

Armourstone —

Part 2: Test methods

The European Standard EN 13383-2:2002 has the status of a British Standard

ICS 91.100.15

National foreword

This British Standard is the official English language version of EN 13383-2:2002, which is included in a package of new European Standards being prepared by CEN/TC 154 relating to aggregates. Although the English text versions of these European Standards will be adopted as British Standards as they become available, the existing British Standards for aggregates will be retained, but only until such time that the completed package of European Standards becomes available. The original group of British Standards will then be withdrawn and this will be noted in BSI *Standards Update*.

The UK participation in its preparation was entrusted by Technical Committee B/502, Aggregates, to Subcommittee B/502/4, Hydraulic bound and unbound aggregates, 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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This British Standard, having been prepared under the direction of the Building and Civil Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 10 May 2002

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This European Standard was approved by CEN on 30 December 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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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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 October 2002, and conflicting national standards shall be withdrawn at the latest by June 2004.

This is the second part of EN 13383 for armourstones, the other part being:

EN 13383-1 Armourstone - Part 1: Specification.

Test methods for other properties of aggregates are covered by Parts of the following European Standards:

EN 932	Tests for general properties of aggregates
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
EN 13179	Tests for filler aggregate used in bituminous mixtures

Annexes A, B, C, D, E, F and G are informative.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies test methods for natural, artificial and recycled aggregates for use as armourstone.

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 932-1:1996, *Tests for general properties of aggregates — Part 1: Methods for sampling*.

EN 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*.

EN 1097-5, *Tests for mechanical and physical properties of aggregates — Part 5: Determination of the water content by drying in a ventilated oven*.

EN 13383-1:2002, *Armourstone - Part 1: Specification*.

ISO 3310-2, *Test sieves - Technical requirements and testing — Part 2: Test sieves of perforated metal plate*.

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1

armourstone grading

armourstone designation with a nominal lower and upper limit

NOTE This designation accepts the presence of undersize and oversize pieces of armourstone.

3.2

nominal lower limit

mass or sieve size in a grading below which the armourstone pieces are considered to be undersized

3.3

nominal upper limit

mass or sieve size in a grading above which the armourstone pieces are considered to be oversized

3.4

coarse grading

designation with a nominal upper limit defined by a sieve size between and including 125 mm and 250 mm

3.5**light grading**

designation with a nominal upper limit defined by a mass between and including 25 kg and 500 kg

3.6**heavy grading**

designation with a nominal upper limit defined by a mass of more than 500 kg

3.7**fragment**

aggregate pieces in the finest fraction of coarse gradings or the lightest fraction of light and heavy gradings for which the particle size distribution or mass distribution requirements apply

NOTE For further information on grading, see EN 13383-1:2002, annex A.

3.8**batch**

production quantity, delivery quantity, partial delivery quantity (railway wagon-load, lorry-load, ship's cargo) or a stockpile produced at one time under conditions that are presumed uniform

NOTE With a continuous process the quantity produced during an agreed period is treated as a batch.

3.9**sampling plan**

procedure of allocation, withdrawal and preparation of a sample or samples from a material to yield the required information

3.10**sampling increment**

quantity of material taken from a batch by one operation of the sampling apparatus

3.11**bulk sample**

aggregation of the sampling increments

3.12**representative sample**

sample created by taking sampling increments according to sampling plan, which makes it likely that the quality of this sample corresponds to that of the batch

3.13**subsample**

sample obtained from sampling increments or a bulk sample by means of a sample reduction procedure

3.14**sampler**

individual or a number of individuals working as a team, or an organisation, taking samples on a routine basis

3.15**length L**

maximum dimension of a piece of armourstone as defined by the greatest distance apart of two parallel planes tangential to the stone's surface

3.16**thickness E**

minimum dimension of a piece of armourstone as defined by the least distance apart of two parallel planes tangential to the stone's surface

3.17

constant mass

Successive weighings after drying at least 24 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 $(110 \pm 5) ^\circ\text{C}$. 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 Methods for sampling

4.1 General

This clause describes methods for obtaining samples of armourstone from preparation and processing plants including stocks and from silos, stockpiles and deliveries.

The aim of sampling is to obtain samples that are representative of the average properties of the batch.

The methods described are also suitable for obtaining sampling increments which are to be tested separately.

