
Ceramic tiles —

Part 3:

**Determination of water absorption,
apparent porosity, apparent relative
density and bulk density**

Carreaux et dalles céramiques —

*Partie 3: Détermination de l'absorption d'eau, de la porosité ouverte,
de la densité relative apparente et de la masse volumique globale*



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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

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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	1
5 Apparatus	1
6 Test specimens	2
6.1 Sampling	2
6.2 Sample cutting	3
6.2.1 General	3
6.2.2 Tiles less than or equal to 400 cm ²	3
6.2.3 Tiles greater than 400 cm ² and less than or equal to 3 600 cm ² , where x and y > 20 cm	4
6.2.4 Tiles greater than 400 cm ² and less than or equal to 3 600 cm ² , where only y is ≤ 20 cm	5
6.2.5 Tiles greater than 3 600 cm ²	5
7 Procedure	6
7.1 Sample preparation	6
7.2 Impregnation with water	7
7.3 Suspended weight	7
8 Expression of results	7
8.1 Water absorption	7
8.2 Apparent porosity	8
8.3 Apparent relative density	8
8.4 Bulk density	8
9 Test report	8

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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 189, *Ceramic tiles*.

This second edition cancels and replaces the first edition (ISO 10545-3:1995 which has been technically revised. It also incorporates ISO 10545-3:1995/Cor.1:1997.

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

- The impregnation of the samples is now only done by vacuum.
- The boiling method for impregnation of the samples has been removed.
- Sampling guidelines according to the dimension of tiles are provided.

A list of all parts in the ISO 10545 series can be found on the ISO website.

Introduction

For ceramic tiles, water absorption is used to classify products. This document outlines the procedures for the measurement of water absorption and related properties using classical Archimedean techniques. Impregnation of the open porosity is achieved by a vacuum method only. Accommodations are provided for large or irregularly shaped ceramic tile.

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Ceramic tiles —

Part 3:

Determination of water absorption, apparent porosity, apparent relative density and bulk density

1 Scope

This document specifies a method for determining water absorption, apparent porosity, apparent relative density and bulk density of ceramic tiles. This method is applicable to classification of tiles and product specifications.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Principle

Impregnation of dry tiles with water and then suspension in water. Calculation of the listed properties using the relationships between dry, saturated and suspended masses.

5 Apparatus

5.1 Drying oven, capable of being operated at least at $(110 \pm 5) ^\circ\text{C}$. Microwave, infrared, or other drying systems may be used provided that it has been determined that the same results are obtained.

5.2 Balance, accurate to 0,01 % of the mass of a test specimen.

5.3 Deionized or distilled water

5.4 Dessicator

5.5 Microfibre cloth

5.6 Wire loop, halter or basket, capable of supporting specimens under water for making suspended mass measurements.

5.7 Glass beaker, or similar container of size and shape such that the sample, when suspended from the balance (5.2) by the wire loop (5.6), is completely immersed in water, with the test specimen and the wire loop being completely free of contact with any part of the container.

5.8 Vacuum chamber and vacuum system, of sufficient capacity to accommodate the test specimens and evacuate to a pressure of 10 ± 5 kPa (91 ± 5 kPa below standard atmospheric pressure of 101 kPa) for 30 min.

6 Test specimens

6.1 Sampling

Sampling shall be carried out according to the dimension of tiles as reported in Table 1. In Table 2 some examples of different common sizes are reported. The number of the specimens to be tested for each tile as well the number of tiles are function of the tile dimension. Tiles and relevant specimens shall not contain visible damage or cracks prior to testing and shall not have been previously tested. Any loose or contaminating material shall be removed. This includes any mesh, paper and adhesive that has been applied to mosaics.

When the mass of each individual tile is below 50 g, a sufficient number of tiles shall be taken so that each test specimen reaches a mass of 50 g to 100 g. For those specimens, 6.2 is not applicable.

Table 1 — Sampling

Maximum area A cm ²	Reference paragraph for sample cutting	n° of specimens per tile to be tested	Total n° of tiles	Total n° of specimens
$A \leq 400$	6.2.2	1	5	5
$400 < A \leq 3\,600$ (with x and y > 20 cm)	6.2.3	1	5	5
$400 < A \leq 3\,600$ (with minor edge y ≤ 20 cm, and major edge x < 100 cm)	6.2.4	1	5	5
$400 < A \leq 3\,600$ (with minor edge y ≤ 20 cm, and major edge x ≥ 100 cm)	6.2.4	2	5	10
$A > 3\,600$ (with minor edge y ≤ 20 cm, and major edge x ≥ 100 cm)	6.2.5	2	3	6
$A > 3\,600$ (with minor edge y > 20 cm)	6.2.5	4	3	12
NOTE For non-rectangular tile, consider the area of the minimum rectangle in which the tile can be fit.				

