SRI LANKA STANDARD 1181: 2019
(ISO 13006: 2018)
UDC 691.4

SPECIFICATION FOR CERAMIC TILES
(Third Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard
SPECIFICATION FOR CERAMIC TILES
(Third Revision)

SLS 1181: 2019
(ISO 13006: 2018)

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SRI LANKA

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract

Sri Lanka Standard
SPECIFICATION FOR CERAMIC TILES
(Third Revision)

NATIONAL FOREWORD

This standard was approved by the Sectoral Committee on Building and Construction Materials and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2019-08-07.

This Sri Lanka Standard is identical with **ISO 13006 : 2018** published by the International Organization for Standardization (**ISO**).

This is the third revision of Sri Lanka Standard **SLS 1181:2013** Specification for Ceramic Tiles and it will be renamed as **SLS 1181: 2019** Specification for Ceramic Tiles. It introduces vacuum method for determination of water absorption.
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TERMINOLOGY AND CONVENTIONS

The text of the International Standard has been accepted as suitable for publication as a Sri Lanka Standard. However, certain terminology and conventions are not identical with those used in Sri Lanka Standards.
Attention is therefore drawn to the following:

a) Wherever the "International Standard" appear referring to this standard they should be interpreted as "Sri Lanka Standard".
b) Wherever page numbers are quoted, they are "**ISO**" page numbers.
c) Wherever ISO 13006 is quoted, it should be read as SLS 1181.
d) Wherever ISO 10545 is quoted, it should be read as SLS ISO 10545.
e) The coma has been used throughout as a decimal marker. In Sri Lanka Standards it is the current practice to use a full point on the base line as the decimal marker.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test method or observation shall be rounded off in accordance with **SLS 102**. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

CROSS-REFERENCES

International Standard	Corresponding Sri Lanka Standard
ISO 10545 – 1, Ceramic Tiles – Part 1: Sampling and basic for acceptance	**SLS ISO 10545 -1,** Ceramic Tiles – Part 1: Sampling and basis for acceptance
ISO 10545 – 2, Ceramic Tiles – Part 2: Determination of dimension and surface quality	**SLS ISO 10545 - 2,** Ceramic Tiles – Part 2: Determination of dimensions and surface quality
ISO 10545 – 3, Ceramic Tiles – Part 3: Determination of water absorption. Apparent porosity, apparent relative density and bulk density	**SLS ISO 10545 - 3,** Ceramic Tiles – Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density
ISO 10545 – 4, Ceramic Tiles – Part 4: Determination of modulus of rupture and breaking strength.	**SLS ISO 10545 - 4,** Ceramic Tiles – Part 4: Determination of modulus of rupture and breaking strength
ISO 10545 – 5, Ceramic Tiles – Part 5: Determination of impact resistance by measurement of coefficient of restitution	**SLS ISO 10545 -5,** Ceramic Tiles – Part 5: Determination of impact resistance by measurement of coefficient of restitution
ISO 10545 – 6, Ceramic Tiles – Part 6: Determination of resistance to deep abrasion for unglazed tiles.	**SLS ISO 10545 - 6,** Ceramic Tiles – Part 6: Determination of resistance to deep abrasion for unglazed tiles.
ISO 10545 – 7, Ceramic Tiles – Part 7: Determination of resistance to surface abrasion for glazed tiles	**SLS ISO 10545 - 7,** Ceramic Tiles – Part 7: Determination of resistance to surface abrasion for glaze tiles
ISO 10545 – 8, Ceramic Tiles – Part 8: Determination of linear thermal expansion	**SLS ISO 10545 - 8,** Ceramic Tiles – Part 8: Determination of linear thermal expansion
ISO 10545 – 9, Ceramic Tiles – Part 9: Determination of resistance to thermal shock	**SLS ISO 10545 - 9,** Ceramic Tiles – Part 9: Determination of resistance to thermal shock
ISO 10545 – 10, Ceramic Tiles – Part 10: Determination of moisture expansion	**SLS ISO 10545 - 10,** Ceramic Tiles – Part 10: Determination of moisture expansion
ISO 10545 – 11, Ceramic Tiles – Part 11: Determination of crazing resistance for glazed tiles	**SLS ISO 10545 - 11,** Ceramic Tiles – Part 11: Determination of crazing resistance for glaze tiles
ISO 10545 – 12, Ceramic Tiles – Part 12: Determination of frost resistance	**SLS ISO 10545 - 12,** Ceramic Tiles – Part 12: Determination of frost resistance
ISO 10545 – 13, Ceramic Tiles – Part 13: Determination of chemical resistance	**SLS ISO 10545 - 13,** Ceramic Tiles – Part 13: Determination of chemical resistance
ISO 10545 – 14, Ceramic Tiles – Part 14: Determination of resistance to stains	**SLS ISO 10545 - 14,** Ceramic Tiles – Part 14: Determination of resistance to stains
ISO 10545 – 15, Ceramic Tiles – Part 15: Determination of lead and cadmium given off by glazed tiles	**SLS ISO 10545 - 15,** Ceramic Tiles – Part 15: Determination of lead and cadmium given off by glazed tiles
ISO 10545 – 16, Ceramic Tiles – Part 16: Determination of small colour differences	**SLS ISO 10545 -16,** Ceramic Tiles – Part 16: Determination of small colour differences

