INTERNATIONAL STANDARD

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Monolithic (unshaped) refractory products —

Part 2: Sampling for testing

Produits réfractaires monolithiques (non façonnés) —

Partie 2: Échantillonnage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1927-2 was prepared by Technical Committee ISO/TC 33, *Refractories*.

ISO 1927 consists of the following parts, under the general title *Monolithic (unshaped) refractory products*:

— *Part 1: Introduction and classification*

— *Part 2: Sampling for testing*

— *Part 3: Characterization as received*

— *Part 4: Determination of consistency of castables*

— *Part 5: Preparation and treatment of test pieces*

— *Part 6: Measurement of physical properties*

— *Part 7: Tests on pre-formed shapes*

— *Part 8: Determination of complementary properties*

Monolithic (unshaped) refractory materials —

Part 2:
Sampling for testing

1 Scope

This part of ISO 1927 gives guidance on the sampling of monolithic (unshaped) refractory materials for the purpose of inspection and testing for quality and general information on the reduction and treatment of samples prior to testing. It covers all materials formulated as monolithic refractory materials.

NOTE The term "monolithic" is the preferred term, whereas "unshaped" is commonly used in Europe. For the purposes of this part of ISO 1927, the terms "monolithic" and "unshaped" can be used interchangeably.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5022, *Shaped refractory products – Sampling and acceptance testing*

ISO 8656-1, *Refractory products — Sampling of raw materials and unshaped products — Part 1: Sampling scheme*

ISO 10725, *Acceptance sampling plans and procedures for the inspection of bulk materials*

3 Terms and definitions

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

3.1
batch
quantity of material from which a sample is to be achieved for testing to determine the quality of the material

NOTE A batch consists of material characterized as being of the same type, composition, grading and which, as far as practical, has been manufactured under the same conditions.

3.2
consignment
quantity of material supplied at one time

NOTE A consignment may consist of one or more batches or parts of batches.

3.3
unit package
packaged part of a batch which can be a bag or a big bag (castables, gunning material, ramming mixes), a carton (plastics), wrapped block (tap-hole mixes), a drum or a can (injection material, refractory grout)

NOTE A pallet is not a unit package.

3.4
increment
quantity of material taken at one time from a larger quantity

3.4.1
elementary increment
quantity of material taken at one time from a unit package

NOTE This operation repeated a number of times will constitute a package increment after mixing.

3.4.2
package increment
increment that is representative of the unit package

NOTE 1 It can be the unit package itself or the result of mixing a certain number of elementary increments.

NOTE 2 The mass and number of elementary increments which are necessary to form the package increment are defined in accordance with ISO 8656-1.

3.4.3
laboratory increment
package increment that has been reduced by an approved method

3.4.4
test-piece increment
test bars or cylinders obtained by shaping the laboratory increment necessary to carry out several physical tests

EXAMPLE Castable test bars for cold modulus of rupture testing.

3.5
sample
one or more increments taken from a batch which are to be used to provide information on the batch and to allow a decision concerning the quality of the batch

3.5.1
batch sample
set of package increments representative of the batch

NOTE The number of package increments which are to form the batch sample should be agreed by the principal parties involved. ISO 5022 or other sampling schemes may be used.

3.5.2
laboratory sample
set of laboratory increments

NOTE The number of laboratory increments is the same as the number of package increments.

3.5.3
test-piece sample
set of test-piece increments

NOTE The number of test increments can be higher than the number of laboratory increments and is governed by international test standards.

4 Sampling scheme

4.1 General principles

4.1.1 It is essential that the adoption of a particular sampling scheme be agreed by the principal parties and that a detailed sampling plan be documented and made available to those responsible for the taking and testing of the increments. The basic framework of a scheme requires decisions and documentation on the following:

a) the constitution and description of the total material to be sampled;

b) the identification of batches and quantities which make up the total material;

c) the type of packaging and mass content for each type of material;

d) the parties responsible for sampling and testing who may be third parties;

e) the location, timing and method of sampling;

f) the level of sampling, population of increments;

g) the properties to be measured;

h) the methods of test (reference to International Standard number);

i) the criteria for assessing values of measured properties for deciding batch quality.

4.1.2 In all cases during sampling, increment division, preparation and storage of the increments, care shall be taken to protect against any changes in the properties to be tested.

4.1.3 Sampling shall be performed under the supervision of a person having adequate experience on sampling. The sampler shall be approved either by the interested parties or by the appropriate body or bodies. The sampler shall be informed of the aim of the sampling.

4.1.4 When individual batches are identified, agreement should be made between the parties on whether, or to what degree, a large batch should be subdivided into smaller batches. This may be undertaken to avoid the possibility of the whole of a large batch being rejected because of a problem with a proportion of it.

4.1.5 When a sample is required for third-party certification of factory production control as the product is being made, the sample shall be achieved by the same method that the producer uses to obtain a sample for production control purposes.

4.1.6 Where required, the consignment may be subdivided into individual test batches, for example, if it is clear that the consignment consists of various batches or should be treated in separate partial quantities.

4.1.7 The sampling framework is presented in Figures A.1 to A.3.

4.2 Procurement of the batch sample

4.2.1 Method

Identify the test batch, i.e. of the consignment or part of the consignment to be sampled (nature of the product, mass, transport conditions, etc.).