Table 2 — Examples of sampling for different common sizes

Maximum area A cm ²	Example of nominal size cm	n° of specimens per tile to be tested	Total n° of tiles	Total n° of specimens
400	20 × 20	1	5	5
600	10 × 60	1	5	5
900	30 × 30	1	5	5
1 350	15 × 90	1	5	5
2 160	18 × 120	2	5	10
2 250	15 × 150	2	5	10
2 500	50 × 50	1	5	5
3 600	60 × 60	1	5	5
4 500	18 × 250	2	3	6
8 100	90 × 90	4	3	12
7 200	60 × 120	4	3	12
16 200	90 × 180	4	3	12
14 400	120 × 120	4	3	12
28 800	120 × 240	4	3	12
30 000	100 × 300	4	3	12
>30 000	120 × 300	4	3	12

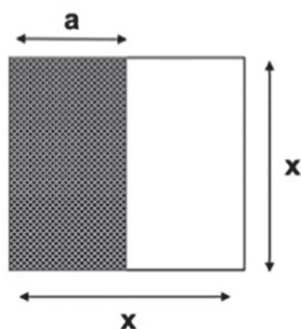
6.2 Sample cutting

6.2.1 General

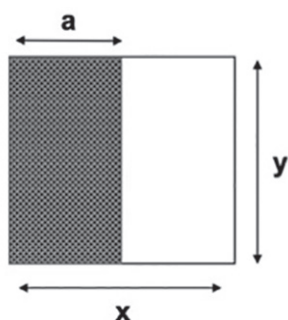
Each tile shall be cut into smaller pieces as described in 6.2.2 through 6.2.5 where some common examples are reported. Cutting of specimens shall consist of scoring and snapping, or sawing when impossible to score and snap with conventional tile-scoring equipment (as can be the case with highly textured and structured porcelain tiles). Cutting may be performed at the factory following the sampling criteria described where the sample being cut is at least 10 cm bigger on each cut side. At the testing facility, cutting shall be done no more than four hours before the specimens are placed in the dryer. Specimens shall be kept clean with no contaminating material after cutting.

6.2.2 Tiles less than or equal to 400 cm²

Specimens shall be cut in half, within 1 cm. Specimens shall be cut perpendicular to the longest side if the specimen has unequal sides. Select one half at random from each specimen for testing (see Figure 1).



a) Equal sides: $x \leq 20$ cm, $a = 1/2 \times$ (within 1 cm)

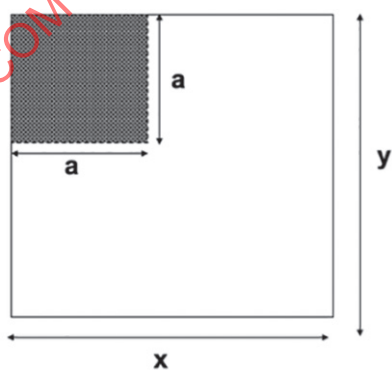


b) Unequal sides: $x > y$, $a = 1/2 \times$ (within 1 cm)

Figure 1 — Scheme of cuts for tiles less than or equal to 400 cm²

6.2.3 Tiles greater than 400 cm² and less than or equal to 3 600 cm², where x and $y > 20$ cm

A 20 × 20 cm portion, within 1 cm, shall be cut from one corner of each specimen for testing (see [Figure 2](#)).



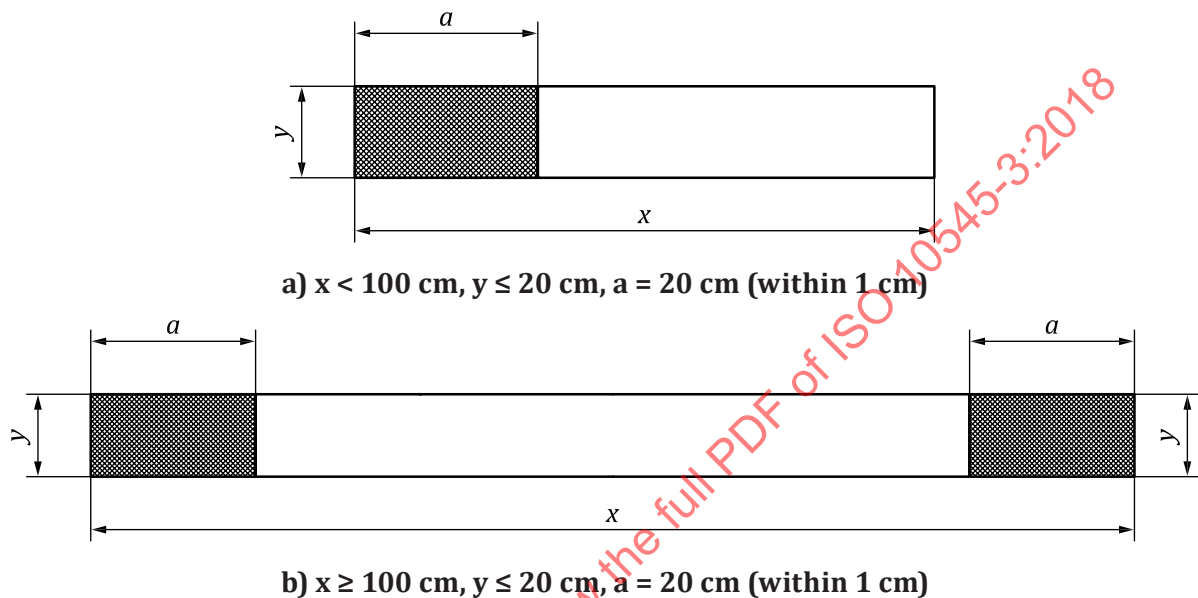
$x > 20$ cm, $y > 20$ cm, $a = 20$ cm (within 1 cm)