SLS 1181: 2019

INTERNATIONAL STANDARD

ISO 13006

Third edition
2018-09

Ceramic tiles — Definitions, classification, characteristics and marking

Carreaux et dalles céramiques — Définitions, classification, caractéristiques et marquage

Reference number
ISO 13006:2018(E)

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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).

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 ISO/TC 189, *Ceramic tile*.

This third edition cancels and replaces the second edition (ISO 13006:2012), which has been technically revised.

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

— The boiling method in ISO 10545-3 is no longer referenced for the determination of water absorption. The vacuum method is now referenced for the determination of water absorption.

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.

INTERNATIONAL STANDARD **ISO 13006:2018(E)**

Ceramic tiles — Definitions, classification, characteristics and marking

1 Scope

This document defines terms and establishes classifications, characteristics and marking requirements for ceramic tiles of the best commercial quality (first quality). This document is not applicable to tiles made by other than normal processes of extrusion or dry pressing. It is not applicable to decorative accessories or trim such as edges, corners, skirting, capping, coves, beads, steps, curved tiles and other accessory pieces or mosaics (i.e. any piece that can fit into a square, the side of which is less than 7 cm).

NOTE ISO 10545 (all parts) describes the test procedures required to determine the product characteristics listed in this document. ISO 10545 is a multi-part standard, each part describes a specific test procedure or related matter.

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 1006, *Building construction — Modular coordination — Basic module*

ISO 10545-1, *Ceramic tiles — Part 1: Sampling and basis for acceptance*

ISO 10545-2, *Ceramic tiles — Part 2: Determination of dimensions and surface quality*

ISO 10545-3, *Ceramic tiles — Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density*

ISO 10545-4, *Ceramic tiles — Part 4: Determination of modulus of rupture and breaking strength*

ISO 10545-5, *Ceramic tiles — Part 5: Determination of impact resistance by measurement of coefficient of restitution*

ISO 10545-6, *Ceramic tiles — Part 6: Determination of resistance to deep abrasion for unglazed tiles*

ISO 10545-7, *Ceramic tiles — Part 7: Determination of resistance to surface abrasion for glazed tiles*

ISO 10545-8, *Ceramic tiles — Part 8: Determination of linear thermal expansion*

ISO 10545-9, *Ceramic tiles — Part 9: Determination of resistance to thermal shock*

ISO 10545-10, *Ceramic tiles — Part 10: Determination of moisture expansion*

ISO 10545-11, *Ceramic tiles — Part 11: Determination of crazing resistance for glazed tiles*

ISO 10545-12, *Ceramic tiles — Part 12: Determination of frost resistance*

ISO 10545-13, *Ceramic tiles — Part 13: Determination of chemical resistance*

ISO 10545-14, *Ceramic tiles — Part 14: Determination of resistance to stains*

ISO 10545-15, *Ceramic tiles — Part 15: Determination of lead and cadmium given off by glazed tiles*

ISO 10545-16, *Ceramic tiles — Part 16: Determination of small colour differences*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1006 and the following apply.

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

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

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

3.1
ceramic tile
thin slab made from clays and/or other inorganic raw materials, generally used as covering for floors and walls, usually shaped by extruding (A) or pressing (B) at room temperature, but may be formed by other processes (C), then dried and subsequently fired at temperatures sufficient to develop the required properties

Note 1 to entry: Tiles may be glazed (GL) or unglazed (UGL); they are incombustible and are not affected by light.

3.2
porcelain tile
fully vitrified tile with water absorption coefficient less than or equal to a mass fraction of 0,5 %, belonging to groups AI_a and BI_a

3.3
glaze
vitrified covering that is impermeable

3.4
engobed surface
clay-based covering with a matt finish which may be permeable or impermeable

Note 1 to entry: A tile with an engobed surface is regarded as an unglazed tile.

3.5
polished surface
surface of glazed and unglazed tile which has been given a glossy finish by mechanical polishing as the last stage of manufacture

3.6
extruded tile
tile, whose body is shaped in the plastic state in an extruder, the column obtained being cut into tiles of pre-determined dimension, and which is designated as Group A

Note 1 to entry: This document classifies extruded tiles as “precision” or “natural”. The classification is dependent upon the different technical characteristics as listed in the individual product standards.

