SLOVENSKI STANDARD
SIST EN 933-6:2014

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Nadomešča:
SIST EN 933-6:2002
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Preskusi geometričnih lastnosti agregatov - 6. del: Ocenjevanje značilnosti površine - Količnik sipkosti agregatov

Tests for geometrical properties of aggregates - Part 6: Assessment of surface characteristics - Flow coefficient of aggregates

Prüfverfahren für geometrische Eigenschaften von Gesteinskörnungen - Teil 6: Beurteilung der Oberflächeneigenschaften - Fließkoeffizienten von Gesteinskörnungen

Essais pour déterminer les caractéristiques géométriques des granulats - Partie 6: Evaluation des caractéristiques de surface - Coefficient d'écoulement des granulats

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EUROPEAN STANDARD

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EN 933-6

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English Version

Tests for geometrical properties of aggregates - Part 6: Assessment of surface characteristics - Flow coefficient of aggregates

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This European Standard was approved by CEN on 6 February 2014.

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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-CENELEC Management Centre has the same status as the official versions.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 933-6:2014) 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of an identical text or by endorsement, at the latest by October 2014, and conflicting national standards shall be withdrawn at the latest by October 2014.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document supersedes EN 933-6:2001.

The main changes to the previous version of EN 933-6 are:

- Scope: Updated to conform SC6 resolution n°237/2006 on the possible use of other test methods under specified conditions, and also to allow the use of advanced test methods;

- Clause 5, Reference materials: a reference fine aggregate has been introduced to improve the precision data of the flow coefficient of fine aggregates;

- 6.4, Additional apparatus required for the determination of the flow coefficient of fine aggregates: a cylindrical feed hopper has been added to improve the precision data of the test;

- 8.5, Test report: the list of required data has been updated;

- Annex B, precision, B.2: The precision data for fine aggregate provided by France have been updated following a more recent interlaboratory experiment for which a cylindrical feed hopper was used.

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*

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 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)

Part 11: Classification test for the constituents of coarse recycled aggregate

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the reference method used for type testing, and in case of dispute, for determining the flow coefficient of coarse and fine aggregates. 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. Examples of advanced test methods can be found in the Bibliography.

This European Standard applies to coarse aggregate of sizes between 4 mm and 20 mm and to fine aggregate of size up to 2 mm.

NOTE 1 For coarse aggregates between 4 mm and 20 mm, the flow coefficient is linked with the percentage of crushed or broken surfaces of an aggregate and can therefore be used in association with the method specified in EN 933–5. Shape and surface texture characteristics also influence the result.

NOTE 2 Experience of this test has been generally limited to natural aggregates.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

EN 933-3, *Tests for geometrical properties of aggregates - Part 3: Determination of particle shape - Flakiness index*

EN 1097-6:2013, *Tests for mechanical and physical properties of aggregates - Part 6: Determination of particle density and water absorption*

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 in terms as *d*/*D*

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
constant mass
mass determined by successive weighings 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.

3.3
laboratory sample
sample intended for laboratory testing

3.4
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)

3.5
test portion
sample used as a whole in a single test

4 Principle

The flow coefficient of an aggregate is the time, expressed in seconds, for a specified volume of aggregate to flow through a given opening, under specified conditions using a standard apparatus.

5 Reference materials

5.1 Coarse aggregate material

A 6,3/10 mm reference aggregate with a flow time of (100 ± 2) s when the shutter has an opening of (42,0 ± 0,2) mm.

In the various calculations, the flow time E_R of this reference coarse aggregate shall be taken as equal to 100 s and its pre-dried particle density ρ_p shall be taken as equal to 2,70 Mg/m^3.

NOTE At present the only recognized source of reference aggregate is a stock of quartzite aggregate controlled by the CEREMA, Direction territoriale Normandie Centre, Laboratoire Régional de Rouen, 10 chemin de la Poudrière, CS 90245, 76121 Le Grand-Quevilly cedex, France. {Telephone: + (33) 2 35 68 81 00 – Fax: + (33) 2 35 68 81 72 – e-mail: LRR.DTerNC@cerema.fr}

An alternative source of reference coarse aggregate can be used provided that the flow coefficient of that aggregate is established in a controlled experiment carried out in at least 10 laboratories, by cross testing against the LRPC reference coarse aggregate. In this case, the flow time E_R and the pre-dried particle density ρ_p of this alternative reference coarse aggregate should be used. In case of dispute, the LRPC reference coarse aggregate should be used.

5.2 Fine aggregate material

A 0,063/2 mm reference aggregate with a flow time of (32 ± 2) s.

In the various calculations, the flow time E_{RS} of this reference fine aggregate shall be taken as equal to 32 s and its pre-dried particle density shall be taken as equal to 2,70 Mg/m^3.

