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Shaped insulating refractory products — Determination of cold crushing strength

Produits réfractaires isolants façonnés — Détermination de la résistance à l'écrasement à température ambiante

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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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 8895 was prepared by Technical Committee ISO/TC 33, *Refractories*.

This second edition cancels and replaces the first edition (ISO 8895:1986), which has been technically revised.

Shaped insulating refractory products — Determination of cold crushing strength

1 Scope

This International Standard specifies a method for determining the cold crushing strength of shaped insulating refractory products.

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*

3 Terms and definitions

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

3.1
cold crushing strength
maximum load (applied under specified conditions at room temperature) divided by the area over which the load is applied, which a refractory can withstand before failure occurs

3.2
shaped insulating product
shaped refractory having a true porosity of not less than 45 % by volume

4 Principle

At ambient temperature, a test piece of specified dimensions is subjected, in a compression test machine, to an increasing load until either the test piece collapses or its height is reduced to 90 % of its original value. During testing, the load is increased at a specified rate. The cold crushing strength is calculated from the maximum force recorded and the dimensions of the test piece.

5 Apparatus

5.1 Mechanical or hydraulic crushing strength machine, that will enable the load to be increased progressively and smoothly, and with a system of measurement that will enable the force exerted on the test piece to be known to within $\pm$ 2 %. The range of the machine shall be such that the maximum force exerted in the test is greater than 10 % of the maximum force of which the machine is capable. One of the platens of the machine shall be mounted on a spherical seating that will compensate for any small error of parallelism between the load-bearing faces of the test pieces. The platens of the machine shall be ground and the lower one shall be marked so as to facilitate placing the test piece at its centre.

5.2 Micrometer, or other suitable instrument, to measure the deformation of the test piece during the test.

5.3 **Measuring equipment**, accurate to 0,1 mm, to measure the size of each test piece and to verify its geometrical form.

5.4 **Drying oven**, capable of being controlled at 110 °C ± 5 °C.

5.5 **Steel rule**.

5.6 0,5 mm **feeler gauge**.

6 Test pieces

6.1 The number of items (e.g., bricks or blocks) to be tested shall be determined in accordance with ISO 5022 or with an alternative sampling plan agreed between the parties concerned.

6.2 One test piece shall be taken from each brick of standard size.

NOTE The number to be taken from larger items is a matter for agreement between the parties concerned. To facilitate further statistical evaluation, the same number of test pieces should be taken from each item.

6.3 Each test piece shall be nominally the size of half a standard brick, i.e.: 114 mm × 114 mm × 76 mm or 114 mm × 114 mm × 64 mm.

6.4 In the case of special shapes, the test pieces shall be dry cut to one of the sizes specified in 6.3.

NOTE If possible, the test report should indicate the relationship of the direction of loading to the direction of pressing or extrusion during manufacture.

6.5 The load-bearing faces of each test piece shall be flat within a tolerance of 0,5 mm. This condition shall be checked across both diagonals of each load-bearing face with a steel rule (5.5) and a 0,5 mm feeler gauge (5.6).

6.6 The load-bearing faces of each test piece shall be parallel within a tolerance of 1 mm. This condition shall be checked by making four measurements of the height of the test piece, one at the centre of each of its four sides; the measurements shall not differ among themselves by more than 1 mm.

6.7 The perpendicularity of each of the four sides of the test piece, with respect to the base, shall be within a tolerance of 1 mm. This condition shall be checked by placing the test piece on a flat, smooth surface and presenting a set square to the centre of a horizontal edge of the side; any gap between the set square and the side of the test piece shall not exceed 1 mm.

7 Procedure

7.1 Measure the length and breadth of each load-bearing face of the test piece, and its height at the mid-point of each of its four sides, in each case to the nearest 0,5 mm.

7.2 Dry the test piece to constant mass in the drying oven (5.4), controlled at 110 °C ± 5 °C, cooling it each time in a dry atmosphere.

7.3 Place the test piece on one of its larger faces (114 mm × 114 mm) in the centre of the lower platen of the testing machine (5.1). No packing material shall be used between the test piece and the platens. Mount the measuring instrument (5.2) on the lower platen to measure the deformation occurring in the test piece.

7.4 Gradually and continuously increase the load at such a rate that

a) if the expected cold crushing strength is less than 10 MPa, the rate of increase of stress in the test piece is 0,05 MPa/s $\pm$ 0,005 MPa/s

or

b) if the expected cold crushing strength is equal to or greater than 10 MPa, the rate of increase of stress in the test piece is 0,2 MPa/s $\pm$ 0,02 MPa/s.

7.5 Continue increasing the load at the rate given in 7.4 until either the test piece collapses (fails to support the load) or its height is reduced to 90 % $\pm$ 1 % of its original height. Record the maximum load indicated during the test.

8 Expression of results

Calculate the cold crushing strength, S, in megapascals, using the equation:

$$S = \frac{F_{\text{max}}}{l \times b}$$

where

F_{max} is the maximum load, in newtons, indicated during the test;

l is the mean of the four measurements of the length, in millimetres, of the test piece;

b is the mean of the four measurements of the breadth, in millimetres, of the test piece.

Report the cold crushing strength to the nearest 0,1 MPa.

9 Test report

The test report shall include the following information:

a) all information necessary for identification of the sample tested including the designation of the material tested (manufacturer, type, batch number);

b) reference to this International Standard, i.e., ISO 8895;

c) the sampling procedure, including:

   1) the number of items tested (see 6.1);

   2) the number of test pieces cut from each item, if more than one (see 6.2);

   3) the dimensions of the test pieces (see 6.3); their positions in the brick (see 6.2) and the presence and location of any fired surface;

   4) where possible, the relationship between the direction of loading and the direction of pressing or extrusion during manufacture (see Note to 6.4);

d) the results of the test, including:

   1) the rate of stress increase (see 7.4);

   2) whether the test was terminated by the collapse of the test piece or by the height being reduced to 90 % of the original (see 7.5);

   3) the individual values of the cold crushing strength for each test piece, calculated as specified in Clause 8 and, if appropriate (see 6.2), the mean value for each item tested;

e) the name of the testing establishment;

f) any information which might help in the interpretation of the test;

g) any deviations from the procedure specified;

h) any unusual features (anomalies) observed during the test;

i) the date of the test.

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