Methods to be used for sample reduction are also given.

4.2 Principles of sampling

Proper and careful sampling and sample transport is a prerequisite for an analysis that will give reliable results. The correct use of the specified apparatus and methods helps to avoid biased sampling inclusive the possibility of human bias introduced by visual selection. Sampling variation caused by the heterogeneity of the batch shall be reduced to an acceptable level by taking an adequate number of sampling increments.

NOTE See annex G for guidance on numbers and sizes of samples and test portions for testing armourstone as specified in EN 13383-1:2002.

Sampling increments are selected at random from all parts of the batch that the samples are to represent. Armourstone from which no sampling increment can be taken (because it is not accessible, or for some other practical reason) shall not be considered to be part of the batch that is represented by the samples. For example, if sampling increments are taken from armourstone discharged from a silo, the samples represent the armourstone that has been discharged, not the armourstone remaining in the silo.

The sampler shall be informed of the aim of the sampling.

4.3 Sampling plan

A sampling plan shall be prepared, prior to sampling, taking into account the grading type, the nature and size of the batch, the local circumstances and the purposes of sampling. It shall include:

- a) the type of the armourstone;
- b) the aim of the sampling including a list of the properties to be tested;
- c) the identification of the sampling points;
- d) the mass or number of stones of sampling increments;
- e) the number of sampling increments;
- f) the sampling apparatus to be used;
- g) the methods of sampling and sample reduction with reference to the clauses of this European Standard;
- h) the relevant marking, packaging and dispatch of the samples.

4.4 Apparatus

4.4.1 General

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

4.4.2 Apparatus for sampling

4.4.2.1 Grab, fitted to either a crane or a hydraulic machine.

4.4.2.2 Bucket or fork, fitted to a wheeled loader or a hydraulic machine.

4.4.2.3 Truck, for receiving and/or transport of samples.

4.4.2.4 Lifting equipment and lifting aids, for stones that cannot be moved manually.

4.4.3 Apparatus for sample reduction and transport

4.4.3.1 A floor area, upon which samples can be deposited and tested. The floor shall be sufficiently clean and close-textured to be able to distinguish and recover the material of the sample from the floor material.

4.4.3.2 Shovels.

4.4.3.3 Rectangular sampling buckets, of sufficient size and of width not less than three times the nominal upper grading limit.

4.4.3.4 Suitable plates and wires, for sample reduction.

4.4.3.5 Containers for transport, such as bags, buckets or other suitable containers.

4.5 Sampling methods

4.5.1 General

Sampling for the determination of particle size and mass distributions shall preferably be undertaken immediately preceding or during loading for transport or unloading after transport.

Regulations for safety and ergonomics shall be followed.

NOTE 1 Some sampling methods will inevitably involve the samplers working close to processing plant and moving vehicles. Those involved in the planning and execution of sampling should work closely with the operational management to ensure safe working practices.

NOTE 2 Mechanically selected gradings should preferably be sampled from a stationary conveyor belt or from the stream of material. Sampling increments should be taken at regular intervals throughout the period the batch is in motion. Gradings of which the pieces of armourstone are individually handled can be sampled at the most convenient location.

NOTE 3 Sampling from static batches should be avoided wherever possible since it is difficult to satisfy the principle of taking sampling increments at random from all parts of the batch, and hence segregation is likely to cause the sampling to produce biased results.

During sampling, grabs or other extraction equipment shall be filled to a minimum such that the degree of filling does not adversely affect the representativity of the sample or sampling increment.

4.5.2 Sampling for the determination of particle size distribution, mass distribution and shape characteristics

4.5.2.1 Sampling of material in bucket conveyors, bucket loaders, or grabs

Each sampling increment shall consist of the entire contents of a grab or bucket.

NOTE When this gives too large a sampling increment, it should be reduced by one of the methods described in 4.6.

4.5.2.2 Sampling at belt and chute discharge points

The period during which the sampling is to be done shall be divided into a number of equal intervals, and a sampling increment shall be taken in the middle of each interval.

A sample increment shall be taken by catching the discharge stream in a loader bucket, making sure that the complete cross-section of the stream of material is intercepted. At the beginning and the ending of the sampling the edge of the bucket shall pass the cross-section of the stream as fast as possible.