Figure 2 — Scheme of cuts for tiles greater than 400 cm² and less than or equal to 3 600 cm² where x and $y > 20$

6.2.4 Tiles greater than 400 cm² and less than or equal to 3 600 cm², where only $y \leq 20$ cm

Proceed as follows (Figure 3 b) also applies to tiles over 3 600 cm²):

- $x < 100$ cm, a portion where one dimension is equal to y and the other dimension is equal to 20 cm, within 1 cm, shall be cut of each specimen for testing (see Figure 3 a)).
- $x \geq 100$ cm, two portions where one dimension is equal to y and the other dimension is equal to 20 cm, within 1 cm, shall be cut of each specimen for testing (see Figure 3 b)).



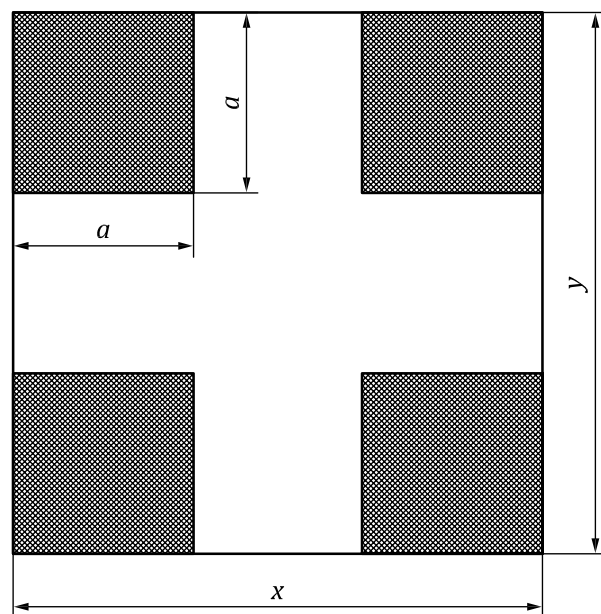
NOTE Figure 3 b) also applies for tiles $> 3\,600$ cm².

Figure 3 — Scheme of cuts for tiles greater than 400 cm² and less than or equal to 3 600 cm² where $y \leq 20$ cm

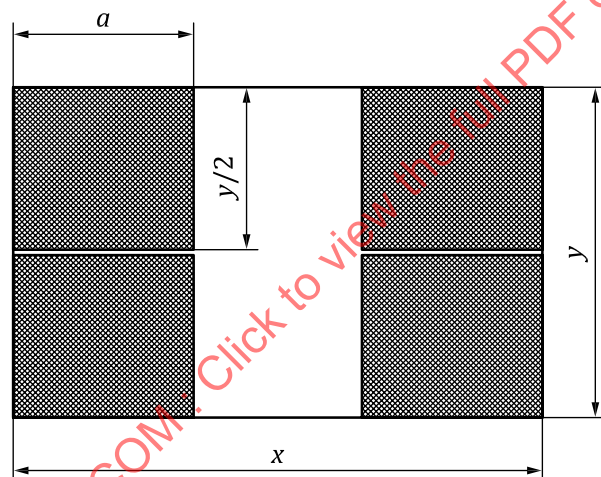
6.2.5 Tiles greater than 3 600 cm²

Proceed as follows:

- if $y \geq 40$ cm, a 20 × 20 cm portion, within 1 cm, shall be cut from four corners of each specimen for testing (see Figure 4 a)).
- if $20 < y < 40$ cm, a portion 20 cm × $y/2$ cm, within 1 cm, shall be cut from four corners of each specimen for testing (see Figure 4 b)).
- if $y \leq 20$ cm, two portions where one dimension is equal to y and the other dimension is equal to 20 cm, within 1 cm, shall be cut of each specimen for testing (see Figure 3 b)).



a) $x \geq 40$ cm, $y \geq 40$ cm, $a = 20$ cm (within 1 cm)



b) $x \geq 40$ cm, $20 < y < 40$ cm, $a = 20$ cm (within 1 cm)

NOTE See also [Figure 3 b\)](#).

Figure 4 — Scheme of cuts for tiles greater than 3 600 cm²

7 Procedure

7.1 Sample preparation

Dry the test specimens to constant mass (see NOTE) in the oven ([5.1](#)) adjusted to a minimum of 110 °C, not to exceed 160 °C for a minimum of 24 h (or such other time as has been established for the oven in use and the mass of tiles being dried). The drying of the specimens and the determination of their masses may be done either before or after the specimens have been impregnated with water. Usually the dry mass is determined before impregnation. However, if the specimens are friable or evidence indicates that particles have broken loose during the impregnation, the specimens shall be dried and