Tests for general properties of aggregates —

Part 2: Methods for reducing laboratory samples

The European Standard EN 932-2:1998 has the status of a British Standard

ICS 91.100.15

National foreword

This British Standard is the English language version of EN 932-2:1998. It is included in a package of European Standards agreed by CEN/TC 154.

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

— aid enquirers to understand the text;

— present to the responsible international/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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

This British Standard, having been prepared under the direction of the Sector Committee for Building and Civil Engineering, was published under the authority of the Standards Committee and comes into effect on 15 May 1999

ISBN 0 580 32099 5

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 932-2

January 1999

ICS 91.100.15

Descriptors: aggregates, tests, samples, specimen preparation, reduction methods

English version

Tests for general properties of aggregates — Part 2: Methods for reducing laboratory samples

Essais pour déterminer les propriétés générales des granulats — Partie 2: Méthodes de réduction d'un échantillon de laboratoire

Prüfverfahren für allgemeine Eigenschaften von Gesteinskörnungen — Teil 2: Verfahren zum Einengen zum Laboratoriumsproben

This European Standard was approved by CEN on 26 December 1998.

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.

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

Ref. No. EN 932-2:1999 E

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 1999, and conflicting national standards shall be withdrawn at the latest by 1 December 2003.

This European Standard is one of a series of standards for tests for general properties of aggregates. Test methods for other properties of aggregates are covered by Parts of the following European Standards:

EN 933, *Tests for geometrical 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.*
prEN 13179, *Tests for filler aggregate used in bituminous mixtures.*

The other parts of EN 932 will be:

Part 1: Methods for sampling.
Part 3: Procedure and terminology for simplified petrographic description.
Part 5: Common equipment and calibration.
Part 6: Definitions of repeatability and reproducibility.

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 methods for reducing laboratory samples of aggregates to test portions, when the test portion mass is:

— specified by a lower limit on the mass;

— specified by a tolerance around a target mass;

— determined precisely by the requirements of a test method.

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.

EN 932-1, *Tests for general properties of aggregates — Part 1: Methods for sampling.*

prEN 932-5, *Tests for general properties of aggregates — Part 5: Common equipment and calibration.*

3 Definitions and symbols

3.1 Definitions

For the purposes of this European Standard, the following definitions apply:

3.1.1

laboratory sample

sample intended for laboratory testing

3.1.2

subsample

sample obtained by means of a sample reduction procedure

3.1.3

test portion

subsample used as a whole in a single test

3.1.4

test specimen

sample used in a single determination when a test method requires more than one determination of a property

3.1.5

½ *division*

division of a sample into two subsamples of approximately equal mass (see Figure 1)

3.1.6

¾ *division*

division of a sample into two subsamples, with masses approximately ¾ and ¼ times the mass of the original sample (see Figure 2)

3.1.7

⅝ *division*

division of a sample into two subsamples with masses approximately ⅝ and ⅜ times the mass of the original sample (see Figure 3).

3.2 Symbols

m_L laboratory sample mass (in grams or kilograms).

m_S subsample mass (in grams or kilograms).

m_T specified test portion mass (in grams or kilograms).

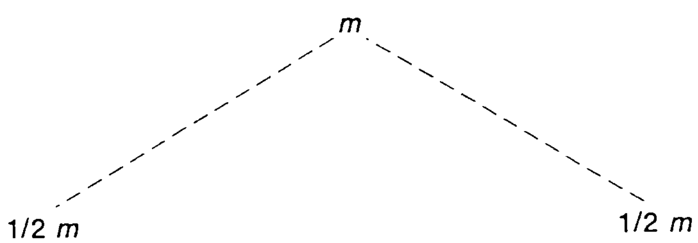
4 Principle

The procedures given in this European Standard are designed so that test portions are obtained by the minimum number of division steps, and so that, as far as possible, the operator is prevented from making small adjustments to the test portion and from choosing the particles that go into the test portion.

