INTERNATIONAL STANDARD

ISO 12678-1

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Refractory products — Measurement of dimensions and external defects of refractory bricks —

Part 1:
Dimensions and conformity to drawings

Produits réfractaires — Mesurage des dimensions et des défauts externes des briques réfractaires —

Partie 1: Dimensions et conformité aux plans

Reference number
ISO 12678-1:1996(E)

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.

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.

International Standard ISO 12678-1 was prepared by Technical Committee ISO/TC 33, *Refractories*.

ISO 12678 consists of the following parts, under the general title *Refractory products — Measurement of dimensions and external defects of refractory bricks*:

— *Part 1: Dimensions and conformity to drawings*

— *Part 2: Corner and edge defects and other surface imperfections*

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Refractory products — Measurement of dimensions and external defects of refractory bricks —

Part 1:
Dimensions and conformity to drawings

1 Scope

This part of ISO 12678 describes apparatus and specifies simple methods for routine measurement of dimensions of refractory bricks. It also specifies methods for inspection of conformity to shape, determining concavity, convexity and out-of-squareness. It does not establish criteria for acceptance or rejection of bricks.

The application of these methods is limited to standard shapes in accordance with ISO 5019-1 to ISO 5019-6 and ISO 5417, unless otherwise agreed.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 12678. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 12678 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5019-1:1984, *Refractory bricks — Dimensions — Part 1: Rectangular bricks.*

ISO 5019-2:1984, *Refractory bricks — Dimensions — Part 2: Arch bricks.*

ISO 5019-3:1984, *Refractory bricks — Dimensions — Part 3: Rectangular checker bricks for regenerative furnaces.*

ISO 5019-4:1988, *Refractory bricks — Dimensions — Part 4: Dome bricks for electric arc furnace roofs.*

ISO 5019-5:1984, *Refractory bricks — Dimensions — Part 5: Skewbacks.*

ISO 5019-6:1984, *Refractory bricks — Dimensions — Part 6: Basic bricks for oxygen steel-making converters.*

ISO 5417:1986, *Refractory bricks for use in rotary kilns — Dimensions.*

3 Apparatus

3.1 General

All instruments shall be calibrated or certified to within the accuracy of the measurements. The accuracy of the linear measuring device (3.2) shall be checked regularly against a length bar complying with national standards.

3.2 Linear measuring device (steel tape graduated in millimetres, calipers) in accordance with the tolerance agreed upon, and conforming to an accuracy of half the intended accuracy of the measurement.

NOTE 1 Measurements made with a steel tape are accurate to 1 mm (0,5 mm can be estimated), whereas caliper measurements are accurate to 0,1 mm. Linear tolerances less than 1 mm should be measured with calipers.

3.3 Steel straightedge, at least 5 mm thick and of sufficient length to span the diagonal of the largest shape to be measured.

3.4 Two steel measuring wedges, which may be either:

a) Type 1, at least 50 mm in length and 10 mm in thickness at one end, of uniform cross-section for a length of at least 10 mm from that end and then tapering to zero thickness at the other end [see, for example, figure 1a)]; or

b) Type 2, up to 160 mm in length with an even taper from 4 mm to zero [see, for example, figure 1b)].

Each wedge shall be graduated and numbered along the slope to show the thickness of the wedge between the base and the slope, in increments of either 0,5 mm (Type 1) or 0,1 mm (Type 2).

The wedges shall be used, together with the steel straightedge, for the determination of warpage (see 8). The wedges of Type 2 shall be used to measure small warpages or, together with the engineer's square, for the determination of the out-of-squareness.

3.5 Surface table or plate, sufficiently large to place the bricks being tested. The surface should be flat and smooth to within 0,1 mm.

3.6 Steel engineer's square, of appropriate size to measure the bricks.

3.7 Feeler gauges, to be used together with the steel engineer's square for controlling right angles in conformity to drawings and out-of-squareness. The gauges can be replaced by measuring wedges, of accuracy in accordance with 3.4.

4 Preparation of bricks for measurement

The definition of edges and surfaces of bricks shall be improved, when necessary, by removing any projections such as fins, blisters and parting sand. This can be achieved by lightly rubbing the bricks together, by scraping, sand-blasting or similar means.

5 Measurement of conformity to drawings

Before the inspection begins, all the dimensions of one brick of each particular shape shall be compared with the nominal dimensions to ensure that the correct shape is being inspected.

6 Measurement of dimensions

6.1 Measure linear dimensions by means of a linear measuring device (3.2) and, unless otherwise agreed upon, round the readings to the nearest 0,5 mm in accordance with 6.2.

In the case of rejection of a brick lot measured by a steel tape, measurements may be repeated using calipers. This additional measurement may be limited to out-of-size bricks.

