



# SLOVENSKI STANDARD

## SIST EN 933-4:2008

01-september-2008

Nadomešča:  
SIST EN 933-4:2000

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**Preskusi geometričnih lastnosti agregatov - 4. del: Določevanje oblike zrn - Modul oblike**

Tests for geometrical properties of aggregates - Part 4: Determination of particle shape - Shape index

Prüfverfahren für geometrische Eigenschaften von Gesteinskörnungen - Teil 4: Bestimmung der Kornform - Kornformkennzahl

Essais pour déterminer les caractéristiques géométriques des granulats - Partie 4: Détermination de la forme des granulats - Indice de forme

**Ta slovenski standard je istoveten z: EN 933-4:2008**

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**ICS:**

91.100.15 Mineralni materiali in izdelki Mineral materials and products

**SIST EN 933-4:2008**

**en,fr,de**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 933-4**

March 2008

ICS 91.100.15

Supersedes EN 933-4:1999

English Version

## Tests for geometrical properties of aggregates - Part 4: Determination of particle shape - Shape index

Essais pour déterminer les caractéristiques géométriques  
des granulats - Partie 4: Détermination de la forme des  
granulats - Coefficient de forme

Prüfverfahren für geometrische Eigenschaften von  
Gesteinskörnungen - Teil 4: Bestimmung der Kornform -  
Kornformkennzahl

This European Standard was approved by CEN on 4 February 2008.

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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## Foreword

This document (EN 933-4:2008) 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 September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

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 933-4:1999.

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: [SIST EN 933-4:2008](https://standards.iteh.ai/catalog/standards/sist/77009cdd-8ca3-4c35-b577-7ec900e1ef14/sist-en-933-4-2008)

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 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 933-4:2008 (E)****1 Scope**

This standard describes the reference method used for type testing and in cases of dispute, for the determination of the shape index of coarse aggregates. For other purposes, in particular factory production control, other methods may be used provided an appropriate working relationship with the reference method has been established.

The test method specified in this European Standard is applicable to particle size fractions  $d_i/D_i$  where  $D_i \leq 63$  mm and  $d_i \geq 4$  mm.

**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 932-2, *Test 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 933-1, *Tests for geometrical properties of aggregates - Part 1: Determination of particle size distribution - Sieving method*

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

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

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**3 Terms and definitions**

For the purposes of this document, 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****test portion**

sample used as a whole in a single test

**3.4****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 (see 5.5) 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.

**3.5****particle length  $L$** 

maximum dimension of a particle as defined by the greatest distance between two parallel planes tangential to the particle surface

**3.6****particle thickness  $E$** 

minimum dimension of a particle as defined by the least distance between two parallel planes tangential to the particle surface

**4 Principle**

Individual particles in a sample of coarse aggregate are classified on the basis of the ratio of their length  $L$  to thickness  $E$  using a particle slide gauge where necessary.

The shape index is calculated as the mass of particles with a ratio of dimensions  $L/E$  more than 3 expressed as a percentage of the total dry mass of particles tested.

**5 Apparatus**

**5.1 All apparatus**, unless otherwise stated, shall conform to the general requirements of EN 932-5.

**5.2 Particle slide gauge**, an example of which is shown in Figure 1.

**5.3 Test sieves**, with nominal size of apertures as specified in EN 933-2.

**5.4 Tightly fitting pan and lid**, for the sieves.

**5.5 Ventilated oven**, thermostatically controlled to maintain  $(110 \pm 5)$  °C, or other suitable equipment for drying the aggregates, if it does not cause any particle size breakdown.