5 Apparatus

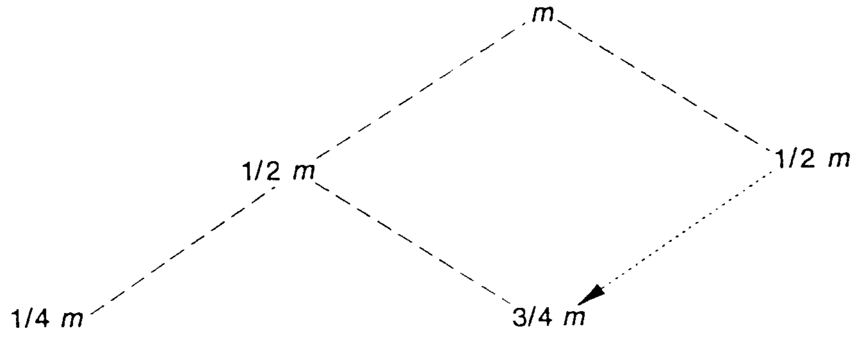
Apparatus shall be as specified in EN 932-1 with the addition of suitable apparatus for crushing and grinding. All apparatus shall comply with the general requirements of prEN 932-5.

NOTE In all cases, alternative designs may be used so long as the essential dimensions of width of opening and length are met, and the devices can be used to fulfil the sample reduction methods specified in clauses **7** to **13**.



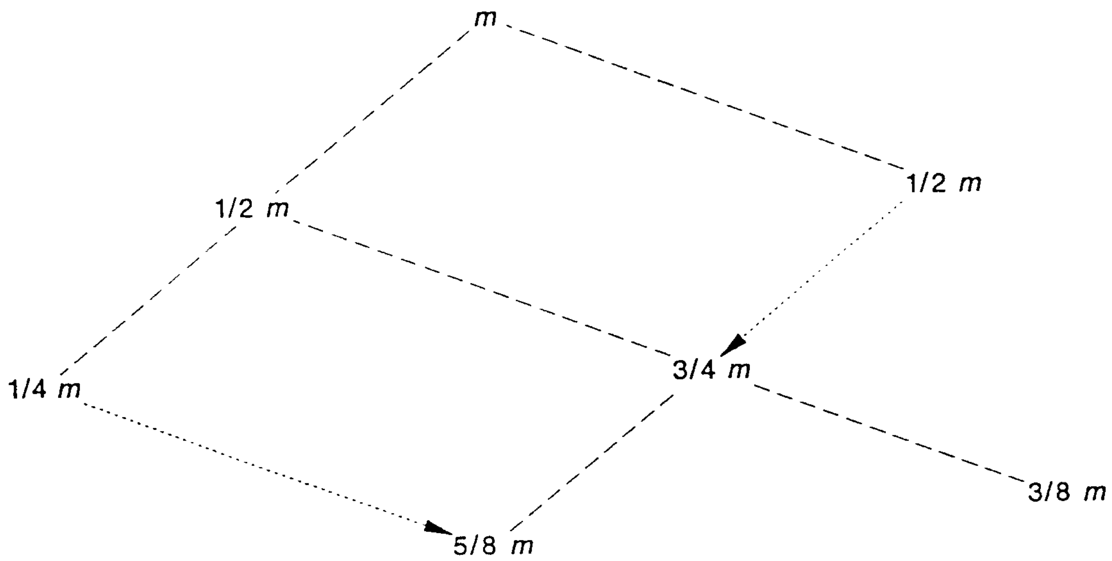
NOTE The dashed lines denote dividing of a sample into two subsamples.

Figure 1 — ½ division



NOTE The dashed lines denote dividing of a sample into two subsamples. A dotted line denotes the addition of a subsample retained from a previous division stage.

Figure 2 — ¾ division



NOTE The dashed lines denote dividing of a sample into two subsamples. A dotted line denotes the addition of a subsample retained from a previous division stage

Figure 3 — ⅝ division

6 Consideration before sample reduction

6.1 Moisture content and homogeneity of the sample

When the moisture content of an aggregate is to be determined, one or more test portions shall be taken prior to drying. A riffle box or a mechanical divider shall not be used.

When test portions are required for other purposes than moisture content and a riffle box or mechanical divider is to be used, the laboratory sample shall be brought to a condition in which it is free-flowing.

NOTE 1 For aggregates containing fines that segregate when dry, or for aggregates containing lumps of clay visible to the naked eye, it is recommended that they are subjected to sample reduction in the condition in which they are received at the laboratory, not dried.

NOTE 2 If on the basis of visual inspection, the laboratory sample needs mixing, then this should be performed on a sampling tray. For aggregate that contains a wide range of particle sizes it can be desirable to separate the laboratory sample into two (or more) fractions by sieving and to treat each fraction to sample reduction separately.

