SLOVENSKI STANDARD
SIST EN 13383-2:2013

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Kamen za obloge pri vodnih zgradbah in drugih gradbenih delih - 2. del: Preskusne metode

Armourstone - Part 2: Test methods

Wasserbausteine - Teil 2: Prüfverfahren

Enrochements - Partie 2: Méthodes d'essais

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91.100.15	Mineralni materiali in izdelki	Mineral materials and products

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EUROPEAN STANDARD

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English Version

Armourstone - Part 2: Test methods

Enrochements - Partie 2: Méthodes d'essai

Wasserbausteine - Teil 2: Prüfverfahren

This European Standard was approved by CEN on 29 July 2011.

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Foreword

This document (EN 13383-2:2013) 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of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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 supersedes EN 13383-2:2002.

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

In comparison with the previous version, the following changes have been made.

- changes and clarifications to the sampling and sample reduction clauses, including a new informative annex on sampling from waterborne plant;
- introduction of requirements for sample preparation for the Micro-Deval test previously in EN 13383-1;
- deletion of an unused wet sieving method for the determination of particle size distribution of coarse gradings of armourstone.
- removal to an informative annex of a previously normative alternative to the reference method for determination of mass distribution of light and heavy gradings.

Otherwise the majority of the changes from the previous version are editorial.

EN 13383 *Armourstone* consists of the following parts:

Part 1: Specifications

Part 2: Test methods

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 sampling and test methods for natural, artificial and recycled aggregates for use as armourstone. This European Standard specifies the reference methods to be used for type testing and in case of dispute where an alternative method has been used. For other purposes, in particular factory production control, other methods may be used provided that an appropriate working relationship with the test method has been established.

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 932-1:1996, *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 933-3, *Tests for geometrical properties of aggregates — Part 3: Determination of particle shape - Flakiness index*

EN 1097-1:2011, *Tests for mechanical and physical properties of aggregates — Part 1: Determination of the resistance to wear (micro-Deval)*

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

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 document, the following terms and definitions apply.

3.1
armourstone grading
armourstone designation with a nominal lower and upper limit

Note 1 to entry: 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 90 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 1 to entry: For further information on grading, see EN 13383-1:2013, Annex A.

3.8
batch
production quantity, a delivery quantity, a 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 1 to entry: 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 *T*
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 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.

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.

NOTE It is preferable that armourstone should be sampled at the quarry or during the loading for transport (or unloading).

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 For guidance on numbers and sizes of samples and test portions for testing armourstone as specified in EN 13383-1:2013, see Annex G.

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 Apparatus for sampling

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

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

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

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

4.4.2 Apparatus for sample reduction and transport

4.4.2.1 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.

4.4.2.2 Shovels.

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

4.4.2.4 Suitable plates and wires, for sample reduction.

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

4.5 Sampling methods

4.5.1 General

Regulations for safety and ergonomics shall be followed.

WARNING 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.

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 may be sampled at the most convenient location.

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 representative nature 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.

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.

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.

Samples may also be taken at the discharge from a screen by the same method.

4.5.2.3 Sampling from stationary conveyor belts

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

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.

4.5.2.4 Sampling from a silo

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

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.

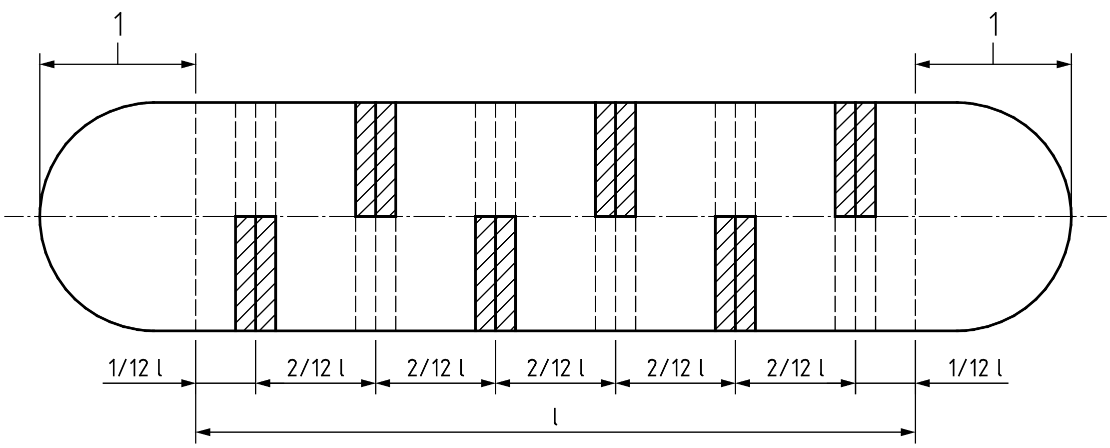
When sampling from a non-segregated stockpile, a sampling increment shall be taken as indicated for a segregated stockpile or by taking a quantity of material from a random location which is easily reached with the equipment available.

4.5.2.6 Sampling from floating equipment

When sampling cannot be performed during loading or unloading, sampling from floating equipment should be performed with reference to Scheme 1 or Scheme 2 of Annex H.

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 1). 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.



Dimensions are approximate

Key

1 potential segregation area

Figure 1 — Sampling locations in a spread-discharged load

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.