6.2 When measuring a dimension, take one reading along the approximate centrelines of the brick face (determined to within 10 mm), selected randomly as shown in figures 2a) and 2b).

7 Measurement of taper differences and out-of-squareness

7.1 Taper differences

7.1.1 Measure taper differences on columns of ten bricks, taking one reading along the approximate centreline of the rectangular brick faces. In the case of instability due to large tapers, the number of bricks in a column may be reduced to five.

In the case of significant length variations of the bricks which could influence the accuracy of the taper measurements, carry out stacking and measurement twice: once with the inside faces in line to measure the inside length, and once with the outside faces in line to measure the outside length, as shown in figures 3a) and 3b).

7.1.2 Taper measurements may also be determined on individual bricks. The taper is calculated by subtracting dimension d from dimension c, as shown in figure 2b).

7.2 Out-of-squareness

Measure out-of-squareness of individual bricks by placing the brick on the surface table or plate (3.5) and determining, to the nearest 0,5 mm, the greatest gap existing when each face in turn is offered up to the engineer's square (3.6) using measuring wedges (3.4) or feeler gauges (3.7).

8 Measurement of warpage (convex and/or concave)

8.1 For a concave surface, place the straightedge (3.3) on its edge across a diagonal of the surface being tested, insert a wedge (3.4) at the point of maximum warpage (ensuring that the reading is not affected by raised imperfections on the brick surface) and record the maximum obtainable reading, to the nearest 0,5 mm, at the point of contact between the wedge and the straightedge.

8.2 For a convex surface, insert a wedge at each end of the straightedge and perpendicular to it as shown in figure 4. Adjust the wedges, to a position not more than 15 mm from the corner of the brick, so that equal readings are obtained on each of them, making certain that contact is maintained by the straightedge at the point of maximum convexity. Record the readings to the nearest 0,5 mm.

8.3 The expression of results can be given as a ratio of warpage, w, in percent, according to the formula

$$w = \frac{100\,h}{l}$$

where

l is the length, in millimetres, of the diagonal of the surface being tested;

h is the reading, in millimetres, of the amount of warpage.

9 Test report

The test report shall include the following information:

a) the name of the testing establishment;

b) the place and date of the test;

c) a reference to this part of ISO 12678, i.e. "Determination of dimensions and conformity to drawing, in accordance with ISO 12678-1";

d) the designation of the material tested (manufacturer, size and shape, quality);

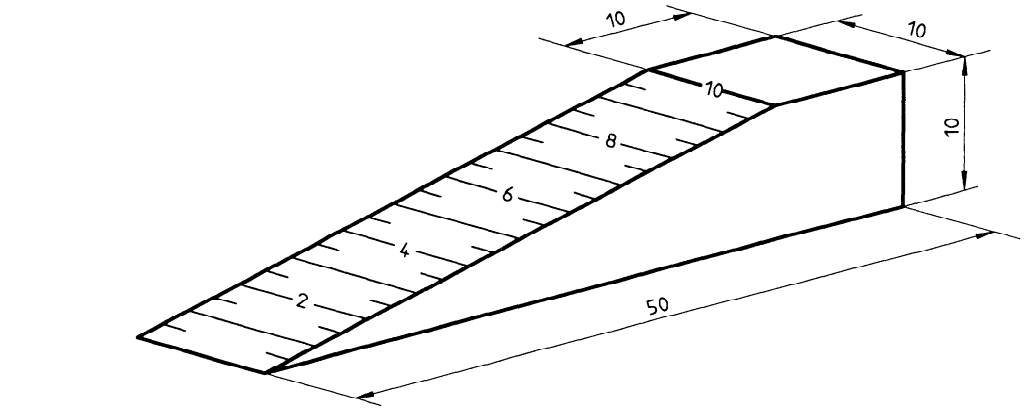
e) batch size and sample size (number of items);

f) inspected properties;

