



SLOVENSKI STANDARD

SIST EN 933-1:1999

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Preskusi geometričnih lastnosti agregatov - 1. del: Določevanje zrnivosti - Metoda sejanja

Tests for geometrical properties of aggregates - Part 1: Determination of particle size distribution - Sieving method

Prüfverfahren für geometrische Eigenschaften von Gesteinskörnungen - Teil 1: Bestimmung der Korngrößenverteilung - Siebverfahren

Essais pour déterminer les caractéristiques géométriques des granulats - Partie 1: Détermination de la gravité - Analyse granulométrique par tamisage

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ICS:

91.100.15 Mineralni materiali in izdelki Mineral materials and products

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EUROPEAN STANDARD

EN 933-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 1997

ICS 91.100.20

Descriptors: aggregates, tests, geometric characteristics, grain size, grain size analysis, sieve analysis, specimen preparation

English version

**Tests for geometrical properties of aggregates -
Part 1: Determination of particle size distribution -
Sieving method**

Essais pour déterminer les caractéristiques
géométriques des granulats - Partie 1:
Détermination de la granularité - Analyse
granulométrique par tamisage

Prüfverfahren für geometrische Eigenschaften
von Gesteinkörnungen - Teil 1: Bestimmung der
Korngrößenverteilung - Siebverfahren

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This European Standard was approved by CEN on 1997-07-16. 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.

The European Standards exist 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.

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.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

Contents

| | Page |
|---|------|
| Foreword | 3 |
| 1 Scope | 4 |
| 2 Normative references | 4 |
| 3 Definitions | 5 |
| 4 Principle | 5 |
| 5 Apparatus | 5 |
| 6 Preparation of test portions | 6 |
| 7 Procedure | 7 |
| 8 Calculation and expression of results | 8 |
| 9 Test report | 9 |
| iTeh STANDARD PREVIEW (standards.iteh.ai) | |
| Annex A (informative) Graphical presentation of results | 10 |
| Annex B (normative) Method of test for aggregates unsuitable for oven-drying SIST EN 933-1:1999 | 11 |
| Annex C (informative) Example of test data sheet https://standards.iteh.ai/standards/sist/bf66a152-ba52-4a6b-a444-13ebde27e837/sist-en-933-1-1999 | 12 |

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 February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

This 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 "Test for filler aggregate used in bituminous mixtures" is in preparation.

The other parts of EN 933 will be:

| | |
|----------|--|
| 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 crushed and broken surfaces in coarse aggregate particles |
| Part 6: | Determination of texture/shape - Flow coefficient of coarse aggregates |
| Part 7: | Determination of shell content - Percentage of shells for coarse aggregates |
| Part 8: | Assessment of fines - Sand equivalent test |
| Part 9: | Assessment of fines - Methylene blue test |
| Part 10: | Determination 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 Part of this European Standard specifies a method, using test sieves, for the determination of the particle size distribution of aggregates. It applies to aggregates of natural or artificial origin, including lightweight aggregates, up to 63 mm nominal size, but excluding filler.

NOTE: The determination of the grading of fillers will be specified in prEN 933-10 Tests for geometrical properties of aggregates Part 10: Determination of fines - Grading of fillers.

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 933-2 : 1995 | Tests for geometrical properties of aggregates Part 2: Determination of particle size distribution - Test sieves, nominal size of apertures |
| prEN 1097-6 | Tests for mechanical and physical properties of aggregates Part 6: Determination of particle density and water absorption |
| ISO 3310-1:1990 | Test sieves - Technical requirements and testing. Part 1: Test sieves of metal wire cloth |
| ISO 3310-2:1990 | Test sieves - Technical requirements and testing. Part 2: Test sieves of perforated metal plate |

3 Definitions

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

3.1 test portion: The sample used as a whole in a single test.

3.2 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 5.3) at (110 ± 5) °C. Test laboratories may determine the time required to achieve constant mass for specific types and sizes of sample dependent upon the drying capacity of the oven used.

4 Principle

The test consists of dividing up and separating, by means of a series of sieves, a material into several particle size classifications of decreasing sizes. The aperture sizes and the number of sieves are selected in accordance with the nature of the sample and the accuracy required.

The method adopted is washing and dry sieving. When washing may alter the physical properties of a lightweight aggregate, dry sieving shall be used and the procedure specified in 7.1 shall not be applied.