Sampling increments consisting of individual pieces of armourstone shall be taken from the batch to be tested and may be taken from the samples which have been taken for the determination of the particle size or mass distribution.

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.

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 may 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 4.6.2, 4.6.3 or 4.6.4 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 4.6.3 or 4.6.4 shall be used for the reduction of the sampling increment.

If a sampling increment of a heavy grading is too large for the preparation of the bulk sample, the procedure as specified in 4.6.4 shall be used for the reduction of the sampling increment.

4.6.2 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.

4.6.3 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.

When discharging a sample from a grab, take all the material from one symmetrical quarter or half of the grab content, discharged between two vertically set plates at right angles to each other or at one side of a vertically set plate.

When reducing a sample already discharged onto a floor area (4.4.2.1) use wires representing imaginary separation planes.

For the reduction of a sample to approximately the half amount, stretch a wire as a separation line over the sample. Where segregation is present in one direction of the deposited sample, place the wire in the same direction (see Figure 2) and take the subsample by removing all armourstone located, or for the largest part located, at one side of the imagined vertical plane projected by the wire.

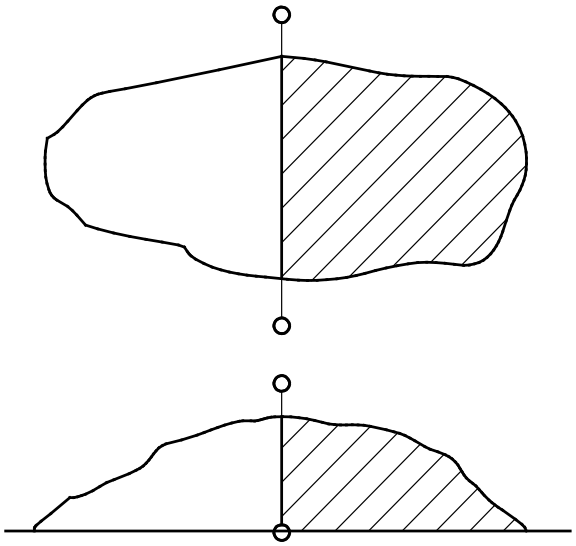


Figure 2 — Halving a sample by means of a separation plane

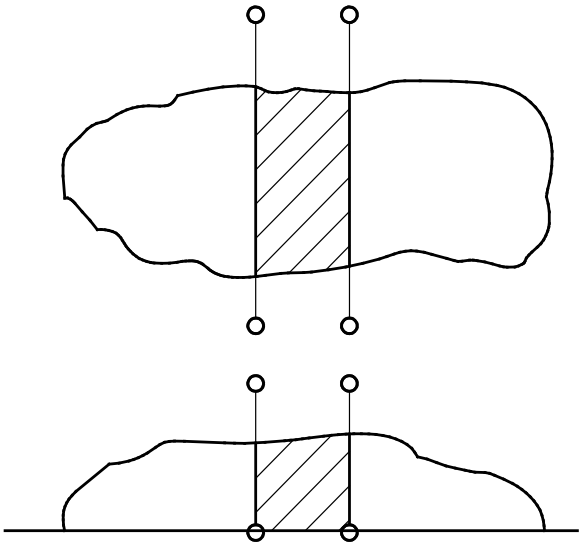


Figure 3 — Dividing a sample with two separation planes

For the reduction of a sample to less than the half amount, stretch two parallel wires as separation lines over the sample, so that the desired subsample lies between the two lines. Where segregation is present in one direction of the deposited sample, place the wires in the same direction (see Figure 3) and take the subsample by removing all stones located, or for the largest part located, between the imaginary vertical planes projected by the wires.

To facilitate the reduction procedure a sample to be reduced by using wires may be spread in a layer of thickness not greater than twice the nominal upper size of the material.

Where no segregation of the material has occurred, the subsample may be limited to half the separated strip.

4.6.4 Reduction using numbering

Each piece of armourstone in the sample shall be allocated an individual number in a consecutive sequence covering the entire sample. Each piece of armourstone shall be marked clearly and durably with the allocated number.

The subsample shall be taken by randomly selecting numbered pieces of armourstone until the required size of test portion is obtained.

4.7 Sample preparation for Micro-Deval test where aggregate sample not available

The test portion shall be prepared in accordance with EN 1097-1:2011, Clause 6, with the following variations:

4.7.1 The test portion shall be obtained by crushing at least six samples from separate pieces of armourstone for which the masses do not differ by more than 25 %. The crushing shall be carried out with a laboratory jaw crusher.

4.7.2 Flaky particles shall be removed by using bar sieves conforming to EN 933-3 as follows:

a) bar sieve of 6,3 mm for the fractions 10 mm to 11,2 mm (or 10 mm to 12,5 mm);

b) bar sieve of 8 mm for the fractions 11,2 mm to 14 mm (or 12,5 mm to 14 mm).

4.7.3 Cubical particles shall be removed by using bar sieves conforming to EN 933-3, as retained particles on the 12,5 mm bar sieve for the fractions 11,2 to 14 mm (or 12,5 mm to 14 mm).

4.8 Marking, packaging and dispatch of samples

The laboratory samples or containers in which they are transported shall be clearly and durably marked.

Marking shall include:

a) a unique code; or

b) identification of the laboratory samples, place of sampling, date of sampling and designation of the material.

Laboratory samples shall be transported in such a way that pieces of armourstone are not broken in transit.