SLOVENSKI STANDARD
SIST EN 933-6:2002

01-september-2002

Preskusi geometriļ nih lastnosti agregatov - 6. del: Ocenjevanje znaļ ilnosti povrģine - Koliļ nik sipkosti agregatov

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

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

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

Ta slovenski standard je istoveten z: **EN 933-6:2001**

ICS:

91.100.15	Mineralni materiali in izdelki	Mineral materials and products

SIST EN 933-6:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 933-6

October 2001

ICS 91.100.15

English version

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This European Standard was approved by CEN on 30 September 2001.

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 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 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

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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of an identical text or by endorsement, at the latest by April 2002, and conflicting national standards shall be withdrawn at the latest by December 2003.

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 will be:

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 fillers (air jet sieving)

Annexes A, B and C are informative.

This standard includes a Bibliography.

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 methods for the determination of the flow coefficient of coarse and fine aggregates. It applies to coarse aggregate of sizes between 4 mm and 20 mm and to fine aggregate of size up to 4 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

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 (including amendments).

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, *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 European 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 in terms 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 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.

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 Materials for the determination of the flow coefficient of coarse aggregate

A 6,3/10 mm reference aggregate with a particle density of 2,70 Mg/m^3 and a flow time (E_R) of (100 ± 2) s when the shutter has an opening of (42,0 ± 0,2) mm. In the formulae where E_R is used, it shall be taken as equal to 100 s and the particle density shall be taken as equal to 2,70 Mg/m^3.

NOTE 1 A recognized source of reference aggregate is the Laboratoire Régional des Ponts et Chaussées (LRPC), Rouen, BP 245, – - 76120 Le Grand-Quevilly, France. {Telephone: + (33) 2 35 68 81 0– - Fax: + (33) 2 35 69 39 55}

NOTE 2 A National Standards Body can recognize an alternative source of reference aggregate. The flow coefficient of the alternative source should be established in a controlled experiment carried out in at least ten laboratories, by cross testing against the LRPC reference aggregate. In case of dispute, the LRPC reference 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

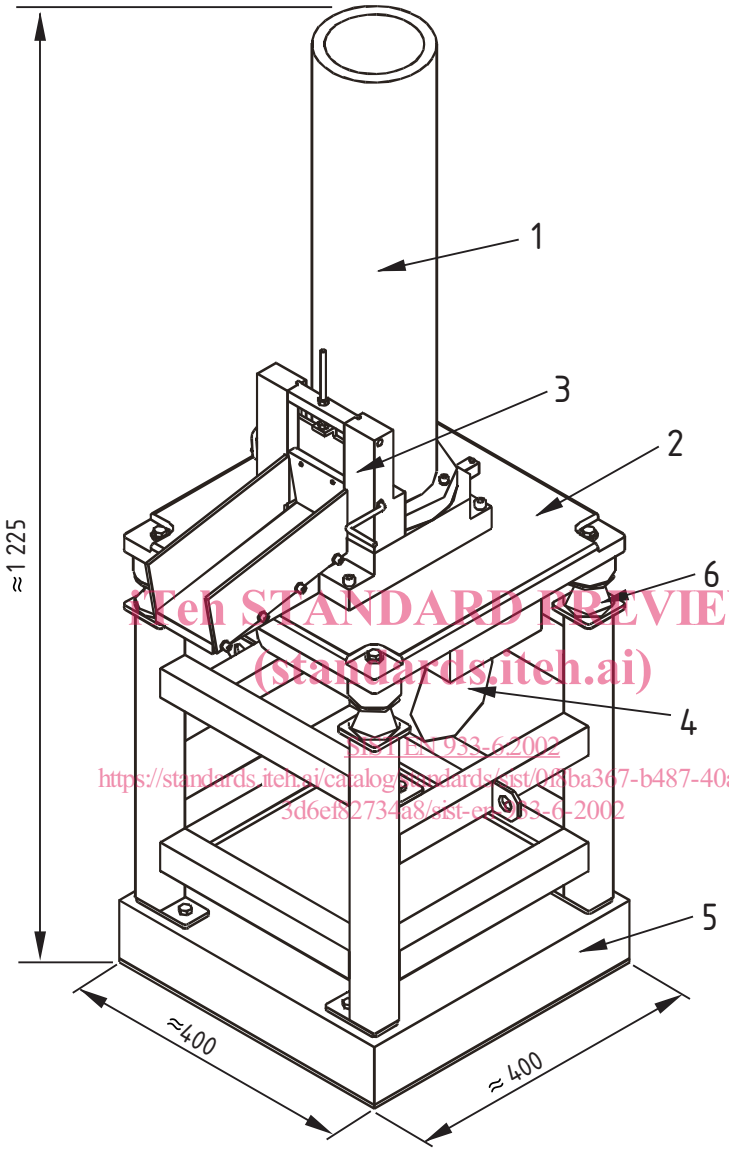
6.3.1 Bar sieves, conforming to EN 933-3, with apertures of 4 mm and 5 mm.