NOTE 1 Where appropriate, sampling should only be started after a preliminary run to ensure that possible irregularities in the pass do not lead to unrepresentative samples.

NOTE 2 Samples can also be taken at the discharge from a screen by the same method.

4.5.2.3 Sampling from stationary conveyor belts

All sampling increments shall be taken at the same sampling point. In every sampling increment all material between two cross-sections shall be taken. The distance between the cross-sections shall be determined by the required quantity of the sampling increment.

NOTE Sampling should only be started after a preliminary run to ensure that possible irregularities in the pass do not lead to unrepresentative samples.

4.5.2.4 Sampling from a silo

Sampling at a silo outlet shall be carried out in accordance with 4.5.2.2.

NOTE During filling of a silo the material segregates and as a result the finer material tends to be found in the centre of the silo with the coarser material along the wall sides. Alternating loading and discharging of a silo leads to a complex segregation pattern in the silo and this segregation causes variations in the particle size distribution of the discharged material. The number of sampling increments should be related to this variation.

4.5.2.5 Sampling from stockpiles

When sampling from a segregated stockpile, from which material is being collected for transporting, a sampling increment shall be taken from the material which is being taken from the stockpile. For this purpose, the contents of one or more loader buckets, grabs, lorries or any other means of handling or transport shall be taken. The period during which the sampling is done shall be divided into a number of equal intervals and a sampling increment shall be taken in the middle of each interval.

If at the time of sampling no material of a segregated stockpile is undergoing routine removal, the removal of material shall be simulated so as not to distort the representativity of the sampling increment with the segregation effects associated with the initiation of stockpile extraction. The sampling increments shall be taken at random or at equal distances around the stockpile or part thereof to be sampled.

When sampling from a non-segregated stockpile, a sampling increment shall be taken as indicated for a segregated stockpile or by taking a quantity of material from a random location which is easily reached with the equipment available.

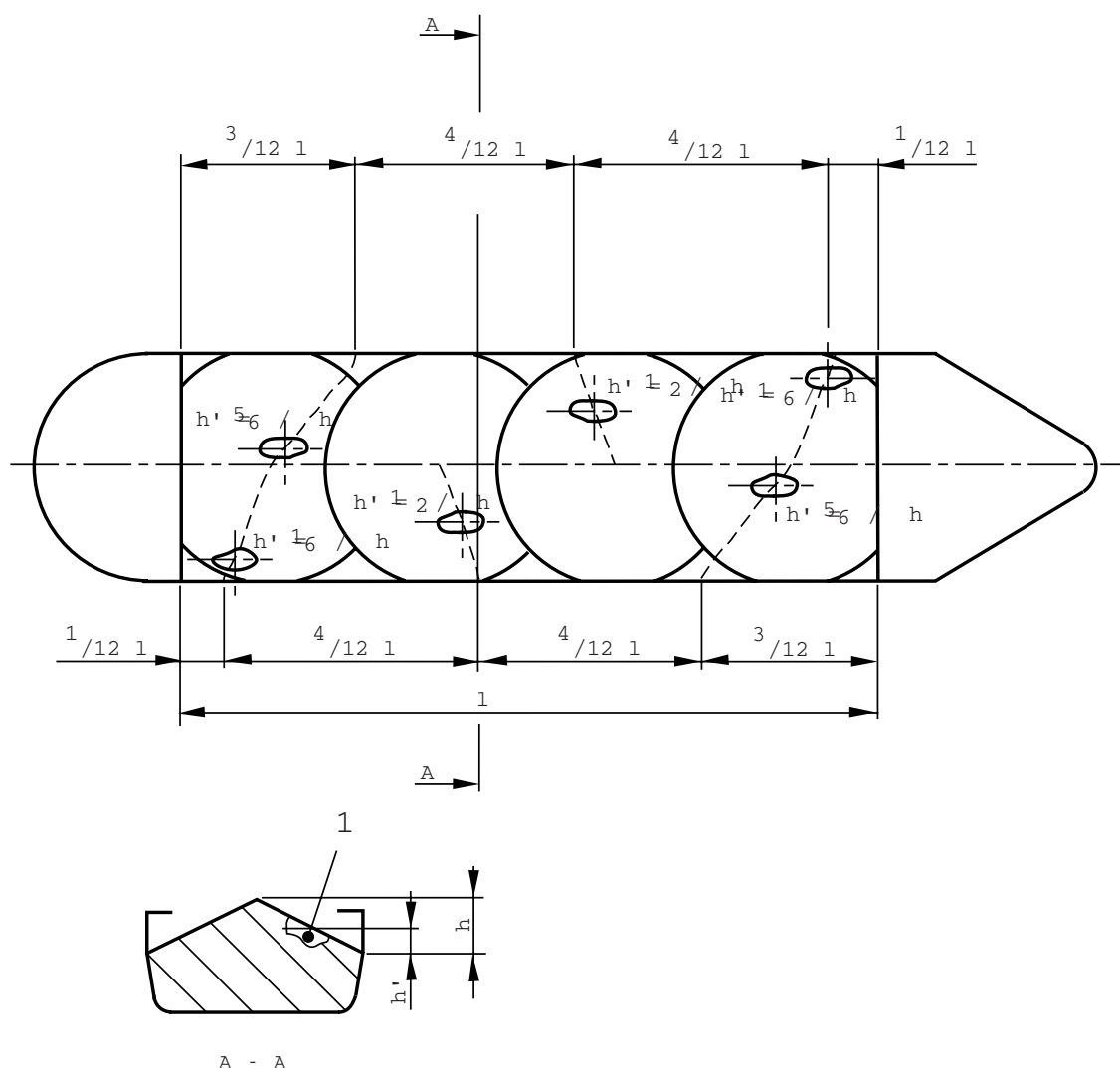
4.5.2.6 Sampling from floating equipment

