



# SLOVENSKI STANDARD

## SIST EN 933-5:1999

01-junij-1999

---

### Preskusi geometričnih lastnosti agregatov - 5. del: Določevanje odstotka lomljenih površin zrn grobega agregata

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

Prüfverfahren für geometrische Eigenschaften von Gesteinskörnungen - Teil 5: Bestimmung des Anteils an gebrochenen Körnern in groben Gesteinskörnungen

Essais pour déterminer les caractéristiques géométriques des granulats - Partie 5: Détermination du pourcentage de surfaces cassées dans les gravillons

<https://standards.iteh.ai/catalog/standards/sist/fa6fa46e-d79e-44fb-8ae6-b2c7174c47c6/sist-en-933-5-1999>

Ta slovenski standard je istoveten z: **EN 933-5:1998**

---

#### **ICS:**

91.100.15      Mineralni materiali in izdelki      Mineral materials and products

**SIST EN 933-5:1999**

**en**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 933-5:1999

<https://standards.iteh.ai/catalog/standards/sist/fa6fa46e-d79e-44fb-8ae6-b2c7174c47c6/sist-en-933-5-1999>

EUROPEAN STANDARD

EN 933-5

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 1998

ICS 91.100.20

Descriptors: aggregates, tests, geometric characteristics, determination, area, fractures : materials, sortings, rates : per unit time, gravel, computation

English version

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

Essais pour déterminer les caractéristiques géométriques  
des granulats - Partie 5: Détermination du pourcentage de  
surfaces cassées dans les gravillons

Prüfverfahren für geometrische Eigenschaften von  
Gesteinskörnungen - Teil 5: Bestimmung des Anteils an  
gebrochenen Körnern in groben Gesteinskörnungen

This European Standard was approved by CEN on 26 December 1997.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

SIST EN 933-5:1999

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Page 2  
EN 933-5:1998

## Contents

	Page
Foreword	3
1 Scope	4
2 Normative references	4
3 Definitions	4
4 Principle	5
5 Apparatus	5
6 Preparation of test portion	6
7 Procedure	7
8 Calculation and expression of results	7
9 Test report	9
Annex A (informative) Example of a test data sheet	10

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 933-5:1999](https://standards.iteh.ai/catalog/standards/sist/fa6fa46e-d79e-44fb-8ac6-b2c7174c47c6/sist-en-933-5-1999)

<https://standards.iteh.ai/catalog/standards/sist/fa6fa46e-d79e-44fb-8ac6-b2c7174c47c6/sist-en-933-5-1999>

**Foreword**

This European Standard 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 July 1998, and conflicting national standards shall be withdrawn at the latest by December 1999.

This European Standard forms part of a series of tests for geometrical properties of aggregates. Test methods for other properties of aggregates will be 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

A European Standard "Tests for filler aggregate used in bituminous mixtures" is in preparation.

The other parts of EN 933 will be:

**STANDARD PREVIEW**  
(standards.iteh.ai)

- 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 6: Assessment of surface characteristics - Flow coefficient for coarse 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

This European Standard specifies a method for the determination of the percentage of particles with crushed and broken surfaces in a sample of natural coarse aggregate. It applies to gravel or mixed aggregate containing gravel.

The test method specified in this part of 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.

NOTE: For aggregate sizes with  $D > 63$  mm and/or  $d < 4$  mm the test may be carried out on particle size fractions  $d_i/D_i$  where  $D_i \leq 63$  mm and  $d_i \geq 4$  mm.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

prEN 932-2	Tests for general properties of aggregates Part 2: Methods for reducing laboratory samples
prEN 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

## 3 Definitions

For the purposes of this standard, the following definitions apply:

**3.1 aggregate size:** A designation of aggregate in terms of lower ( $d$ ) and upper ( $D$ ) sieve sizes.

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**: The 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 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 totally crushed or broken particle**: Particle with more than 90 % of its surface crushed or broken (tc).

**3.6 crushed or broken particle**: Particle with more than 50 % of its surface crushed or broken (c).

**3.7 rounded particle**: Particle with 50 % or less of its surface crushed or broken (r).

**3.8 totally rounded particle**: Particle with more than 90 % of its surface rounded (tr).

**3.9 crushed or broken surfaces**: Facets of a particle of gravel produced by crushing or broken by natural forces and bounded by sharp edges. If the surface edges of a particle of crushed or broken gravel are worn or weathered then its surfaces shall be considered as rounded for the purposes of this test method.