6.2 Test methods that specify only a lower limit to the test portion mass

For test methods that specify only a minimum mass (m_T) for the test portion or each of several test specimens one of the following procedures to yield 100 % to 150 % of the specified mass shall be used:

a) sample reduction using a rotary sample divider (see clause **7**);

b) sample reduction using a riffle box (see clause **8**);

c) sample reduction using fractional shovelling (see clause **9**);

d) sample reduction by quartering (see clause **10**).

NOTE a) above is the preferred procedure and d) is not recommended for wide gradings.

6.3 Test methods that allow a sizeable tolerance round a target mass

For test methods, which require a test portion mass suited to the capacity of the equipment that is used, but can allow a sizeable tolerance around the test portion mass (for example, determination of water-soluble sulfates), one of the following procedures that gives a test portion mass within ± 15 % of the specified mass shall be used:

a) sample reduction using a rotary sample divider (see clause **7**);

b) sample reduction using a riffle box (see clause **8**);

c) sample reduction using fractional shovelling (see clause **9**).

NOTE a) above is the preferred procedure.

6.4 Test methods that specify a test portion mass within a small tolerance

For the following types of test methods, which require a test portion mass to be within a small tolerance of a specified mass, the procedure specified in clause **11** shall be used:

a) test methods for which the test portion mass is determined by the capacity of a container used in the test (for example, bulk density);

b) test methods that involve the manufacture of specimens (for example mortar or bituminous bound or hydraulically bound test specimens) from aggregate fractions that have to be weighed to the nearest 5 g or less;

c) test methods where the test portion mass is specified with a very narrow tolerance.

7 Sample reduction technique using a rotary sample divider

Select a configuration of the sample divider that will yield the test portions within 100 % to 150 % of the specified mass, or within 85 % to 115 % of the specified mass, as appropriate to the test method requirements.

NOTE The calculations and schemes of sample reduction divisions using a riffle box given in clause **8** can also be applied to a rotary sample divider provided it can divide into a small and even number of subsamples.

Place the sample into the hopper and start the rotor. When the rotor is rotating at its operating speed start the vibrating feeder.

Check that at least 35 revolutions are completed before the laboratory sample is exhausted. If this is not achieved, recombine the subsamples and repeat the sample reduction with a lower feed rate.

If the mechanical sample divider is not equipped with a feeder and/or 35 revolutions cannot be achieved, the mass of each portion shall be checked and shall be within 100 % to 150 % of the specified mass, or within 85 % to 115 % of the specified mass as appropriate.

8 Sample reduction using a riffle box

Put the sample into one of the riffle box receptacles. Spread the material out evenly over the full length of the receptacle. Place the other two receptacles in position. Pour the sample from the long side of the riffle box down the centre line of the riffle box.

An example of the division steps using a riffle box is shown in annex A.

8.1 To provide a test portion mass within 100 % to 150 % of a specified mass

8.1.1 *Calculations*

Obtain the value of the specified test portion mass m_T from the test method and calculate 0,75 m_T and 1,5 m_T.

NOTE If a test method is performed frequently then it may be convenient to display the pertinent information in the laboratory where the sample reduction is carried out, see Figure B.1.

Determine the mass of the laboratory sample, m_L. Calculate $m_S = m_L/2$, $m_L/4$, $m_L/8$, $m_L/16$, ... until a mass m_S is obtained that is less than 1,5 m_T.

8.1.2 ***Sample reduction*** (see Figure 4)

If m_S is between 0,75 m_T to m_T	reduce the laboratory sample by one ¾ division operation and then proceed using ½ divisions to obtain the required test portion mass;
if m_S is between m_T to 1,5 m_T	proceed using ½ divisions to obtain the required test portion mass.

NOTE After three successive ½ divisions it is advisable to determine the mass m_S of the subsample and decide if a further ¾ division is needed, using the same method as before, but with m_S in place of m_L.

8.2 To provide a test portion mass within 85 % to 115 % of a specified mass

8.2.1 ***Calculations***

Obtain the value of the specified test portion mass m_T from the test method and calculate 0,75 m_T, 0,85 m_T, 1,15 m_T and 1,5 m_T.

NOTE If a test method is performed frequently then it can be convenient to display the pertinent information in the laboratory where sample division is carried out (see Figure B.2).