6.3.2 Container, of volume approximately 10 l.

6.3.3 Vibratory plate, (see 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.

Dimensions in millimetres

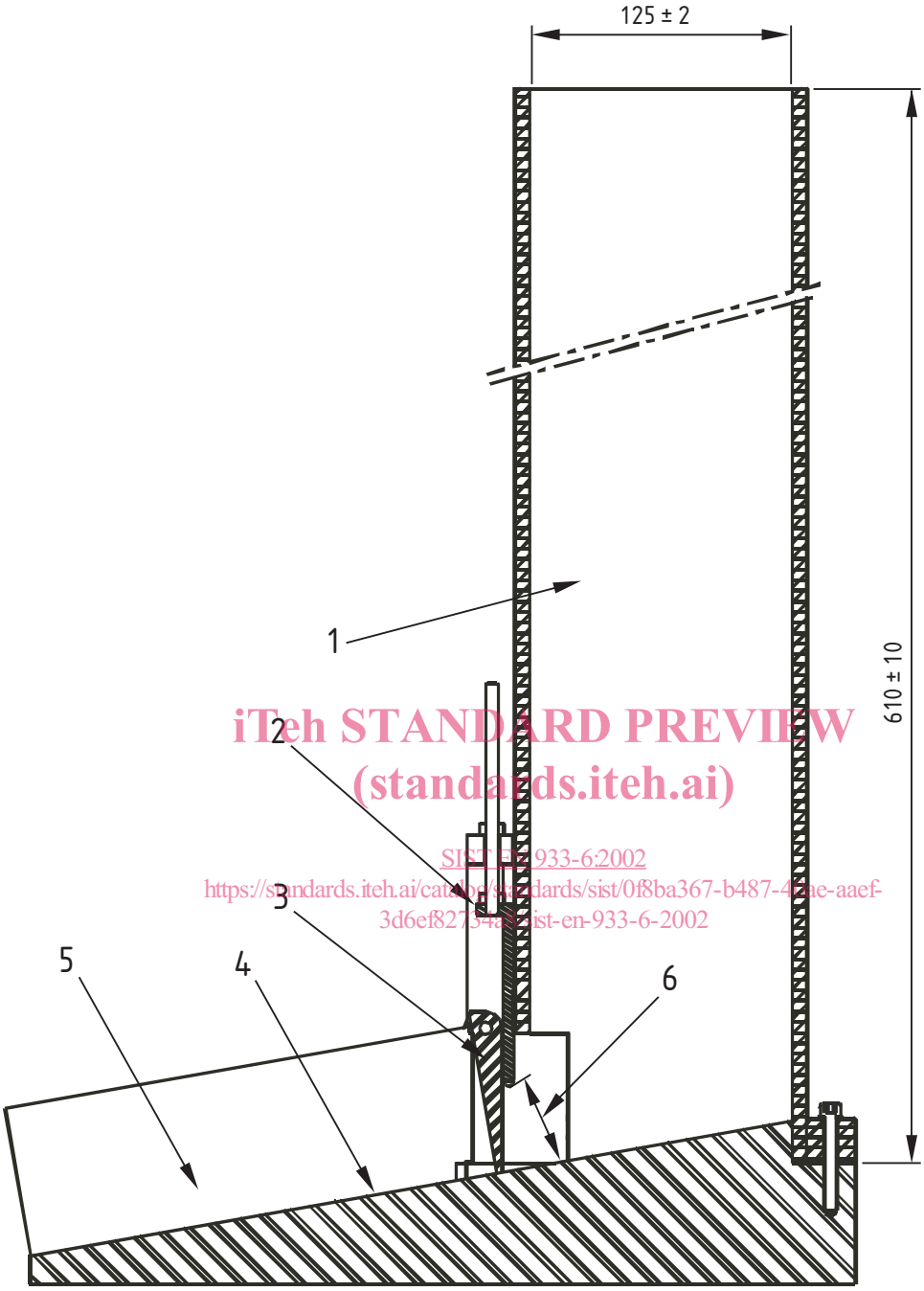


Key

1 Tube for test portion (see 6.3.4.4 and Figure 2)
2 Vibratory plate (see 6.3.3 and Figure 2)
3 Flow channel (see Figure 2)
4 Vibrator (see 6.3.3.4)
5 Baseplate (see 6.3.3.3)
6 Rubber suspension (see 6.3.3.2)