For the sampling prior to the unloading of a segregated load, sampling increments shall be taken from the locations shown in Figure 1 at the surface of the load, with the aid of the unloading equipment.

For the sampling of a non-segregated load, sampling increments shall be taken as is indicated for a segregated load or by taking a quantity of material at random or evenly distributed locations at the surface of the load as shown in Figure 2, with the aid of the unloading equipment.

When sampling during unloading, sampling increments shall be taken with the aid of the unloading equipment. The required number of sampling increments shall be taken at approximately equal intervals from the whole of the load to be sampled.

Dimensions are approximate

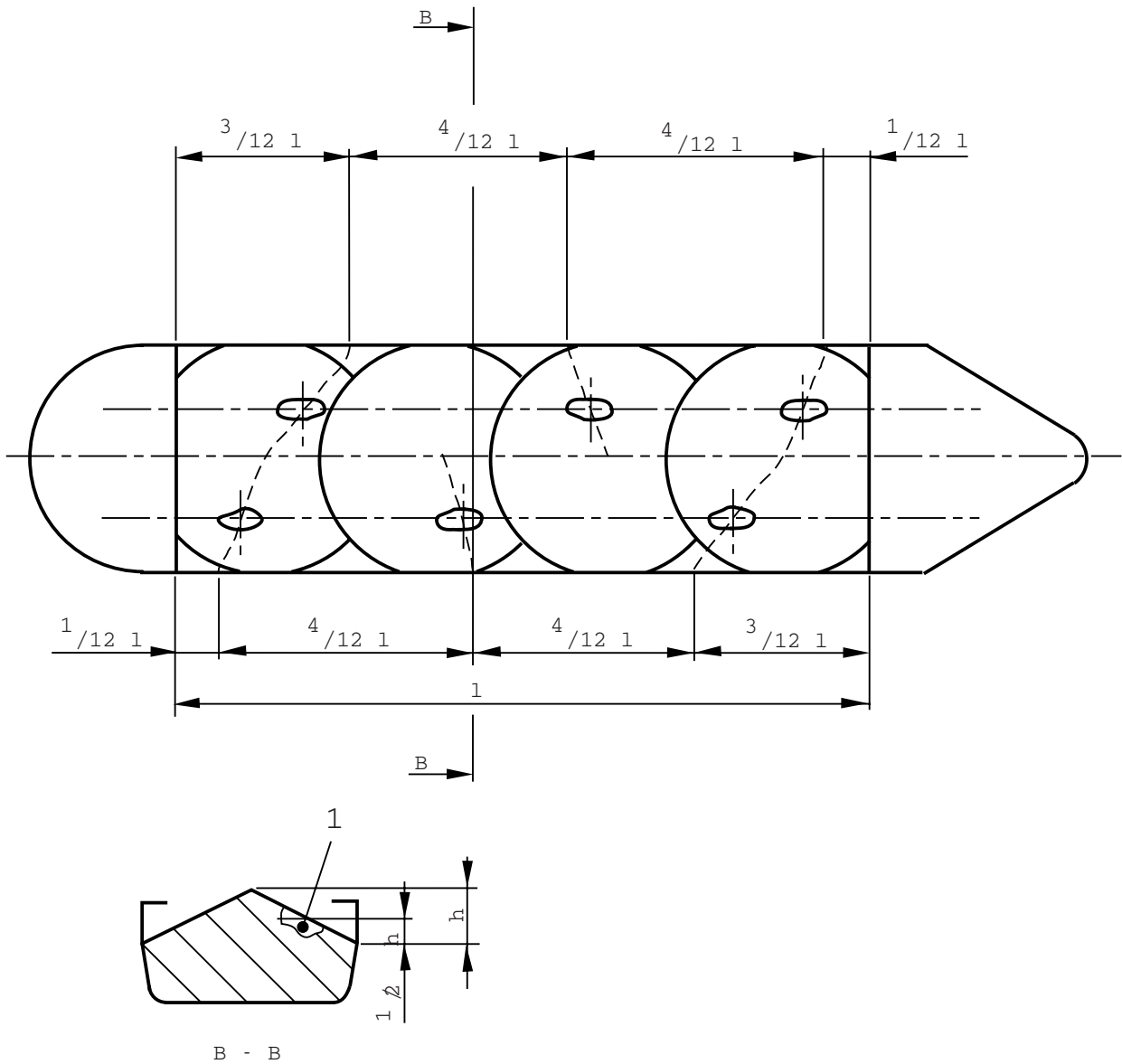


Key

- 1 Sample

Figure 1 — Sampling locations in a load

Dimensions are approximate

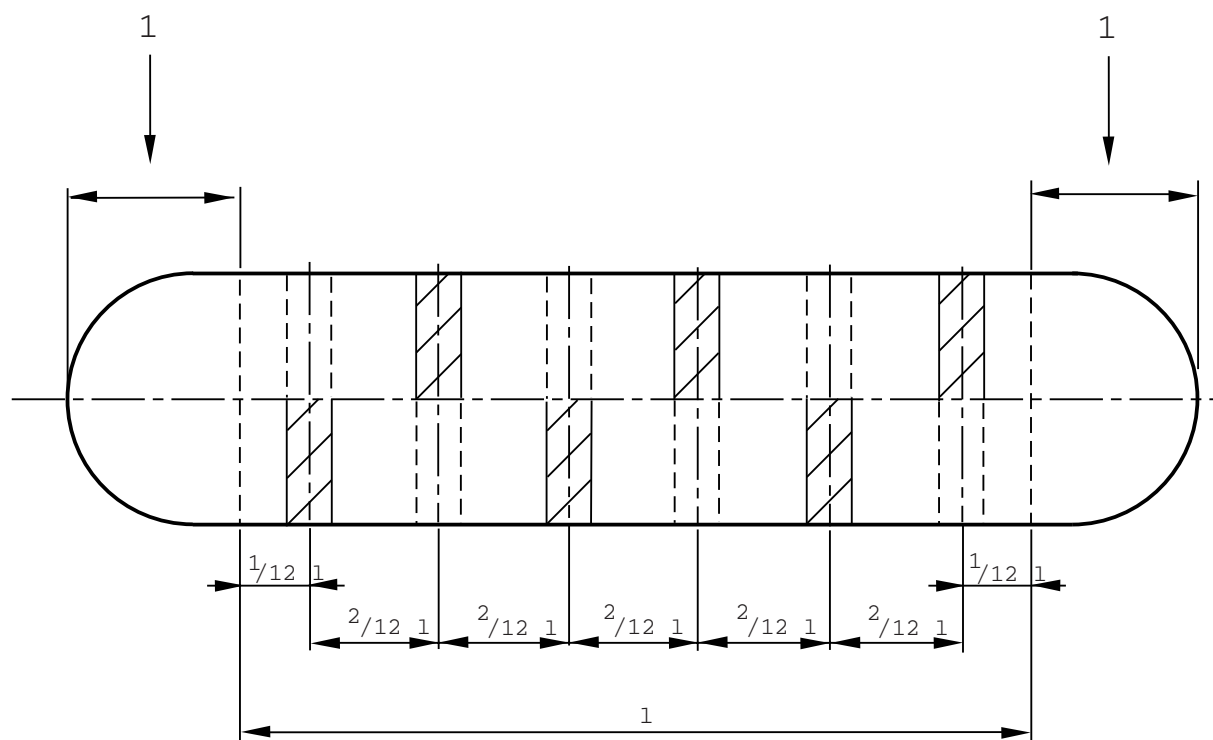


Key

- 1 Sample

Figure 2 — Sampling locations in a non-segregated load

Dimensions are approximate

**Key**

1 Potential segregation area

Figure 3 — Sampling locations in a spread-discharged load**4.5.2.7 Sampling from wheeled transport**

Discharge the contents of the vehicle partially or completely in a manner which produces an evenly distributed longitudinal pile of material. Sampling increments shall be taken from across the pile by removing, at random or at equally distributed locations, adequate quantities of material whilst avoiding the possibly segregated material at the start and finish of the pile (see Figure 3). Take the material in strips over the full width of the pile or in equal numbers of half strips from the left and right hand side of the centre line of the pile.

When a batch to be sampled consists of more than one load, the sampling increments shall be taken from randomly selected loads using the method described above or taking each selected load as a whole as an increment.