Determine the mass of the laboratory sample m_L. Calculate $m_S = m_L/2$, $m_L/4$, $m_L/8$ ...... until a mass m_S is obtained that is less than 1,5 m_T.

8.2.2 ***Sample reduction*** (see Figure 5)

If m_S is between 0,75 m_T and 0,85 m_T	reduce the laboratory sample by one ⅝ division operation and then proceed using ½ divisions to obtain the required test portion mass;
if m_S is between 0,85 m_T and 1,15 m_T	proceed using ½ divisions to obtain the required test portion mass;
if m_S is between 1,15 m_T and 1,5 m_T	reduce the laboratory sample by one ¾ division operation and then proceed using ½ divisions to obtain the required test portion mass.

NOTE After three successive ½ divisions it is advisable to determine the mass m_T of the subsample and decide if a further ¾ or ⅝ division is needed, using the same method as before, but with m_S in place of m_L.

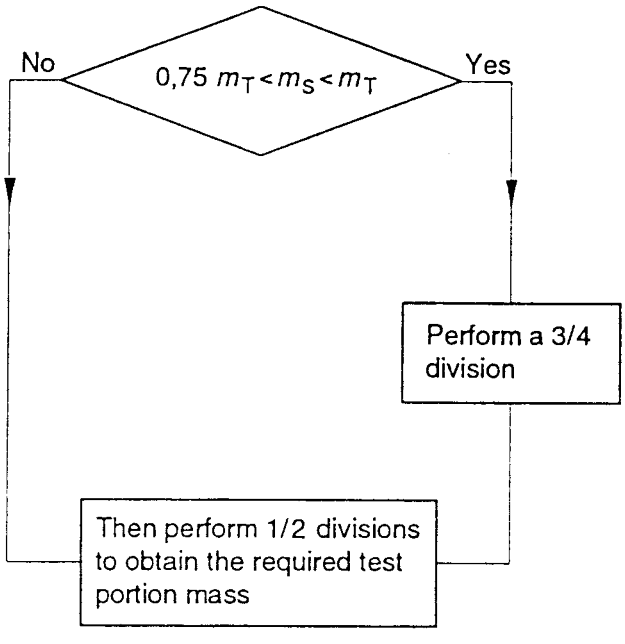


Figure 4 — Sample reduction procedure for 8.1

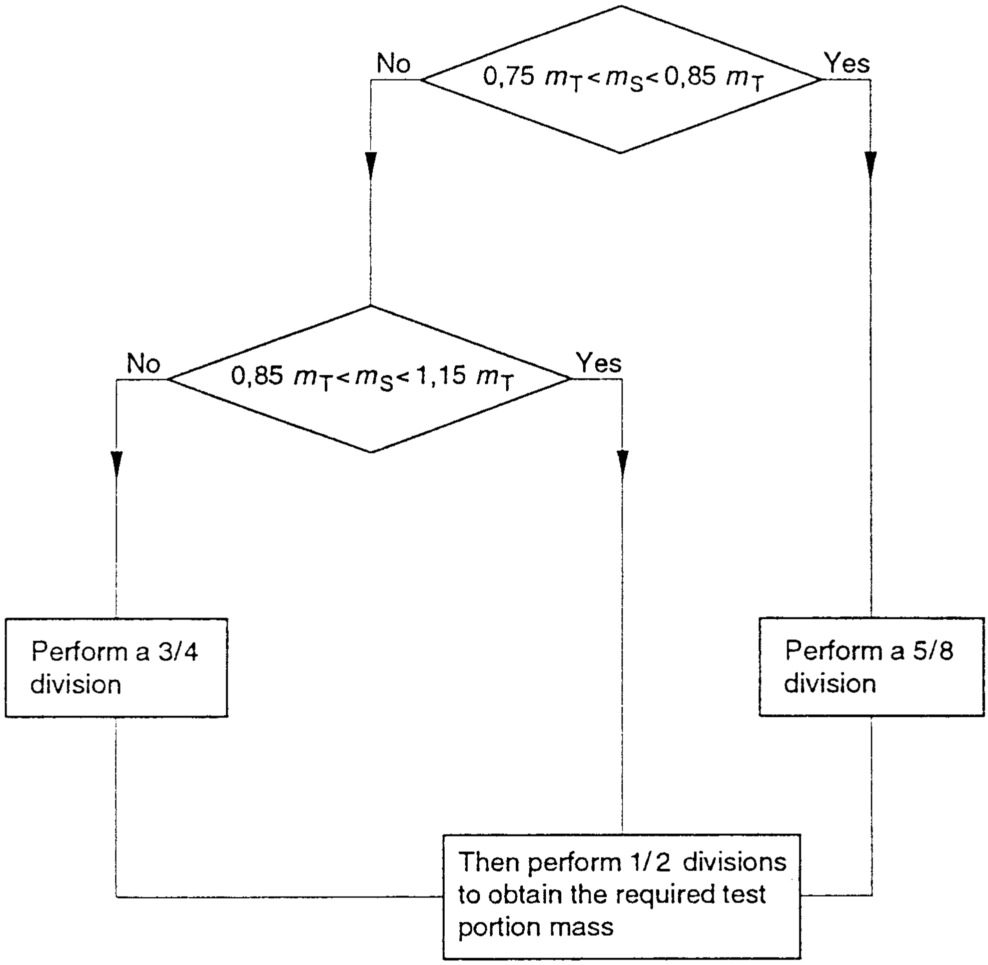


Figure 5 — Sample reduction procedure for 8.2

9 Sample reduction using fractional shovelling

If an appropriate sample divider is not available, fractional shovelling can be used to divide a laboratory sample into a number of subsamples of approximately equal mass.

Determine the mass of the laboratory sample, m_L.

Calculate the number n of subsamples to be produced by fractional shovelling as:

$$n = m_L/m_T$$

If the test portion mass is to be within 100 % to 150 % of m_T, round "n" down to the nearest whole number (the required tolerance can be achieved provided that $n \geq 2$).

If the test portion mass is to be within 85 % to 115 % of m_T, round "n" to the nearest whole number (the required tolerance can be achieved provided that $n \geq 3$).

The shovel shall hold at most a mass (in kilograms) of $m_L/(10\ n)$ of the aggregate, where m_L is the mass of the laboratory sample and n the number of subsamples to which it is to be reduced.

Take successively n shovelfuls from the laboratory sample and put them in n separate places on the working surface and number them from 1 to n. Proceed taking shovelfuls and add them to each of the n subsamples in turn, until the whole of the laboratory sample has been used.