**5.6 Balances or scales**, of suitable capacity, readable to 0,1 % of the mass to be weighed.

**5.7 Trays**

**5.8 Sieving machine**, (optional).

Dimensions in millimetres

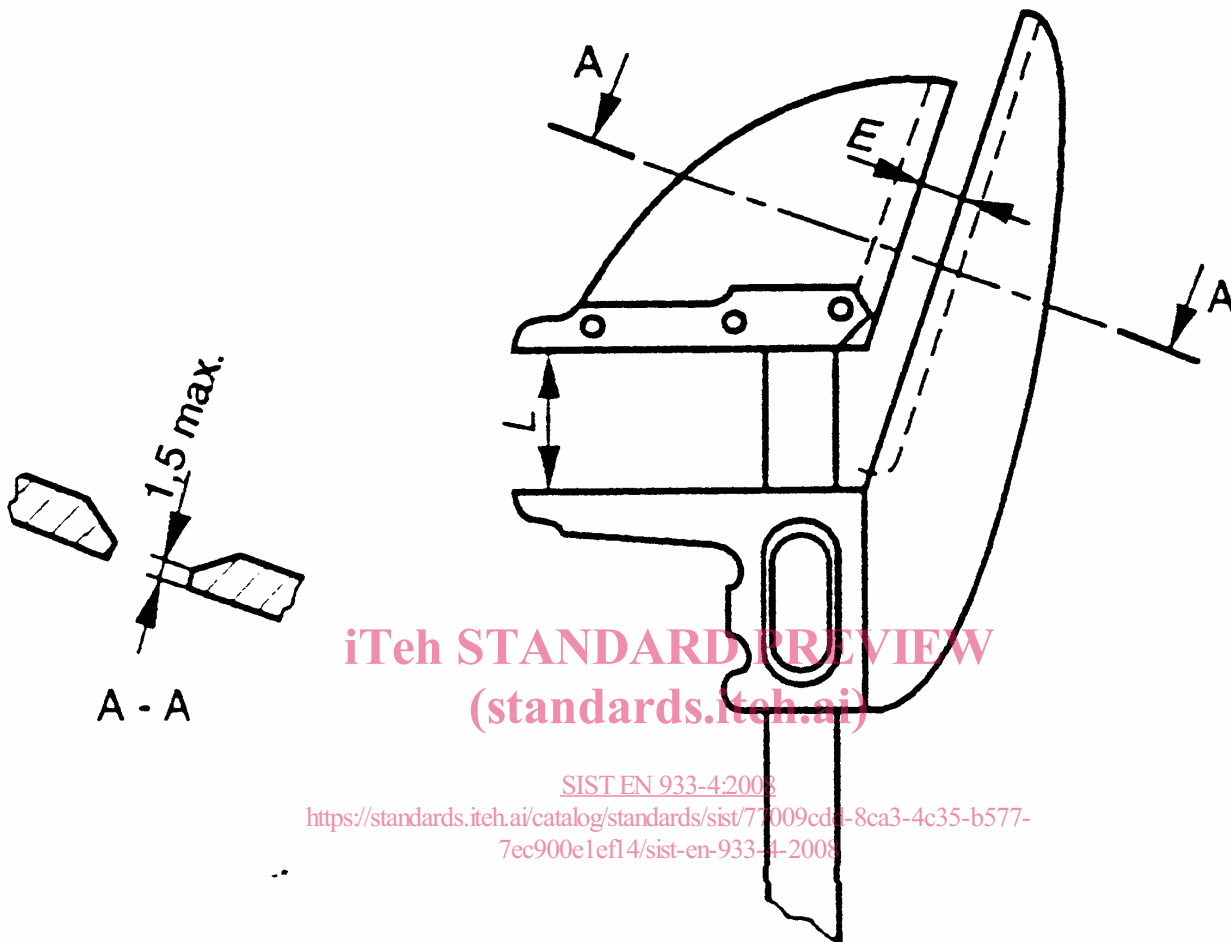


Figure 1 - Example of a particle slide gauge

## 6 Preparation of test portion

The sample shall be reduced in accordance with the requirements of EN 932-2.

Dry the sample at  $(110 \pm 5) ^\circ\text{C}$  to constant mass.

Sieve on appropriate test sieves with sufficient vigour to ensure complete separation of particles greater than 4 mm. Discard the particles retained on the 63 mm test sieve and those passing the 4 mm test sieve.

If necessary further reduce the sample in accordance with EN 932-2 to produce a test portion.

Record the mass of the test portion as  $M_o$ .



The mass of the test portion shall be as specified in Table 1.

**Table 1 - Mass of test portions**

Upper aggregate size $D$	Test portion mass (minimum)
mm	kg
63	45
32	6
16	1
8	0,1

NOTE 1 For the other upper aggregate sizes  $D$ , appropriate test portion masses may be interpolated from those given in Table 1.

NOTE 2 For aggregates of particle density less than 2,00 Mg/m<sup>3</sup> or more than 3,00 Mg/m<sup>3</sup> in accordance with EN 1097-6 an appropriate correction should be applied to the test portion masses given in Table 1 based on the density ratio, in order to produce a test portion of approximately the same volume as those for aggregates of normal density.

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Sample reduction shall yield a test portion with a mass larger than the minimum but not of an exact predetermined value.

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## 7 Procedure

### 7.1 General

The test shall be carried out on each particle size fraction  $d_i/D_i$  where  $D_i \leq 2d_i$ .

Test portions from samples for which  $D > 2d$  shall be separated into particle size fractions  $d_i/D_i$  where  $D_i \leq 2d_i$  during the subsequent test procedure.

### 7.2 Test portions where $D \leq 2d$

Separate the particle size fraction  $d_i/D_i$  where  $D_i \leq 2d_i$  from the test portion by sieving in accordance with EN 933-1.

Discard any particles smaller than  $d_i$  and any larger than  $D_i$ .

Record the particle size fraction  $d_i/D_i$  that is to be tested and record the mass of the particle size fraction  $d_i/D_i$  as  $M_1$ .

Assess the length  $L$  and thickness  $E$  of each particle using a particle slide gauge where necessary and set aside those particles which have a dimensional ratio  $L/E > 3$ . These particles are classified as non-cubical.

NOTE The number of particles requiring individual classification using the gauge can be reduced by a preliminary separation of particles with a  $L/E$  ratio significantly different from 3.

Weigh the non-cubical particles and record their mass as  $M_2$ .