When one load contains insufficient material for one sample to be tested several loads shall be taken.

4.5.3 Sampling for the determination of physical, chemical, durability and other properties

For the determination of physical, chemical, durability and other properties individual pieces of armourstone excluding fragments shall be taken randomly as sampling increments, forming together a bulk sample. For properties for which testing of aggregate is permitted, sampling shall be carried out in accordance with EN 932-1.

The sampling increments consisting of individual pieces of armourstone shall be taken from the samples which have been taken for the determination of the particle size or mass distribution. When such samples are not available, the sampling increments shall be taken from the batch to be tested.

Sampling increments shall be selected by one of the following methods:

- a) using random numbers (see EN 932-1:1996, annex D);
- b) taking pieces of armourstone in a sequence of predetermined positions relative to a randomly chosen starting point in a static batch;
- c) taking pieces of armourstone from random sieve fractions or parts thereof during or after the determination of the particle size distribution using two samplers, one being a blindfolded selector and the other performing the actions;
- d) taking pieces of armourstone at a time or number interval when the material to be sampled is passing in a random sequence of the stones, for instance during the determination of the mass distribution.

NOTE If individual pieces of armourstone are significantly larger than the minimum size or mass required for the test(s) to be executed, a portion of appropriate size or mass can be obtained by breaking a representative piece. (The objective is to obtain laboratory samples representative of the batch to be tested but to have carried sample reduction at source so as to minimize transport costs and reduce unnecessary sample reduction at the testing laboratory.)

