BRITISH STANDARD

BS EN
933-7:1998

Tests for geometrical properties of aggregates —

Part 7: Determination of shell content — Percentage of shells in coarse aggregates

The European Standard EN 933-7:1998 has the status of a British Standard

ICS 91.100.20

National foreword

This British Standard is the English language version of EN 933-7:1998. It supersedes BS 812-106:1985 which, it is intended, will be withdrawn on 1999-12-01 if all the European Standards included in the package are available.

The UK participation in its preparation was entrusted by Technical Committee B/502, Aggregates, to Subcommittee B/502/6, Test methods, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 5 and a back cover.

This British Standard, having been prepared under the direction of the Sector Board for Building and Civil Engineering, was published under the authority of the Standards Board and comes into effect on 15 July 1998

ISBN 0 580 29780 2

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 933-7

March 1998

ICS 91.100.20

Descriptors: Aggregates, tests, geometrical characteristics, determination, percentage, gravel

English version

Tests for geometrical properties of aggregates — Part 7: Determination of shell content — Percentage of shells in coarse aggregates

Essais pour déterminer les propriétés géométriques des granulats — Partie 7: Détermination de la teneur en éléments coquilliers — Pourcentage des coquilles dans les gravillons

Prüfverfahren für geometrische Eigenschaften von Gesteinkörnungen — Teil 7: Bestimmung des Muschelschalengehaltes — Prozentsatz von Muschelschalen in groben Gesteinkörnungen

This European Standard was approved by CEN on 15 February 1998.

CEN

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

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

Ref. No. EN 933-7:1998 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 154, Aggregates, the secretariat of which is held by BSI.

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 *Tests for filler aggregate used in bituminous mixtures* is in the course of preparation.

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: Assessment of surface characteristics — Percentage of crushed and broken surfaces in coarse aggregates.

Part 6: Assessment of surface characteristics — Flow ocoefficient of 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).

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

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.

Contents

1 Scope

This European Standard specifies a method for the determination of shell content of coarse aggregates. 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 by 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 European 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)

NOTE The lower limit may be zero.

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 (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.

3.5

shell

the hard outer casing of a testaceous animal

4 Principle

The test consists of sorting by hand shells and shell fragments from a test portion of coarse aggregate. The shell content is determined as the proportion of the mass of shells and shell fragments to the mass of the test portion. The shell content, *SC*, is expressed as a percentage.

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 in accordance with EN 933-2.

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 equipment for drying the aggregate which does not cause any particle size breakdown.

5.4 *Balances or scale*, of suitable capacity, readable to ±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 ± 5) °C to constant mass. Weigh and record the mass as M_0.

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_1. The mass of the test portion shall be as specified in Table 1.

Table 1 — Mass of test portions

Upper aggregate size D mm	**Test portion mass (minimum)** 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 $D_i \leq 2\,d_i$.

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

7 Procedure

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

Spread the particles of the test portion on a flat surface and separate out the shells and shell fragments by hand.

Weigh the shells and shell fragments and record their mass M_2.

7.2 Test portion where $D > 2\,d$

Separate the test portion into particle size fractions d_i/D_i where $D_i \leq 2\,d_i$ 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 them as specified in **7.1**.

Record the mass of shell and shell fragments in each of these size fractions d_i/D_i as M_{2i}.

8 Calculation and expression of results

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

Calculate the shell content SC in accordance with the following equation:

$$SC = (M_2/M_1) \times 100$$

where:

M_1 is the mass of the test portion, in grams;

M_2 is the mass of the shells and shell fragments, in grams.

Record the value of SC to the nearest whole number.

8.2 Test portions where $D > 2\,d$

8.2.1 *Size fractions not reduced*

If no size fractions have been reduced calculate the shell content in accordance with the following equation:

$$SC = \frac{\sum M_{2i}}{\sum M_{1i}} \times 100$$

where:

$\sum M_{1i}$ is the sum of the masses in the size fractions tested, in grams.

$\sum M_{2i}$ is the sum of the masses of shells and shell fragments in each of the size fractions tested, in grams.

Record the value of SC to the nearest whole number.

8.2.2 *Reduced size fractions*

If any size fractions have been reduced calculate the percentages by mass of shells and shell fragments in each particle size fraction and record as SC_i.

Calculate the weighted mean percentage value of the shells and shell fragments in accordance with the following equation:

$$SC = \frac{\sum(V_i SC_i)}{\sum V_i}$$

where:

V_i is the percentage by mass of particle size fraction i in the sample tested;

SC_i is the percentage by mass of shells and shell fragments in particle size fraction i.

Record the weighted mean percentage of shells and shell fragments to the nearest whole number.

9 Test report

9.1 Required data

The test report shall include the following information:

a) reference to this European Standard;

b) identification of the sample;

c) identification of the laboratory;

d) sample reception date;

e) shell content *SC*, to the nearest whole number;

f) where applicable, the weighted mean percentage.

9.2 Optional data

The test report may include the information:

a) name and location of the sample source;

b) description of the material and of the sample reduction procedure;

c) visual description of shells (e.g., hollow or flat);

d) mass of sample M_0;

e) mass of test portion M_1;

f) mass of shells and fragments M_2;

g) any size fraction consisting of less than 100 particles;

h) sampling certificate, if available;

i) date of test.

Annex A (informative)
Example of a test data sheet

EN 933-7 Identification of the sample:	Laboratory: Date: Operator:

M_0 = g

Particle size fraction d/D_i **where** $D_i \leq 2\ d_i$ mm	**Mass** M_1 g	**Mass** M_2 g	**Shell content** SC **=** $(M_2/M_1) \times 100$ **(to the nearest whole number)** %

NOTE When a particle size fraction d_i/D_i has been reduced, an appropriate test data sheet should be used and the weighted mean values calculated as specified in **8.2**.

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