Figure 1 — Vibratory table and flow unit for coarse aggregate

Dimensions in millimetres



Key

1 Tube for test portion (see 6.3.4.4)
2 Shutter (see 6.3.4.2)
3 Movable flap (see 6.3.4.3)
4 Flow channel (see 6.3.4.1)
5 Slope 10° ± 0,1°
6 Adjustable from (40 ± 1) to (60 ± 1)

Figure 2 — Flow unit for coarse aggregate

Dimensions in millimetres

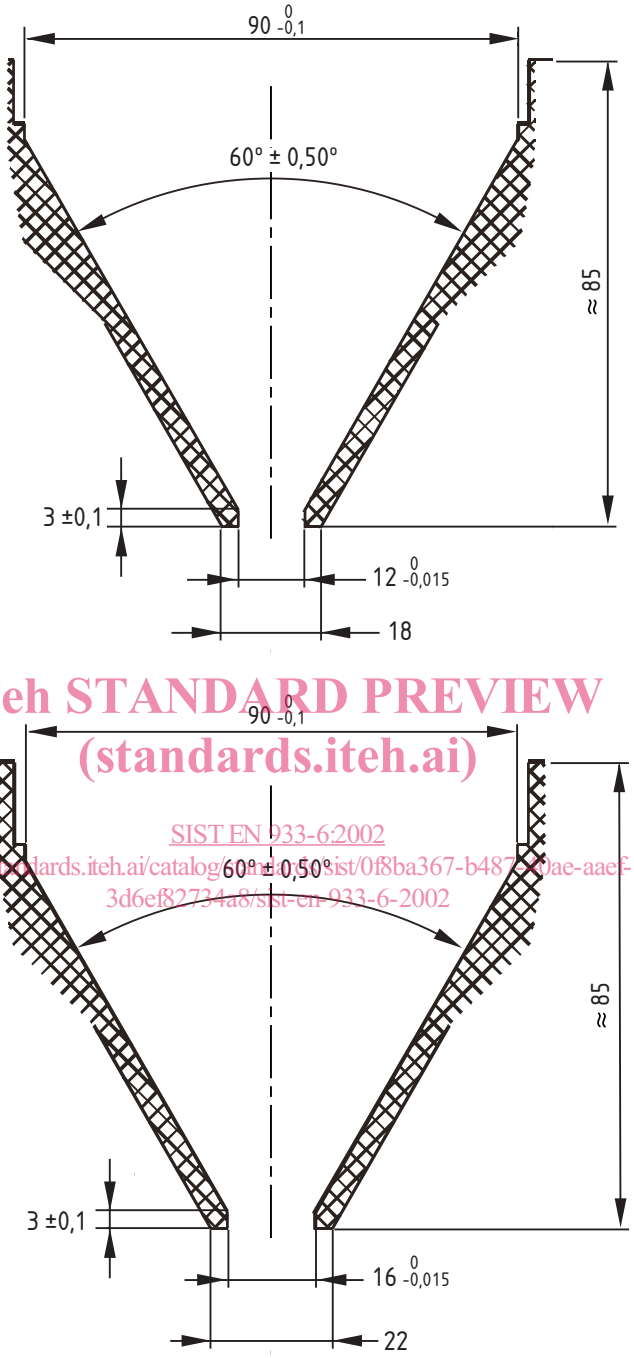


Figure 3 — Additional funnels for flow unit for fine aggregate

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

6.3.3.4 **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 it shall have a frequency of vibration of 50 Hz and an amplitude of (0,18 ± 0,02) mm when the flow unit is empty.

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

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

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

6.4 Additional apparatus required for the determination of the flow coefficient of fine aggregate

6.4.1 **Flow unit,** comprising the following:

6.4.1.1 **Two funnels**, 85 mm high, made from polycarbonate, one with a 12 mm opening, the other with a 16 mm opening (see Figure 3).

6.4.1.2 **Cylindrical body,** which can be fitted into the wider end of the funnels, inside diameter 90 mm, and minimum 125 mm high.

6.4.1.3 **Stand**, to hold the cylinder and funnel with a cover plate which can be moved to open and close the opening at the lower end of the funnel.

6.4.2 **Container**, of sufficient capacity to receive the material flowing from the funnel.

7 Determination of the flow coefficient of coarse aggregates

7.1 General

The test is carried out on one of the following particle size fractions:

4/6,3 mm, 6,3/10 mm, 10/14 mm, 4/10 mm or 4/20 mm.

7.2 Preparation of test portions

7.2.1 Reference aggregate

Wash and dry sieve a sufficient quantity of the 6,3/10 mm reference aggregate (see clause 5) on 6,3 mm, 8 mm and 10 mm test sieves and retain separately the 6,3/8 mm and the 8/10 mm size fractions.