4.6 Sample reduction

4.6.1 General

Wherever possible, samples shall be reduced to produce samples for testing of appropriate size at the sampling location.

If a sampling increment of a coarse grading is too large as test portion, one of the procedures as described in 4.6.1.1 or 4.6.1.2 shall be used for the reduction of the sampling increment.

If a sampling increment of a light grading is too large for the preparation of the bulk sample, the procedure as specified in 4.6.1.2 shall be used for the reduction of the sampling increment.

4.6.1.1 Reduction using buckets

Discharge the sample over one or more sample buckets.

When discharging a sample from a loader bucket, arrange the receiver bucket(s) to catch all the material from a cross-sectional segment or from one side of an imaginary cross-sectional plane in the centre of the loader bucket.

When discharging a sample from a grab, catch all the material from one symmetrical quarter or half of the grab content in one or more buckets.

If further reduction is required, tip the bucket(s) containing the reduced sample over two adjoining buckets and discard the contents of one bucket. Repeat this procedure until the required size of test portion is obtained.

4.6.1.2 Reduction using plates or wires

Discharge the sample over one or two vertically set plates. The distance between two parallel set plates shall be at least three times the sieve size of the nominal upper grading limit.

When discharging a sample from a loader bucket, take all the material from a cross-sectional segment or from one side of an imaginary cross-sectional plane in the centre of the loader bucket, discharged between two parallel and vertically set plates or at one side of a vertically set plate.