Using random numbers (see annexes B and D of EN 932-1:1996), randomly select the subsample, or subsamples, that are to be retained.

10 Sample reduction by quartering

Place the laboratory sample on the working surface. Thoroughly mix the sample by heaping it up to form a cone, and turning it over with the shovel to form a new cone. Repeat this operation three times. When forming the cones, deposit each shovelful on the peak of the new cone in such a way that the aggregate runs down all sides of the cone and is evenly distributed so that the different sizes become well-mixed.

Flatten the third cone by inserting the shovel repeatedly and vertically into the peak of the cone to form a flat heap which has a uniform thickness and diameter.

Quarter the flat heap along two diagonals intersecting at right angles (see Figure 6). Discard one pair of opposite quarters and shovel the remainder into a stockpile.

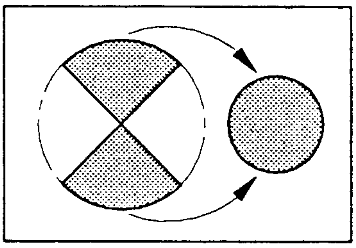


Figure 6 — Sample reduction by quartering

Repeat the process of mixing and quartering until the specified test portion is obtained.

NOTE The use of a plate or a quartering cross of wood or sheet metal, which can be forced down through the heap, often facilitates quartering in cases where the material tends to segregate.

11 Sample reduction to a test portion of a specified mass within a small tolerance

Use a procedure as described in **6.2** to obtain a subsample mass in excess of that required for the test portion.

Tip the subsample on to the working surface, mix thoroughly and form a line of aggregate across the working surface. Starting at one end of the line, and using a flat bottomed scoop or a scraper, continue to withdraw aggregate from that end until a test portion of sufficient mass is obtained. Take care that smaller particles are not left behind.

12 Sample reduction with crushing to reduce the particle size

The reduction of laboratory samples to test portions for chemical analysis shall be achieved by one or more of the procedures specified in clauses **7** to **11** and crushing of subsamples at intermediate stages.