NOTE: Dry sieving is also an alternative method which may be used for aggregates free from particles which cause agglomeration. In cases of dispute washing and sieving is the preferred method.

The mass of the particles retained on the various sieves is related to the initial mass of the material. The cumulative percentages passing each sieve are reported in numerical form and when required in graphical form (see annex A).

5 Apparatus

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

5.1 Test sieves, with apertures as specified in prEN 933-2 and conforming to the requirements of ISO 3310-1 and ISO 3310-2.

5.2 Tightly fitting pan and lid, for the sieves.

5.3 Ventilated oven, thermostatically controlled to maintain a temperature of (110 ± 5) °C, or other suitable equipment for drying the aggregates, if it does not cause any particle size breakdown.

5.4 Washing equipment.

5.5 Balances or scales, accurate to $\pm 0,1$ % of test portion mass.

5.6 Trays, brushes.

5.7 Sieving machine, (optional).

6 Preparation of test portions

Samples shall be reduced in accordance with prEN 932-2 to produce the required number of test portions.

NOTE: It may be necessary to moisten samples containing substantial amounts of fines before reduction to minimise segregation and loss of dust.

The mass of each test portion shall be as specified in table 1 for aggregates of density between 2,00 Mg/m³ and 3,00 Mg/m³.

Table 1: Mass of test portions for normal weight aggregates

| Aggregate size <i>D</i> (maximum) mm | Test portion mass (minimum) kg |
|--|--------------------------------------|
| 63 | 40 |
| 32 | 10 |
| 16 | 2,6 |
| 8 | 0,6 |
| ≤ 4 | 0,2 |

NOTE 1: For aggregates of other sizes, the minimum test portion mass may be interpolated from the masses given in table 1.

NOTE 2: If the test portion mass does not comply with table 1, the particle size distribution obtained does not comply with this standard, and this shall be stated in the report sheet.

NOTE 3: For aggregates of particle density less than 2,00 Mg/m³ or more than 3,00 Mg/m³ (see prEN 1097-6) an appropriate correction shall 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.

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

Dry the test portion by heating at a temperature of (110 ± 5) °C to constant mass. Allow to cool, weigh and record the mass as M_1 .

For some types of aggregate, drying at 110 °C binds particles together sufficiently strongly to prevent separation of single particles during subsequent washing and/or sieving procedures. For such aggregates the procedure given in annex B shall be adopted.

7 Procedure

7.1 Washing

Place the test portion in a container and add sufficient water to cover the test portion.

NOTE 1: A storage period of 24 h under water is helpful in breaking down lumps. A dispersion agent may be used.

Agitate the sample with sufficient vigour to result in complete separation and suspension of the fines.

Wet both sides of a 63 μm sieve reserved for use in this test only, and fit a guard sieve (e.g. 1 mm or 2 mm) on top. Mount the sieves in such a way that the suspension passing the test sieve can be run to waste or, when required, collected in a suitable vessel. Pour the contents of the container on to the top sieve. Continue washing until the water passing the 63 μm test sieve is clear.

NOTE 2: Care should be taken to prevent overloading, overflowing or damaging the 63 μm test sieve or the guard sieve. For some aggregates it will be found necessary to pour only the suspended fines from the container onto the 63 μm guarded test sieve, continuing to wash the coarse residue in the container and decanting the suspended fines onto the guard sieve until the water passing the 63 μm test sieve is clear.

Dry the residue retained on the 63 μm sieve at $(110 \pm 5) ^\circ\text{C}$ to constant mass. Allow to cool, weigh and record as M_2 .

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7.2 Sieving

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Pour the washed and dried material (or directly the dry sample) into the sieving column. The column comprises a number of sieves fitted together and arranged, from top to bottom, in order of decreasing aperture sizes with the pan and lid.

NOTE 1: Experience has shown that washing does not necessarily remove all the fines. It is therefore necessary to incorporate a 63 μm test sieve in the series.

Shake the column, manually or mechanically, then remove the sieves one by one, commencing with the largest aperture size opening and shake each sieve manually ensuring no material is lost by using, for example, a pan and lid.

Transfer all the material which passes each sieve onto the next sieve in the column before continuing the operation with that sieve.

NOTE 2: The sieving process may be considered completed when the retained material does not change more than 1,0% during 1 min of this sieving operation.

To avoid overloading of sieves, the fraction retained at the end of the sieving operation on each sieve (expressed in grams) shall not exceed:

$$A \times \sqrt{d}$$