Identify the unit package. The average mass (m) of this unit package shall be known.

Obtain the number of package increments which form the batch sample as agreed between parties. The sampling scheme of ISO 5022 can be agreed by the parties if the unit packages, considered as equivalent to shaped pieces, weigh less than 35 kg.

Randomly, select this number of the unit packages from the batch.

Proceed to sample the selected unit packages, if their mass is more than 35 kg. This means obtain a package increment of each of these unit packages. In this case, ISO 8656-1 shall be applied to determine the mass and the number of elementary increments which are necessary to obtain the package increment:

a) Estimate the maximum grain size of the material. This estimation is important because the minimum mass of the elementary increment shall be determined, taking into account the maximum grain size of the material in order to avoid systematic errors during sampling (see Table 1).

Table 1 — Minimum mass of elementary increment depending on the maximum grain size

Maximum grain size mm	Minimum mass of elementary increment
10	500 g
3	200 g
1	50 g

NOTE 1 The masses of the elementary increments relate to a bulk density greater than 1 g/cm^3. For lower bulk densities, the mass of the elementary increment can be determined by multiplying the numerical value in Table 1 by the bulk density of the material.

NOTE 2 Special agreements should be made in the case of very lumpy products. In the case of pre-ground or pre-homogenized material, the minimum mass of the elementary increment can be determined, not from the grain size of the coarsest aggregate, but from the maximum size of the grains of the material before aggregating.

NOTE 3 The actual elementary increment masses should depend on the sampling equipment and the tests to be performed. This is the case for monolithic products if the physico-mechanical properties of test pieces taken from these products are to be determined.

b) Determine the mass of the elementary increment in accordance with ISO 8656-1, taking into account the minimum quantities required for the tests which are to be performed.

c) Classify the test batch in a quality variation class because the number of increments taken for testing from a batch shall be determined taking into account the deviations in the properties of the material.

The mean value and the standard deviation of a given property and type of monolithic product, designated respectively by μ and σ, define the coefficient of variation $C_V = 100\ \sigma/\mu$ of this property, expressed in practice as a percentage.

The values of the coefficient of variation are divided into three classes:

— $0 < C_V < 5$ %, small variation, class 1;

— 5 % $< C_V <$ 15 %, medium variation, class 2;

— 15 % $< C_V <$ 30 %, large variation, class 3.

The property which presents the highest value of the coefficient of variation is used to determine the number of elementary increments.

If the coefficient of variation is unknown or if it is greater than 30, use the class 3 values (large variations).

The number of elementary increments to be taken is determined in accordance with Table 2.

Table 2 — Minimum number n of elementary increments

Class of deviations of the property %			Mass m of unit packages
Class 1	Class 2	Class 3	
$C_V < 5$	$5 < C_V < 15$	$15 < C_V < 30$	10^3 kg
4	4	8	$m < 1$ or $= 1$
4	6	12	$1 < m < 5$

The value of ***n*** given in Table 2 is a minimum and generally the actual number should not be less than that specified in the table.

Package increment mass is equal to the minimum mass of elementary increment multiplied by the minimum number of increments.

If the fixed mass for the package increment is less than the mass required for the various tests, increase either the mass of the elementary increment or the number of the increments so as to obtain a sufficient amount.

NOTE For unit packages exceeding 5 000 kg, the sampling may be agreed between the principal parties or based on ISO 10725.

4.2.2 Apparatus to take increments

General requirements and suggested designs for apparatus are given in ISO 8656-1. It is possible to use a sampling box, sampling tube, sampling spear or scoop.

— In all cases, the width of the opening shall be not less than 10 mm and not less than three times the upper aggregate size.

— The length of the sampling box opening shall be larger than the depth of the stream of material to be sampled. Its depth shall be such that no particles are lost by rebounding out of the box.

— The length of the sampling tube or spear shall be 1 000 mm to 2 000 mm.

4.2.3 Method to take increments

4.2.3.1 Sampling from a big bag

Sampling from a big bag is very difficult because:

a) the mass of this large amount of product prevents the use of the sampling tube or spear;

b) during transportation, segregation can occur.

Consequently, the optimum conditions of sampling accuracy are obtained only if the elementary increments are taken from the material in movement.

An elementary increment shall be taken by passing the sampling box through the discharge stream in a uniform movement, making sure that the complete cross-section of the stream of materials is intercepted. Shovels or scoops shall not be used for sampling of moving materials.

In the case of certain prepared monolithic products (for example, castables) where it is known that the material is delivered in unblended form or where it is evident that the material has segregated during transportation, it is necessary to take the elementary increment(s) after mixing the full big bag. This sampling method is expensive as it results in large quantities of materials being handled.

As soon as elementary increments are obtained, they shall be mixed to form a package increment.

4.2.3.2 Sampling from cans, wrapped blocks (mass limited to 35 kg)

These unit packages are considered as equivalent to shaped pieces. According to 4.2.1 c), remove for inspection a number of containers, taking them at random from the lot.

4.3 Size reduction of the increments

4.3.1 General

The procedures described in 4.3.2 and 4.3.4 shall preferably be used for the preparation of the laboratory sample from the batch sample. The method described in 4.3.3 may be used when other methods are not suitable or the devices are not available. All the methods may also be used in combination, for example, by using quartering for the first few reduction stages followed by riffling.