To ensure that the test portion is representative of the original laboratory samples, the mass of the subsample at any intermediate stage shall not fall below the limiting value in Table 1 appropriate for its particle size.

When the subsample mass approaches the limiting value specified in Table 1, the material shall be crushed or ground to a smaller size to enable further subdivision. This procedure shall be repeated until a test portion of the required mass is achieved.

Table 1 — Minimum mass of subsample during sample division of chemical analysis

Maximum particle size mm	Minimum mass of subsample g
1	100
2	200
4	500
8	800
16	1 000
32	2 000
63	10 000

13 Procedures for obtaining duplicate test portions

When two test portions are required for testing by the same method (for example, to check the repeatability of a test method), one of the procedures specified in **13.1**, **13.2** or **13.3** shall be used.

13.1 Divide the laboratory sample into two subsamples by ½ division. Keep the two subsamples apart and produce a test portion of the specified mass from each subsample using the procedures specified in clauses **7** to **9**.

13.2 Produce one test portion of the required mass as specified in clauses **7** to **9**. Re-combine all the discard material, mix thoroughly, then follow the same procedure as before to obtain the second test portion.

13.3 Produce a number of test portions of the required mass using the procedures specified in clauses **7** to **9**. Choose two for testing using random numbers (see annexes B and D in EN 932-1:1996).

Annex A (informative)