<https://standards.iteh.ai/catalog/standards/sist/fa6fa46e-d79e-44fb-8ae6-b2c7174c47c6/sist-en-933-5-1999>

## 4 Principle

The test consists of sorting particles by hand, from a test portion of coarse aggregates into:

- crushed or broken particles, including totally crushed or broken particles;
- rounded particles, including totally rounded particles.

The mass of each of these groups is determined and expressed as a percentage of the test portion mass.

Totally crushed or broken particles and totally rounded particles are then sorted by hand from crushed or broken particles and rounded particles and the mass of these groups is determined and expressed as a percentage of the test portion mass.

## 5 Apparatus

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

**5.1** Test sieves, of nominal size of apertures conforming with EN 933-2.

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

Page 6

EN 933-5:1998

5.3 Ventilated oven, thermostatically controlled to maintain a temperature of  $(110 \pm 5)$  °C or equipment for drying the aggregate which does not cause any particle size breakdown.

5.4 Balance or scale, of suitable capacity, readable to  $\pm 0,1$  % of the mass to be weighed.

5.5 Trays.

5.6 Brushes.

5.7 Sieving machine, optional.

## 6 Preparation of test portion

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

Dry the sample at  $(110 \pm 5)$  °C to constant mass. Weigh and record the mass as  $M_o$ .

Sieve on appropriate test sieves agitating 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 prEN 932-2 to produce a test portion. Record the mass of the test portion as  $M_i$ . 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: For other aggregate sizes  $D$ , appropriate test portion masses may be interpolated from those given in table 1.

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

Carry out the test on each particle size fraction  $d_i/D_i$  where  $D_i \leq 2d_i$ .

Samples for which  $D > 2d$  shall first be separated into particle size fractions  $d_i/D_i$  where  $D_i \leq 2d_i$ .



## 7 Procedure

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

Spread the particles of the test portion on a flat surface and separate the particles by hand into the following two groups:

- crushed or broken particles (c) including the totally crushed or broken particles (tc);
- rounded particles (r) including the totally rounded particles (tr).

Weigh each group and record the masses as  $M_c$  and  $M_r$ .

Spread the crushed or broken particles (c) on a flat surface and separate by hand the totally crushed or broken particles (tc) from the others. Weigh the totally crushed or broken particles (tc) and record the mass as  $M_{tc}$ .

Spread the rounded particles (r) on a flat surface and separate by hand the totally rounded particles (tr) from the others. Weigh the totally rounded particles (tr) and record the mass as  $M_{tr}$ .

### 7.2 Test portions where $D > 2d$

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

Record the mass of each particle size fraction as  $M_i$  and calculate and record the percentage by mass of each particle size fraction  $d_i/D_i$  to the test portion mass  $M_1$  as  $V_i$ .

Discard any size fraction  $d_i/D_i$  which comprises less than 10 % of  $M_1$ .

NOTE 1: Any remaining size fraction  $d_i/D_i$  which contains less than 100 particles should, if required, be recorded in the test report.

NOTE 2: Size fractions  $d_i/D_i$  which contain an excessive number of particles can be further reduced in accordance with prEN 932-2.

NOTE 3: Size fractions can be further reduced if they consist of significantly more than 200 particles.

Record the mass of particles to be tested in each remaining particle size fraction  $d_i/D_i$  as  $M_{1i}$  and sort the particles in each of these remaining size fractions separately in accordance with 7.1.

Record the masses of crushed or broken particles, rounded particles, totally crushed or broken and totally rounded particles in each of these size fractions  $d_i/D_i$  as  $M_{ci}$ ,  $M_{ri}$ ,  $M_{tci}$  and  $M_{tri}$  respectively.

## 8 Calculation and expression of results

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

Record the masses  $M_1$  and  $M_c$ ,  $M_r$ ,  $M_{tc}$  and  $M_{tr}$  on a test data sheet (see example given in annex A) and calculate the percentage  $C$  of particles in each group in accordance with the following equation: