Stirrer.

5.10 Dry soft absorbent rag.

5.11 Graduated measuring cylinder, of suitable capacity, graduated to 1 cm^3 or 5 cm^3 (depending on the required precision for volume measurement).

5.12 Plunger, for the graduated cylinder.

6 Preparation of the test portion

The test shall be carried out on aggregate passing the 63 mm sieve and retained on the 8 mm sieve.

NOTE Informative Annex C gives guidance for testing a 4/63 mm fraction.

Reduce samples in accordance with EN 932-2 to produce a test portion of minimum mass specified in Table 1.

Table 1 — Guidance on mass of test portion

Upper aggregate size D	Minimum test portion mass
mm	kg
63	50
32	15
20	5
NOTE Larger test portion masses can be necessary to ensure sufficient precision in the determination of low proportions of restricted constituents (see Annex A).	

Dry the sample to constant mass. In the presence of temperature sensitive constituents, such as expanded polystyrene or bituminous mixtures, the drying temperature should be (40 ± 5) °C. In other cases, the sample may be dried at (110 ± 5) °C. Record the drying temperature as T.

Weigh and record the dry mass of the sample as M_0.

Sieve the d/D sample on the test sieves, agitating with sufficient vigour to ensure complete separation of particles greater than 8 mm.

If overloading occurs, see definition in EN 933-1, the fraction should be divided into smaller portions and sieved one after the other.

Weigh and record the mass of particles retained on the 63 mm sieve as $M_{>63}$, and then discard them. Weigh and record the mass of particles passing the 8 mm sieve as $M_{<8}$, and then discard them.

Record the mass of the obtained 8/63 mm test portion as M_1.

Separate clay lumps and soil from the test portion and retain in a tray. Weigh and record the mass of clay and soil as M_{cs}.

7 Procedure

7.1 General

The procedure is divided into two parts: Identification of floating particles by means of immersing the test portion in a water tank (7.2), and visual sorting of non-floating particles into constituents based on their components (7.3).

NOTE 1 Informative Annex A specifies an additive to the test procedure, to be carried out after the test. It is suitable for test portions with low proportions of floating particles and is aimed at determining the proportion of floating particles with a higher precision level.

NOTE 2 Informative Annex D specifies a method where the content of floating particles is estimated on a visual basis, after the visual sorting, without the immersing procedure.

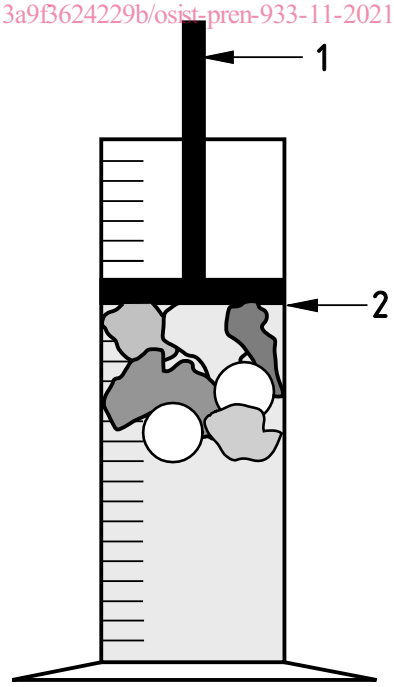
7.2 Determination of the content of floating particles

Slowly immerse the 8/63 mm size fraction into the filled watertight tank (5.8) and stir for (20 ± 5) s in order to wash the particles and release the floating ones.

Collect the floating particles within maximum 1 min after immersing.

Determine their volume V_{FL} in cm^3. For this purpose, gently surface dry them using the dry absorbent rag (5.10). Then, introduce them into the graduated cylinder (5.11) filled with a known volume of water, sufficient to allow their total immersion. Use the plunger (5.12) to achieve total immersion of the floating particles alone (see Figure 1). Do not immerse the plunger itself or entrap air. Use the cylinder gradation to assess the resulting volume increase V_{FL}.

NOTE Informative Annex E describes an additive to the test procedure in order to separate floating particles into organic and inorganic.



Key

1 plunger

2 water level

Figure 1 — Example of determining the volume of floating particles

7.3 Visual sorting of non-floating particles

Weigh and record the mass of remaining non-floating particles as M_2.

To facilitate the sorting, the number of these particles can be further reduced to 1 000 particles, in accordance with EN 932-2. Table 2 gives guidance on the mass required to provide at least 1 000 particles.

Table 2 — Guidance on the mass of at least 1 000 particles of the 8/*D* fraction

Upper aggregate size *D* mm	**Minimum mass** kg
63	10
32	5
20	3
16	1,5
< 16	1
NOTE The mass depends on the particle size distribution and particle density of the aggregate. Experience will allow test laboratories to estimate the mass required for materials that are tested routinely.	

Weigh the reduced number of non-floating particles to be sorted and record the mass as M_3.

Spread the wet particles on a flat surface and separate by hand those belonging to each separate constituent (e.g. *Ru* and *Rg)* as defined in Table 3. All particles in the sample have to be assigned to one of the constituents. Table 3 does not give guidance on the sorting order.

NOTE 1 Visual recognition is improved when the particles to be sorted have wet surfaces.

When constituents are only declared as a combination of constituents (e.g. *Rcu* or *Rcug*) it is not required to fully separate the individual constituents (e.g. *Ru* and *Rg*).

NOTE 2 Detailed recording of individual constituents can be valuable for future information (e.g. in case of dispute) and quality improvement within the FPC system.

Weigh the particles assigned to each constituent and record the masses as M_{Rc}, M_{Ru}, M_{Rb}, M_{Ra} and M_{Rg}, or weigh and record the masses of combinations of constituents (e.g. M_{Rcu}) if appropriate.

Put the particles assigned to the constituent *X* in the tray where the clay lumps and soil are retained (see Clause 6). Weigh and record the combined mass as M_X.

NOTE 3 There is no criterion on weight loss which is depending on many factors, such as drying effects and further examining of particles during sorting.