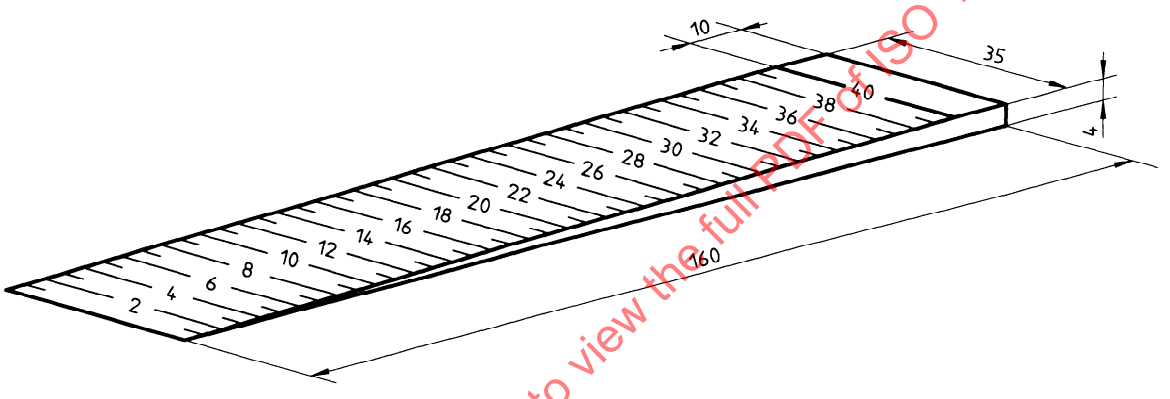
g) results of the inspection;

h) name and signature of the inspector.

Dimensions in millimetres

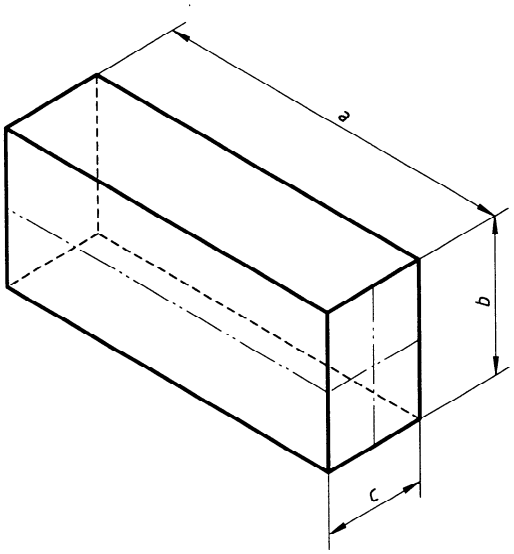


a) Type 1

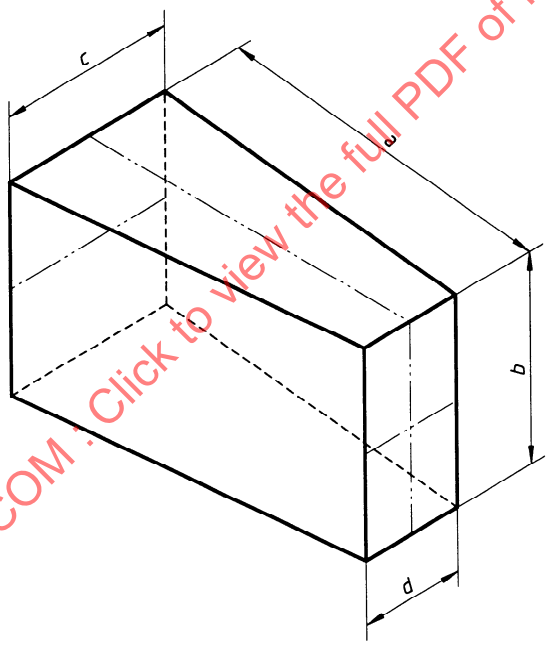


b) Type 2

Figure 1 — Two types of measuring wedge used for determining warpage

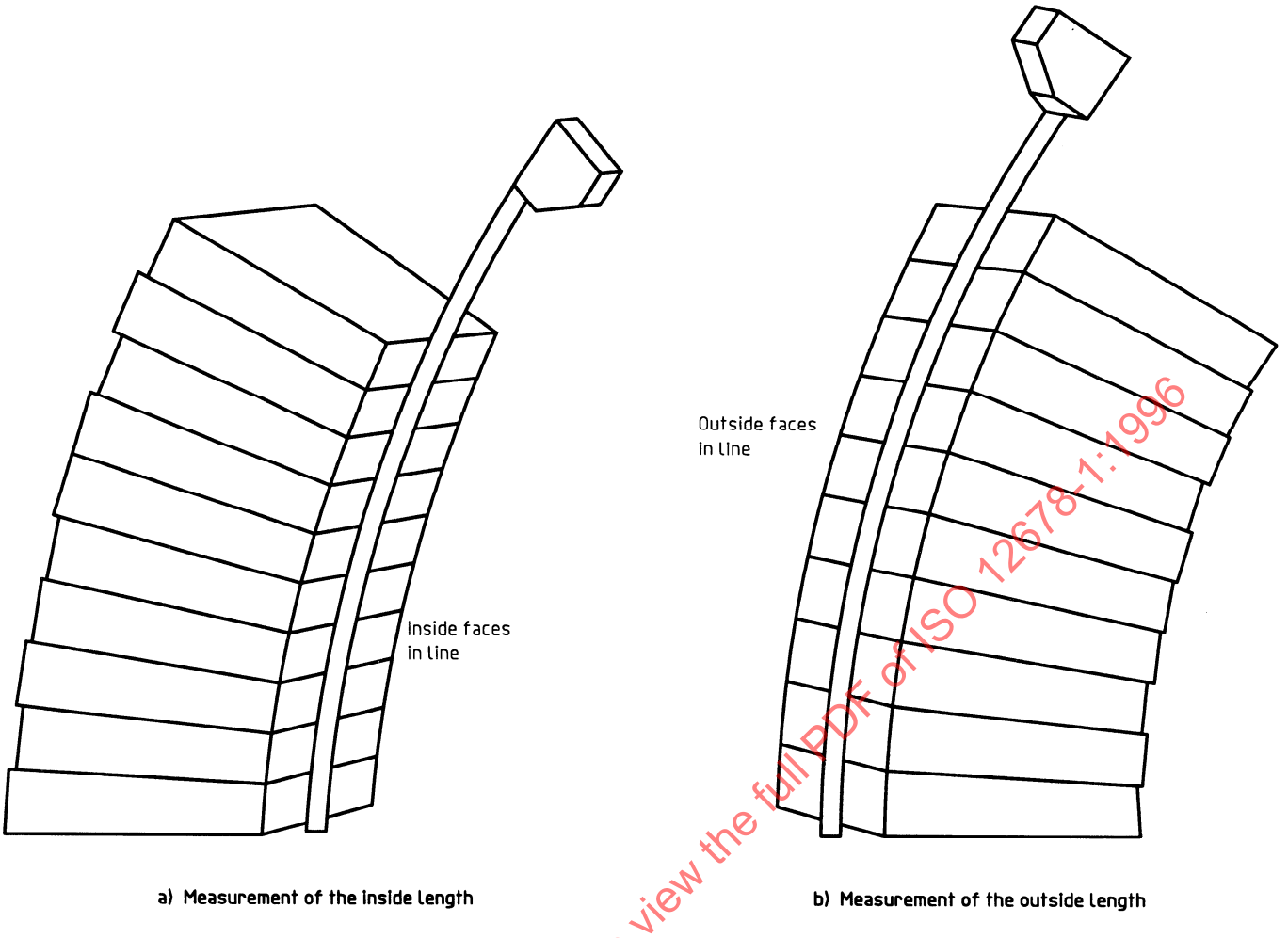


a) Measurement of a square brick



b) Measurement of an end-arch brick

Figure 2 — Measurement of brick dimensions and taper differences



a) Measurement of the inside length

b) Measurement of the outside length

Figure 3 — Measurement of taper difference for bricks with significant length variations

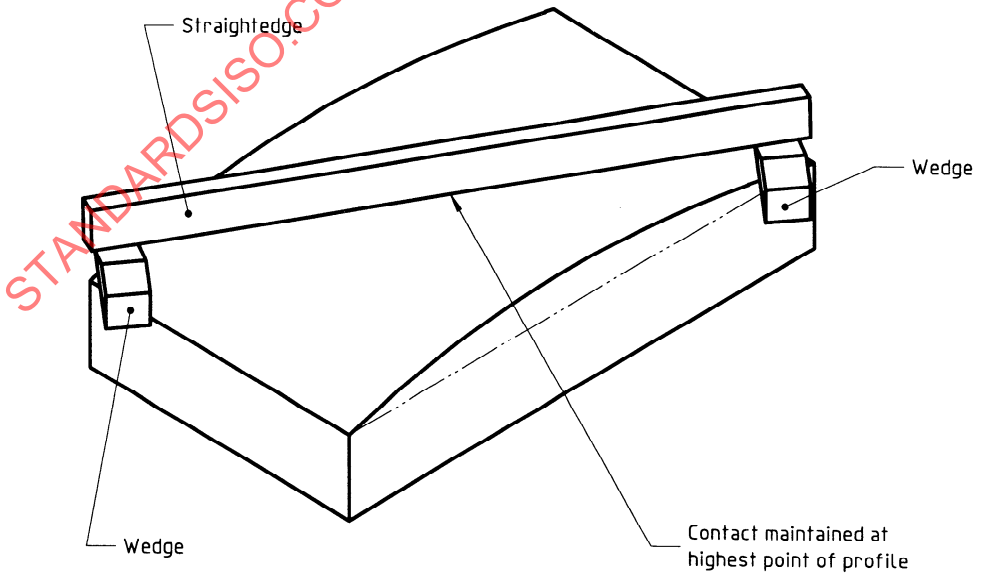


Figure 4 — Measurement of convex warpage

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