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**Ceramic tiles —**

**Part 10:  
Determination of moisture expansion**

*Carreaux et dalles céramiques —*

*Partie 10: Détermination de la dilatation à l'humidité*

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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.

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](http://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](http://www.iso.org/patents)).

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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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 189, *Ceramic tile*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 67, *Ceramic tiles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 10545-10:1995), which has been technically revised.

The main changes compared to the previous edition are as follows:

- addition of [Clause 2](#) "normative references", subsequent clauses have been renumbered;
- modification of [Clause 6](#) "Test specimens".

A list of all parts in the ISO 10545 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](http://www.iso.org/members.html).

# Ceramic tiles —

## Part 10: Determination of moisture expansion

### 1 Scope

This document specifies a method for determining the moisture expansion of ceramic tiles.

### 2 Normative references

There are no normative references in this document.

### 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

#### moisture expansion

proportional accelerated expansion that results from subjecting reheated tiles to extended immersion in boiling water

### 4 Principle

The principle of this document is the determination of accelerated moisture expansion by subjecting a reheated tile to boiling water and measuring the proportional change in length. See additional remarks regarding moisture expansion in [Annex A](#).

### 5 Apparatus

**5.1 Measuring frame**, a suitable type of measuring frame, fitted with a micrometer, dial gauge, transducer or similar device, with an accuracy of at least 0,01 % of the dimension of the specimen.

**5.2 Reference bars of nickel steel (Invar)**, of approximately the same length as the test specimens, fitted with an insulated grip.

**5.3 Kiln**, capable of firing up to 600 °C, at a rate of temperature rise of 150 °C/h and with a control over the temperature of  $\pm 15$  °C.

**5.4 Boiling apparatus**, to maintain the test specimens in boiling deionized or distilled water for 24 h.

## 6 Test specimens

For tiles with a nominal area  $\leq 3600 \text{ cm}^2$ , 3 whole tiles shall be tested (Table 1). If the size of the measuring frame is such that a whole tile does not fit, a test specimen shall be cut from the centre of each tile with a minimum length of 100 mm, a minimum width of 35 mm and the thickness of the tile.

For tiles with a nominal area  $> 3600 \text{ cm}^2$ , a test specimen shall be cut from the centre of each tile with a minimum length of 100 mm, a minimum width of 35 mm and the thickness of the tile. Test specimens shall fit the measuring frame and shall always have an area  $\leq 3600 \text{ cm}^2$ .

In the case of extruded tiles, the length of the test specimens shall be in the direction of the extrusion.

**Table 1 — Number of tiles to be tested**

Nominal area <i>A</i> $\text{cm}^2$	Number of tiles
$A \leq 3600$	5
$A > 3600$	3

## 7 Procedure

### 7.1 Refiring

Refire the test specimens in a kiln (5.3) with a rate of temperature rise of  $150 \text{ }^\circ\text{C/h}$  and a 2 h step at  $(550 \pm 15) \text{ }^\circ\text{C}$ . Allow the test specimens to cool inside the kiln. Remove them when the temperature falls to  $(70 \pm 10) \text{ }^\circ\text{C}$  and keep in a dry desiccator until the samples reach room temperature.

Should any of the specimen crack on refiring, carry out a further refiring on a fresh tile with slower heating and cooling rates.

After thermal stabilization for 1 h of the measuring frame and reference bar at room temperature, register the ambient temperature and determine the initial length of each test specimen, with an accuracy of 0,1 %, by comparing with a reference bar. Measure the test specimen twice, with 3 h between measurements, at a room temperature within  $5 \text{ }^\circ\text{C}$  from the temperature of the initial measurements.

### 7.2 Treatment in boiling water

Bring deionized or distilled water to boil and immerse the test specimens in the boiling water for  $24 \text{ h} \pm 30 \text{ min}$  consecutively, ensuring that there is at least 5 cm of water above the specimens, and that they do not touch each other or touch the base or sides of the container. Remove the test specimens from the boiling water. Allow them to cool to room temperature, ensuring that the test specimens do not touch each other. Measure them  $1 \text{ h} \pm 5 \text{ min}$  after removal from the boiling apparatus, and again after a further  $3 \text{ h} \pm 5 \text{ min}$ . Record the measurements as in 7.1. For each test specimen, determine the mean of the two measurements prior to treatment in boiling water, the mean of the two measurements after treatment in boiling water, and then determine the difference between the two mean values.

## 8 Expression of results

The moisture expansion, expressed in millimetres per metre, is calculated using Formula (1):

$$\frac{\Delta L}{L} \times 1000 \quad (1)$$

where

$\Delta L$  is the difference between the two mean values, in millimetres;

$L$  is the mean initial length, in millimetres, of the test specimen.

The moisture expansion, expressed as a percentage, may be calculated using [Formula \(2\)](#).

$$\frac{\Delta L}{L} \times 100 \quad (2)$$

## 9 Test report

The test report shall include the following information:

- a) a reference to this document including publication year;
- b) a description of the tiles and the sizes of the tested specimens;
- c) the moisture expansion of each test specimen, underlining the maximum value obtained;
- d) the average moisture expansion of the tiles.

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## **Annex A** **(informative)**

### **Remarks on the moisture expansion of ceramic tiles**

The majority of glazed and unglazed tiles have negligible natural moisture expansion that does not contribute to tiling problems when the tiles are correctly fixed.

However, with unsatisfactory fixing practices and in certain climatic conditions, natural moisture expansion may aggravate problems, especially when tiles are directly fixed to inadequately aged concrete substrates. In these cases, a maximum limit of 0,06 % moisture expansion is recommended when the test is used.

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