



**SLOVENSKI STANDARD**  
**SIST EN 933-11:2009**

**01-september-2009**

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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 von recyceltem Grobkom

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

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**ICS:**

91.100.15      Mineralni materiali in izdelki      Mineral materials and products

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EUROPEAN STANDARD

EN 933-11

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April 2009

ICS 91.100.15

English Version

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

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

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

This European Standard was approved by CEN on 1 March 2009.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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.

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COMITÉ EUROPÉEN DE NORMALISATION  
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## Contents

Page

Foreword .....	3
1 Scope.....	4
2 Normative references .....	4
3 Terms and Definitions .....	4
4 Principle .....	5
5 Apparatus .....	5
6 Preparation of test portion .....	6
7 Procedure .....	6
8 Calculation and expression of results .....	10
9 Test report .....	10
9.1 Required data .....	10
9.2 Optional data .....	10
Annex A (informative) Additive to the test procedure for low proportions of floating particles .....	12
Annex B (informative) Example of a test data sheet .....	13

[SIST EN 933-11:2009](https://standards.iteh.ai/catalog/standards/sist/3650051f-94e6-493c-96f1-6cd0ef3c6162/sist-en-933-11-2009)

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## Foreword

This document (EN 933-11:2009) 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 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

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 is one of a series of standards for tests for geometrical properties of aggregates. Test methods for other properties of aggregates are covered by parts of the following European Standards:

EN 932 Tests for general properties of aggregates

EN 1097 Tests for mechanical and physical properties of aggregates

EN 1367 Tests for thermal and weathering properties of aggregates

EN 1744 Tests for chemical properties of aggregates

EN 13179 Tests for filler aggregate used in bituminous mixtures

The other parts of EN 933 are:

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 and broken surfaces in coarse aggregate particles

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 fillers (air jet sieving)

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 the United Kingdom.

**EN 933-11:2009 (E)****1 Scope**

This European Standard describes a simple method for the examination of coarse recycled aggregates for the purpose of identifying and estimating the relative proportions of constituent materials. This reference test method should be used for type testing and in case of dispute. For other purposes, in particular factory production control, other methods may be used provided that an appropriate working relationship with the reference method has been established.

NOTE 1 This method is not appropriate for lightweight aggregates covered by EN 13055 series.

NOTE 2 If dangerous substances are found in while carrying out this method, they should be dealt with in accordance with regulations in the place of use.

**2 Normative references**

The following referenced documents are indispensable for the application 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 932-1, *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 933-2, *Tests for geometrical properties of aggregates – Part 2: Determination of particle size distribution – Test sieves, nominal size of apertures*

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**3 Terms and Definitions**

For the purpose of this standard, the following terms and definitions apply:

**3.1****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 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****constant mass**

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

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  $(110 \pm 5)$  °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.

**3.4****floating particles**

particles that float in water

**3.5****test portion**

sample used as a whole in a single test

**4 Principle**

The test consists of hand sorting particles from a test portion of coarse recycled aggregate into a list of constituents.

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 4 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  $(40 \pm 5)$  °C or  $(110 \pm 5)$  °C.

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

**5.5 Trays**

**5.6 Brushes**

**5.7 Sieving machine**, 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 or 5 cm<sup>3</sup> (depending on the required precision for volume measurement).

**5.12 Plunger**, for the graduated cylinder.

## EN 933-11:2009 (E)

## 6 Preparation of test portion

The sample shall be taken in accordance with EN 932-1 and reduced in accordance with EN 932-2 to produce a test portion of minimum mass given in Table 1.

Dry the sample at  $(40 \pm 5) ^\circ\text{C}$  to constant mass. Weigh and record the dry mass of the sample as  $M_0$ .

NOTE In the absence of temperature sensitive constituents such as bituminous mixtures, the sample may be dried at  $(110 \pm 5) ^\circ\text{C}$ .

Record the drying temperature as T.

Sieve the sample on the test sieves, agitating with sufficient vigour to ensure complete separation of particles greater than 4 mm.

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 4 mm sieve as  $M_4$ , and then discard them. Record the mass of the obtained test portion as  $M_1$ .

**Table 1 — Guidance on mass of test portion**

Upper Aggregate size D mm	Test portion mass (minimum) Kg
63	50
32 and below	20
Note Higher test portion masses may be necessary to ensure sufficient precision in the determination of low proportions of restricted constituents, (see Annex A).	

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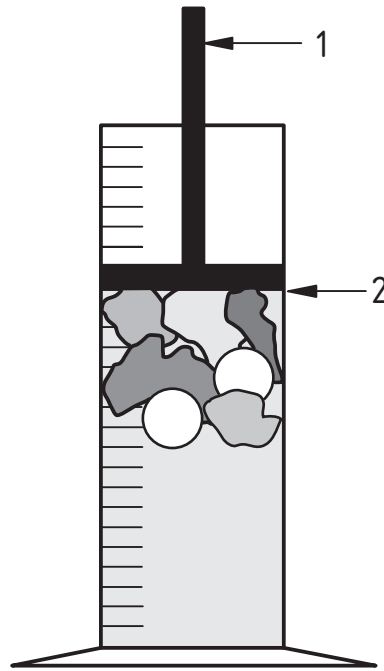
## 7 Procedure

Separate and retain clay and soil from the test portion and put it in a tray.

Immerse the rest of the test portion into the filled watertight tank and stir in order to wash the particles and release the floating ones. Collect these floating particles and determine their volume  $V_{FL}$  in  $\text{cm}^3$ . For this purpose, gently surface dry them using the dry absorbent rag, then introduce them into the graduated cylinder filled with a known volume of water, sufficient to allow their total immersion. Use the plunger to achieve total immersion of the floating particles alone (see Figure 1), viz. do not immerse the plunger itself or entrap air, and use the cylinder gradation to assess the resulting volume increase.

Collect the non-floating particles and dry them apart at same temperature as before to constant mass. Spread these particles on a flat surface and separate by hand those belonging to constituent X as defined in Table 2. Put them in the tray together with the soil and the clay. Weigh and record the combined mass of particles as  $M_X$ .



**Key**

- 1 Plunger
- 2 Water level

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**Figure 1 — Example of determination of the volume of floating particles**

**Table 2 — Non-floating constituents of coarse recycled aggregates**

Constituent	Description
Rc	Concrete, concrete products, mortar Concrete masonry units
Ru	Unbound aggregate, natural stone Hydraulically bound aggregate
Rb	Clay masonry units (i.e. bricks and tiles) Calcium silicate masonry units Aerated non-floating concrete
Ra	Bituminous materials
Rg	Glass
X	Other: Cohesive (i.e. clay and soil) Miscellaneous: metals (ferrous and non-ferrous), non-floating wood, plastic and rubber Gypsum plaster

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 at least 1000 particles according to EN 932-2.