½, ¾ and ⅝ divisions by a riffle box

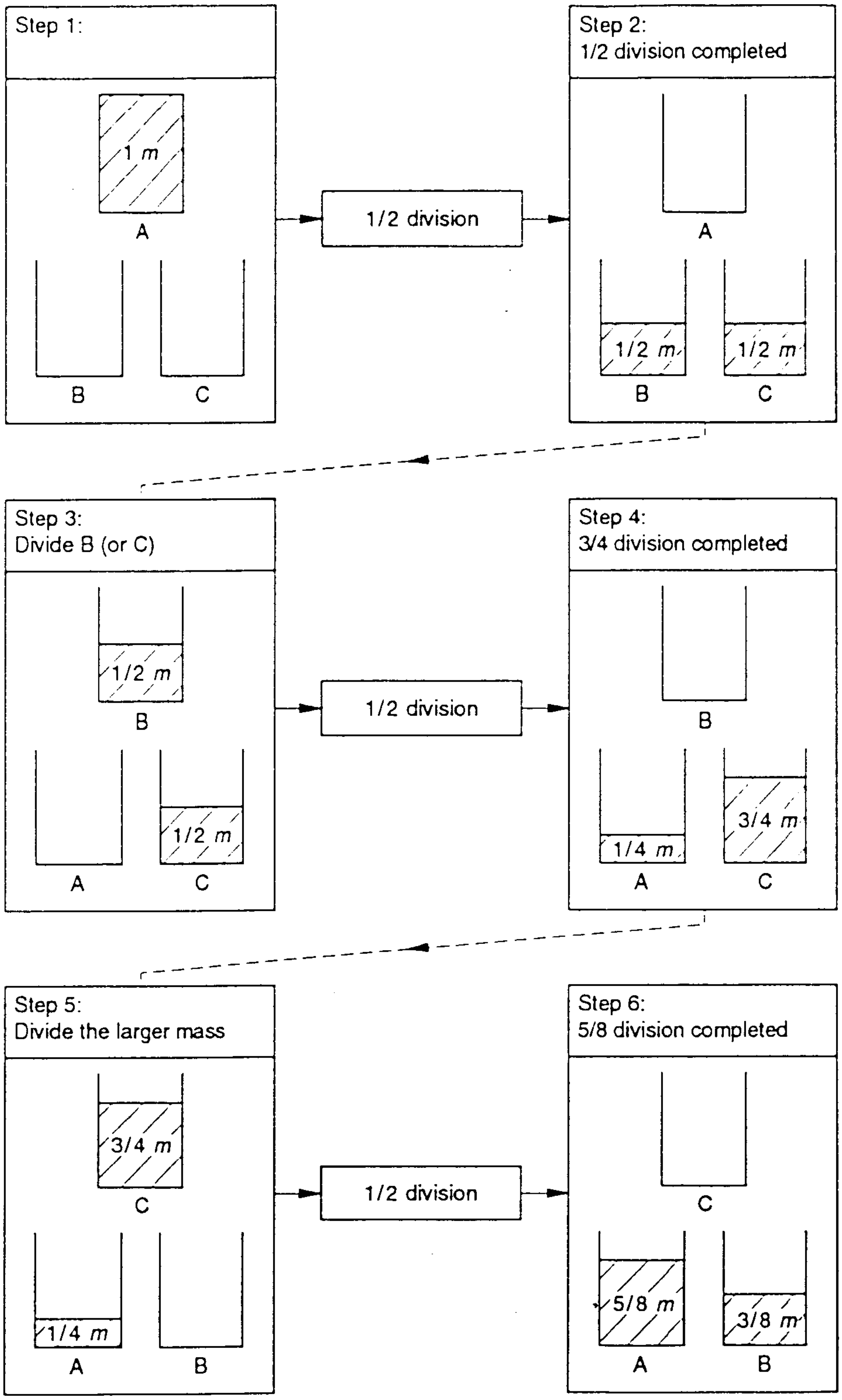


Figure A.1

Annex B (informative)

Worked examples

B.1 Example 1: Preparation of a test portion for a sieving test from a laboratory sample with a maximum grain size of 32 mm

The sieving method requires a test portion of at least 10 kg for the given particle size. A tolerance of 100 % to 150 % is acceptable, as specified in **6.2**, with m_T = 10 kg.

Following the procedures specified in **8.1.1**, calculate:

a) 0,75 m_T = 7,5 kg;

b) 1,5 m_T = 15,0 kg.

Let the mass of the laboratory sample be m_L = 75 kg. Calculate successive ½ divisions of the laboratory sample mass as shown in Table B.1.

This shows that a subsample of mass 9,4 kg would be obtained after three ½ divisions. This would be less than the minimum test portion mass required. Therefore the first step should be a ¾ division followed by two ½ divisions as shown in Table B.2. A subsample of 14,1 kg is an acceptable test portion.

Table B.1 — Calculation of successive ½ divisions of a laboratory sample of mass 75 kg

Number of ½ divisions	Subsample mass kg
0	75,0
1	37,5
2	18,8
3	9,4

Table B.2 — ¾ division followed by ½ divisions

Division step	Subsample mass kg
—	75,0
¾	56,3
½	28,1
½	14,1

It can be helpful to display the following information given in Figure B.1 in the laboratory where the sample reduction is carried out.

SIEVE TEST, 32 mm AGGREGATE	
Target test portion mass:	10 kg to 15 kg
m_S between 7,5 kg and 10,0 kg:	one ¾ division, then ½ divisions
m_S between 10,0 kg and 15,0 kg:	½ divisions

Figure B.1 — Sieve test of a 32 mm aggregate

B.2 Example 2: Preparation of a test portion for the determination of lightweight contaminators in fine aggregates

The test method requires a test portion of mass (350 ± 50) g, so m_T = 350 g.

Let the mass of the laboratory sample be m_L = 8950 g. Following the procedures specified in **8.2.1**, calculate:

a) 0,75 m_T = 262,5 g;

b) 0,85 m_T = 297,5 g;

c) 1,15 m_T = 402,5 g;

d) 1,5 m_T = 525 g.

Calculate successive ½ divisions of the laboratory sample mass as shown in Table B.3.

This shows that a subsample of mass 280 g would be obtained after five ½ divisions. This would be less than the required test portion. Therefore the first step should be a ⅝ division step followed by successive ½ divisions, which would yield the required test portion mass as shown in Table B.4.

Table B.3 — Calculation of successive ½ divisions of a laboratory sample of mass 8950 g

Number of ½ divisions	Subsample mass g
0	8950
1	4475
2	2238
3	1119
4	559
5	280

Table B.4 — ⅝ division followed by ½ divisions

Division step	Subsample mass g
—	8950
⅝	5594
½	2797
½	1398
½	699
½	350

It can be helpful to display the following information given in Figure A.2 in the laboratory where the sample reduction is carried out.

LIGHTWEIGHT CONTAMINATORS IN FINE AGGREGATE	
Target test portion mass:	300 g to 400 g
m_S between 260 g and 300 g:	One ⅝ division, then ½ divisions
m_S between 300 g and 400 g:	½ divisions
m_S between 400 g and 525 g:	one ¾ division, then ½ divisions

Figure B.2 — Determination of lightweight contaminators in fine aggregate

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL