DRAFT INTERNATIONAL STANDARD

ISO/DIS 13765-7

ISO/TC **33**

Secretariat: **BSI**

Voting begins on:
2019-02-08

Voting terminates on:
2019-05-03

Refractory mortars —

Part 7:
Determination of permanent change in dimensions on heating

Mortiers réfractaires —

Partie 7: Détermination des variations dimensionnelles permanentes lors du chauffage

ICS: 81.080

This document is circulated as received from the committee secretariat.

Reference number
ISO/DIS 13765-7:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 13765- series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Refractory mortars —

Part 7:
Determination of permanent change in dimensions on heating

1 Scope

This part of ISO 13765 describes the method for determining the permanent change in dimensions on heating (drying and/or firing) of refractory mortars.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 8656-1, *Refractory products — Sampling of raw materials and unshaped products — Part 1: Sampling scheme*

ISO 13765-1, *Refractory mortars — Part 1: Determination of consistency using the penetrating cone method*

ISO 13765-2, *Refractory mortars — Part 2: Determination of consistency using the reciprocating flow table method*

ISO 13765-3, *Refractory mortars — Part 3: Determination of joint stability*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
permanent change in dimensions on heating
dimensional expansion or contraction that remains in refractory mortars that is heated (dried and /or fired) with no externally applied force to a specified temperature for a specified time and then cooled to room temperature

4 Principle

Place the test specimens of refractory mortars, whose length between two marks has been determined, in a drying oven or furnace. Heat (drying and/or firing) to a specified temperature for a specified time and then cool to room temperature. Measure the length between two marks again. Calculate the permanent change in dimensions on heating.

5 Apparatus

5.1 Mixer, as specified in ISO 13765-1 or ISO 13765-2.

5.2 Balance, with a maximum weighing capacity of 2 kg and capable of weighing to the nearest 1 g.

5.3 Consistency determining device, as specified in ISO 13765-1 or ISO 13765-2.

5.4 Nylon filter cloth, single layer nylon mesh filter cloth, 80 mesh~200 mesh.

5.5 Electrical drying oven, fitted with a temperature controller and capable of operating at 110 °C ± 5 °C.

5.6 Furnace, capable of meeting the heating requirements specified in 7.4.

5.7 Thermocouple pyrometer, at least 3, used to measure the temperature and the temperature distribution of the sample.

5.8 Length determining device, capable of measuring to the nearest 0.05 mm.

5.9 Platinum wire, with diameter 0.5 mm and length 5 mm~8 mm.

6 Test preparation

6.1 Sampling

For dry mortar, sample the mortar in accordance with ISO 8656-1 or as agreed between parties. Reduce the sample to 5 kg by quartering or with a riffle sampler.

Sample ready-mixed mortars by emptying the entire contents of the container in which the mortar is supplied into another container of larger capacity and mixing thoroughly. It is important that any supernatant liquid not be discarded. Ensure that a representative sample of the wet mixture is obtained

6.2 Preparation of the refractory bricks

The size of the test specimens and the refractory bricks recommended to use is shown in Table 1. The initial distance between two marks referred in Table 1 is the spacing of the two marks on each diagonal of the rectangular test specimens. The actual dimensions used shall be agreed upon between parties prior to testing.

Six refractory bricks are required. These are used for making three test specimens. Each refractory mortar test specimen is formed by two refractory bricks. The surfaces of refractory bricks to be bonded shall be clean and have no visible craters, open cracks, fins, protrusions and indentations of surface. The bricks used in the test shall be compatible with the mortar being tested. Before testing, place the bricks in the drying oven, raise the temperature to 110 °C ± 5 °C and keep for 24 h or until constant weight is achieved. Then cool to room temperature naturally.

Table 1 — The size of the test specimens and the refractory bricks

Category	Test specimen size $l \times b$ mm	Initial distance between two marks l_0 mm	Refractory brick size recommended $l\times b\times t$ mm
A	200×100	200±0.5	230×114×32 (65)
B	100×50	100±0.5	114×65 (75)×32 (65)

7 Procedure

7.1 Preparation of the test specimens

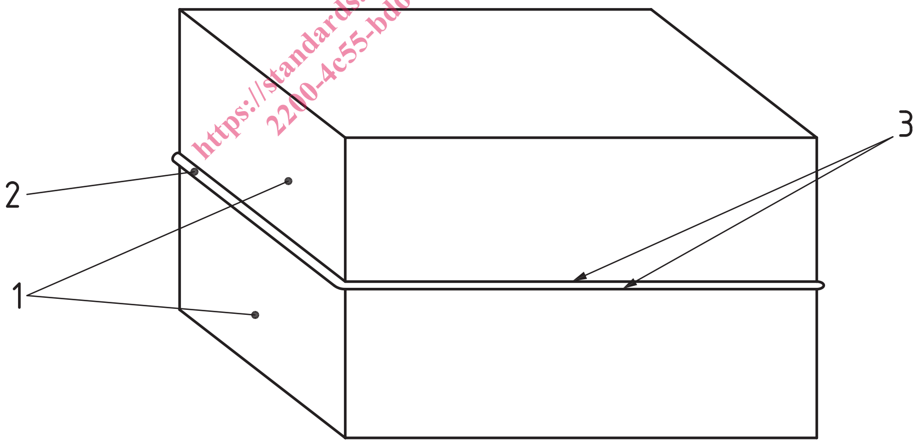
7.1.1 For dry mortars, take 2 kg using the balance and mix with water (or a specified mixing liquid) in accordance with ISO 13765-1 or ISO 13765-2 to attain the desired consistency. Determine the consistency and allow to rest for 30 min or in accordance with the manufacturer's instructions.

For ready-mixed mortars, weight 2.5 kg after mixing thoroughly.

After determining the consistency, carry out the procedures described in 7.1.2.

7.1.2 Take a pair of dried refractory bricks and lay nylon filter cloth on both of the uncut faces for bonding. The nylon filter cloth can be replaced with any thin materials which the binding agent in the mortar can permeate easily, such as paper etc. Take out one brick and apply a layer of the well-mixed mortar to the nylon filter cloth. Place the other refractory brick with the nylon filter cloth on the mortars as shown in Figure 1. Press the top brick and move it laterally at the same time.

The faces of each brick shall be parallel to each other within a tolerance of 1mm. Force out the excess mortar to form a joint of 2 mm thick, unless otherwise agreed.



Key

1 Brick

2 Mortar

3 Nylon filter cloth

Figure 1 — Placement of bricks

7.1.3 When the joint is stable, remove the top refractory brick and tear off the nylon filter cloth on the mortars. Sprinkle a layer of dry, fine refractory powder(≤0.1 mm), which does not react with the refractory mortars and bricks when heating, on the exposed surface, and place the refractory brick on the

mortars again. Reverse the two refractory bricks and mortars as a whole and remove the top refractory brick and tear off the nylon filter cloth on the mortars.

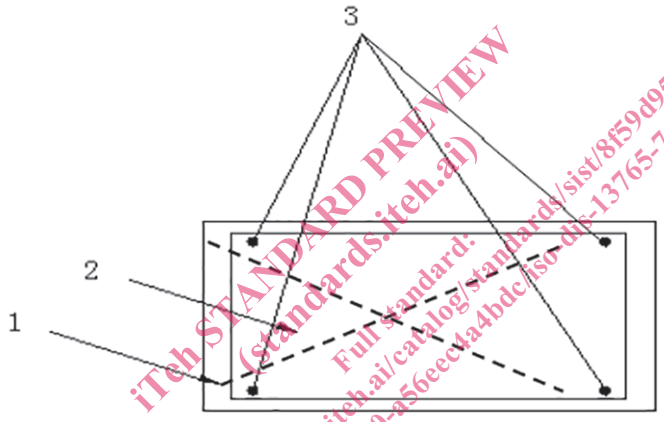
Do not break the mortars layer when tearing off the nylon filter cloth. Bubbles and cavity are not permitted. Otherwise the specimens should be prepared again.

7.1.4 Cut the mortar layer according to the sizes and the tolerances shown in Table 1 as test specimens. The test specimen is placed on the refractory brick, separated from fine refractory powder with a particle size less than 0.1 mm.

Repeat the above operations, using the six refractory bricks to make three specimens.

7.2 Measurement of test specimens

Insert 2 platinum wires vertically into the mortars on one diagonal as two marks, 5 mm to 15 mm from each corner. Record the actual distance, l_0. Repeat the above operations on the other diagonal. As shown in Figure 2.



Key

1 Mrick
2 Mortar
3 marks with platinum wires

Figure 2 — Test specimen

7.3 Drying the test specimens

Air dry the test specimens and bricks naturally at room temperature for 24 h, and then carefully place the air-dried specimens and bricks in the drying oven, raise the temperature to 65 °C ± 5 °C for 4 h. Then raise the temperature to 110 °C ± 5 °C and hold for 12 h.

7.4 Firing the test specimens

Place the dried specimens and bricks in the soaking zone of the furnace. The distance between the specimens themselves and that between the specimens and the soaking plates shall not be less than 10 mm. The distance between the specimens and the heating element shall not be less than 20 mm. If the soaking plates are absent, the radiant heat of the heating elements shall not directly reach the bonded faces of the specimens.

When heating, maintain an oxidizing atmosphere in the furnace. Use the following heating rate:

— normally 5 °C/min;

— silica mortar 3 °C/min.

When the specified temperature is reached, hold for 3 h (5 h for silica mortar), over which the fluctuations of the temperature shall not exceed ±10 °C.

After the holding period, cool the specimens in the furnace to room temperature naturally.

7.5 Measurement of test specimens after heating (drying or firing)

Along the same diagonal, measure the distance between two marks l_1 after dried and l_2 after fired.

8 Procedure

8.1 Calculate the permanent change in dimensions for each of the two diagonals, in percentage. Report the permanent change in dimensions on heating of each test specimen as the mean value of the two results.

8.1.1 The permanent change in dimensions on drying, L_d, using the equation

$$L_d = \frac{l_1 - l_0}{l_0} \times 100 \quad (1)$$

where

l_0 is distance between the two marks along the same diagonal of the specimens before dried, in millimetres;

l_1 is distance between the two marks along the same diagonal of the specimens after dried, in millimetres.

8.1.2 The permanent change in dimensions on firing, L_f, using the equation

$$L_f = \frac{l_2 - l_1}{l_1} \times 100 \quad (2)$$

where

l_1 is distance between the two marks along the same diagonal of the specimens after dried, in millimetres;

l_2 is distance between the two marks along the same diagonal of the specimens after fired , in millimetres.

8.1.3 The permanent change in dimensions on heating, L_c, using the equation

$$L_c = \frac{l_2 - l_0}{l_0} \times 100 \quad (3)$$

where

l_0 is distance between the two marks along the same diagonal of the specimens before dried, in millimetres;

l_2 is distance between the two marks along the same diagonal of the specimens after fired , in millimeres.