NOTE At present the only recognized source of reference aggregate is a siliceous Somme bay fine aggregate controlled by the CEREMA, Direction territoriale Normandie Centre, Laboratoire Régional de Rouen, 10 chemin de la Poudrière, CS 90245, 76121 Le Grand-Quevilly cedex, France. {Telephone: + (33) 2 35 68 81 00 – Fax: + (33) 2 35 68 81 72 – e-mail: LRR.DTerNC@cerema.fr}

An alternative source of reference fine aggregate can be used provided that the flow coefficient of that aggregate is established in a controlled experiment carried out in at least 10 laboratories, by cross testing against the LRPC reference fine aggregate. In this case, the flow time E_{RS} and the pre-dried

particle density ρ_p of this alternative reference fine aggregate should be used. In case of dispute, the LRPC reference fine aggregate should be used.

6 Apparatus

6.1 General

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

6.2 Apparatus for general purposes

6.2.1 Test sieves, conforming to EN 933-2, of the following aperture sizes:

0,063 mm, 2 mm, 4 mm, 6,3 mm, 8 mm, 10 mm, 14 mm and 20 mm.

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

6.2.3 Balance, accurate to 0,1 % of the mass to be weighed.

6.2.4 Stopwatch or stopclock, to read 0,1 s.

6.3 Additional apparatus required for the determination of the flow coefficient of coarse aggregate

6.3.1 Bar sieves, conforming to EN 933-3, with apertures of 4 mm and 5 mm.

6.3.2 Container, of volume approximately 10 l.

6.3.3 Vibratory table, (Figure 1) comprising the following parts:

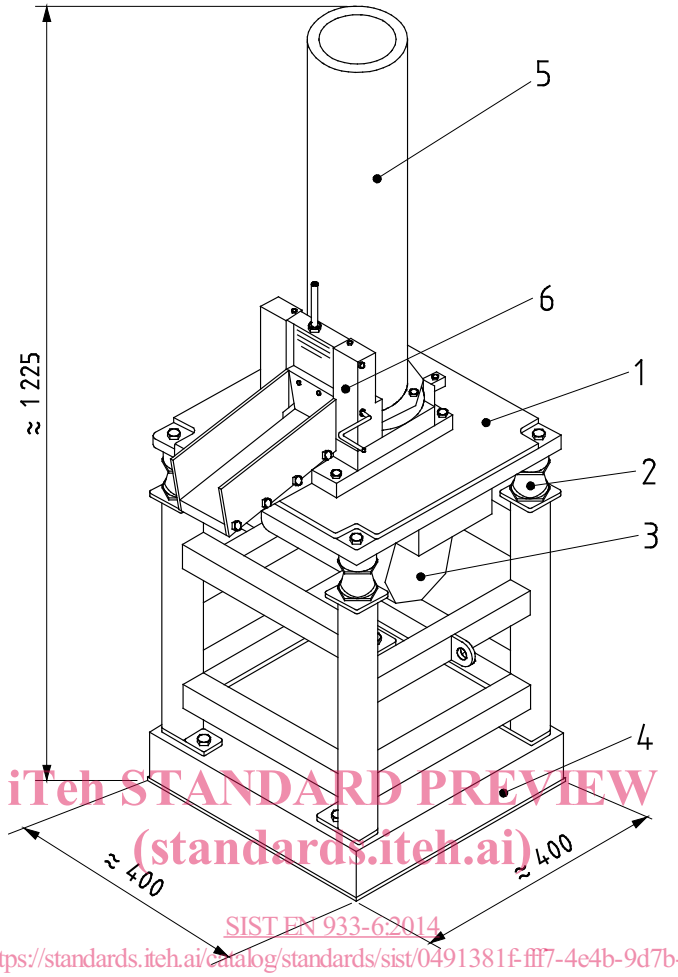
6.3.3.1 Bubble level, incorporated in the upper platform of the table and capable of setting in a horizontal position.

6.3.3.2 Four rubber suspensions, of Shore hardness (160 ± 30) N/mm joining the upper platform of the table to the support frame.

6.3.3.3 Vibrator, using unbalanced weights, fixed under the platform; with its axis of rotation horizontal and perpendicular to the axis of the flow channel. The speed of rotation shall be (2970 ± 20) revolutions/min and the amplitude (0,18 ± 0,02) mm when the flow unit is empty.

6.3.3.4 Baseplate, of mass (100 ± 10) kg, fixed under the frame.

Dimensions in millimetres



Key

1	vibratory platform	5	tube for test portion (see 6.3.4.1 and detail in Figure 2)
2	rubber suspension (see 6.3.3.2)	6	flow channel (see detail in Figure 2)
3	vibrator (see 6.3.3.3)		
4	baseplate (see 6.3.3.4)		

Figure 1 — Vibratory table and flow unit for coarse aggregate

6.3.4 **Flow unit**, of total mass (42,3 ± 0,1) kg (Figure 2) comprising the following:

6.3.4.1 **Plastic tube for test portion**, inside diameter (125 ± 2) mm and height (610 ± 10) mm.

6.3.4.2 **Metal shutter,** to adjust the height of the opening between (40 ± 1) mm and (60 ± 1) mm.

NOTE The height of the opening can be checked by using metal gauge block of a given height ± 0,1 mm.

6.3.4.3 **Metal movable flap**, to release the flow of material.

6.3.4.4 **Metal flow channel**, with a slope of (10,0 ± 0,5)°, a width of (90 ± 1) mm and fitted with plastic sides.