
INTERNATIONAL STANDARD



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Shaped insulating refractory products – Determination of the permanent change in dimensions on heating

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing *International Standards* is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2477 was drawn up by Technical Committee ISO/TC 33, *Refractories*, and circulated to the Member Bodies in November 1971.

It has been approved by the Member Bodies of the following countries :

Austria	India	Spain
Czechoslovakia	Netherlands	Sweden
Egypt, Arab Rep. of	New Zealand	Switzerland
France	Portugal	United Kingdom
Hungary	South Africa, Rep. of	U.S.S.R.

No Member Body expressed disapproval of the document.

Shaped insulating refractory products — Determination of the permanent change in dimensions on heating

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the permanent change in dimensions of shaped insulating refractory products on heating to a predetermined temperature which is maintained for a specified period of time.

2 REFERENCE

ISO/R 475, *Sizes of rectangular refractory bricks.*

3 DEFINITION

permanent change in dimensions : The expansion or contraction remaining after cooling to ambient temperature of a refractory product heated for a fixed time at a given temperature.

It is usually expressed as the change, ΔL , in one dimension of the sample, calculated as a percentage of the original dimension, L (i.e. $100 \Delta L/L$).

4 PRINCIPLE

Cutting of test pieces, in the form of rectangular prisms, from the sample and measurement of the linear dimensions of these test pieces.

Heating the test pieces at a prescribed rate in a furnace having an oxidizing atmosphere, to a predetermined temperature, and maintaining this temperature for a specified period of time.

Allowing the test pieces to cool to ambient temperature then measuring the linear dimensions and calculating the changes which have taken place.

5 APPARATUS

The following apparatus is required :

5.1 Furnace

The use of an electric furnace is recommended for carrying out these tests. Nevertheless, tests using gas fired furnaces are acceptable provided that the furnace atmosphere is continuously oxidizing and does not have any reducing action on the test piece.

The furnace shall be capable of heating the test piece to, and maintaining it at, the testing temperature specified in section 7.

5.2 Thermocouples

5.3 Length measuring devices

Slide calipers or another instrument of measurement having an accuracy better than $\pm 0,2$ mm may be used.

6 TEST PIECES

Five test pieces shall be cut, each from a different brick, and have the following dimensions :

100 mm \times 114 mm \times 64 mm.

The 100 mm dimension shall be in the direction of the length of the brick; the other two dimensions represent the width and thickness of a normal rectangular brick as given in ISO/R 475.

In cases where the width and/or thickness of the brick are less than 114 mm and 64 mm, these dimensions can be reduced by agreement between the interested parties.

7 PROCEDURE

7.1 Measurement of test pieces

The linear change in dimension shall be determined in the direction of the length of the brick, i.e. on the 100 mm dimension of the test piece.

Measure the length of each test piece in five positions arranged as follows (see figure) :

- on the median line of each of the two vertical faces (AB and A'B');
- on the median line of each of the two horizontal faces (CD and C'D');
- on the central axis of the test piece (OO').

Dimensions in millimetres

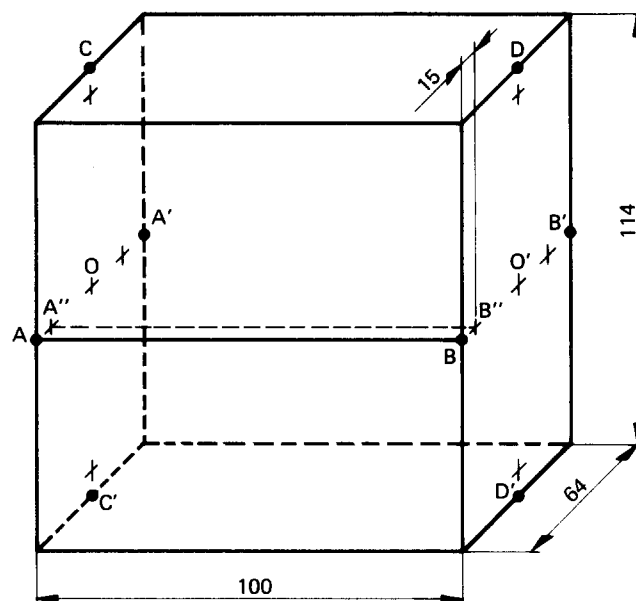


FIGURE — Measurements of test piece length
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As it may be difficult to make accurate measurements on test pieces of insulating products, care is recommended and the reference positions should be marked 15 mm from the edges and on the centre lines of the end faces, as indicated in the figure (A''B'', etc.).

The accuracy of the measurements shall be better than $\pm 0,2$ mm.

7.2 Firing

7.2.1 Location of test pieces

The test pieces shall rest on one of their 100 mm X 64 mm surfaces.:

It is recommended :

- that the test pieces be separated from each other by a distance of at least 50 mm;
- that the test pieces be separated from the walls of the furnace by a distance of at least 70 mm;
- that the test pieces be protected from direct radiation in an electrically heated furnace or from the flame of the gas burner in a gas fired furnace;
- that each test piece be placed in the furnace on a brick 30 to 65 mm thick, of the same kind as the materials submitted for the tests, laid flat on the apices of two supports of triangular cross-section of height 20 to 50 mm and 80 mm apart.

7.2.2 Temperature measurement and distribution

Measure the temperature using at least three thermocouples distributed throughout the test space within the furnace, away from the walls and the heaters and out of contact with flames.

At no time during the maintenance of the constant temperature shall the temperatures indicated by the thermocouples differ from one another by more than 10 K, nor shall their average differ from the test temperature by more than 10 K.

7.2.3 Temperature of the test

The test shall be carried out at a temperature exceeding 1 000 °C by a multiple of 50 K.

7.2.4 Heating schedule

The rate of rise in temperature shall conform to the following schedule :

- up to 900 °C at 5 K/min;
- from 900 to 1 200 °C or to 50 K below the test temperature, whichever is lower, at 2 K/min;
- from 1 200 °C or from 50 K below the test temperature, whichever is lower, at 1 K/min.

7.2.5 Time at test temperature

The test temperature shall be maintained within ± 10 K for a period of 12 h, except that, when the information obtained thereby is inadequate, this period may be increased to 50 h.

7.3 Measurement of test pieces after firing

After the test pieces have cooled to room temperature, measure their lengths at each of the five positions described in 7.1, using the same method as that previously used.

8 EXPRESSION OF RESULTS

For each test piece, calculate the linear change at each measuring point as a percentage of the original length. Report the individual values so calculated together with their mean value.

The result of the test is the arithmetical mean of the mean values so obtained for the five test pieces.

9 TEST REPORT

The test report shall contain the following information :

- a) type of furnace used;
- b) dimensions of the test pieces and their orientation in the furnace;
- c) final test temperature;
- d) period at test temperature;
- e) oxygen content of the furnace atmosphere (if required);
- f) the result of the test.

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