Note 2 to entry: Traditional terms used for extruded products are “split tiles” and “quarry tiles”. They commonly indicate double-extruded and single-extruded tiles, respectively. The term “quarry tiles” only refers to extruded tiles with a water absorption coefficient of a mass fraction not exceeding 6 %.

3.7
dry-pressed tile
tile, formed from a finely milled body mixture and shaped (e.g. in dies or moulds) at high pressure, and which is designated as Group B

3.8
water absorption
E_v
percentage of water impregnating a tile

Note 1 to entry: This is measured in accordance with ISO 10545-3.

Note 2 to entry: Water absorption is expressed as a mass fraction of dry mass.

3.9 Sizes

Note 1 to entry The sizes are only defined for rectangular tiles. If the sizes of non-rectangular tiles are required, they are defined by the smallest rectangle into which they fit.

3.9.1
nominal size
size used to describe the product

Note 1 to entry: See Figures 1 and 2.

3.9.2
work size
size of a tile specified for manufacturing to which the actual size shall conform within specified permissible deviations

Note 1 to entry: See Figures 1 and 2.

3.9.3
actual size
size obtained by measuring the face of a tile

Note 1 to entry: This is measured in accordance with ISO 10545-2.

Note 2 to entry: See Figures 1 and 2.

3.9.4
coordinating size
work size plus the joint width

Note 1 to entry: See Figures 1 and 2.

3.9.5
modular size
tile and size based on module M, 2 M, 3 M and 5 M and also their multiples or subdivisions, except for tiles with a surface area of less than 9 000 mm^2

Note 1 to entry: See ISO 1006, where 1 M = 100 mm.

Note 2 to entry: See Figures 1 and 2.

3.9.6
non-modular size
size not based on module M

Note 1 to entry: See ISO 1006, where 1 M = 100 mm.

Note 2 to entry: Tiles of these sizes are those commonly used in most countries.

Note 3 to entry: See Figures 1 and 2.

3.9.7
tolerance
difference between the permissible limits of size

Note 1 to entry: See Figures 1 and 2.

3.10
spacer lug
projection that is located along certain edges of tiles so that where two tiles are placed together, in line, the lugs on adjacent edges separate the tiles by a distance of not less than the specified width of the joint

Note 1 to entry: See Figure 2.

3.11
rectified tile
ceramic tile that, after firing, is subjected to a precise mechanical finishing of the edges

3.12
back feet
parallel ridges running across the back surface of some exterior wall tiles which possess a geometry intended to facilitate an interlocking connection between tile and cement mortar

Note 1 to entry: See Figure 3.

Note 2 to entry: Back feet dimensions shall be measured with vernier calipers, and each specimen in a 10-tile sample is required to satisfy the requirements in Annexes A to H and Annexes J to M.

4 Classification

4.1 Basis of classification

Ceramic tiles are divided into groups according to their method of manufacture and their water absorption (see 3.8 and Table 1). The groups do not presuppose the usage of the products.

4.2 Methods of manufacture

The following are the two methods of manufacture:

— method A, extruded tiles (see 3.6);

— method B, dry-pressed tiles (see 3.7).

4.3 Water absorption according to group

4.3.1 General

The following are the three groups according to water absorption, E_v.

4.3.2 Subdivision of the three groups

The three groups are divided into tiles of low, medium and high water absorption, namely Groups I, II and III, respectively.

a) Tiles of low water absorption, i.e. absorption coefficient less than or equal to a mass fraction of 3 %, $E_v \leq 3$ %, belong to Group I. Group I consists of the following:

   1) for extruded tiles

      i) $E_v \leq 0{,}5$ % (Group AI_a), and

      ii) $0{,}5\ \% < E_v \leq 3\ \%$ (Group AI_b);

   2) for dry-pressed tiles:

      i) $E_v \leq 0{,}5$ % (Group BI_a);

ii) 0,5 % < E_v ≤ 3 % (Group BI_b).

b) Tiles of medium water absorption, i.e. 3 % < E_v ≤ 10 %, belong to Group II. Group II consists of the following:

1) for extruded tiles

i) 3 % < E_v ≤ 6 % [Group AII_a, Subgroups (Parts) 1 and 2; see Annex B for Subgroup (Part) 1 or Annex C for Subgroup (Part) 2], and

ii) 6 % < E_v ≤ 10 % [Group AII_b, Subgroups (Parts) 1 and 2; see Annex D for Subgroup (Part) 1 or Annex E for Subgroup (Part) 2];

2) for dry-pressed tiles

i) 3 % < E_v ≤ 6 % (Group BII_a), and

ii) 6 % < E_v ≤ 10 % (Group BII_b).

c) Tiles of high water absorption, i.e. E_v > 10 %, belong to Group III.

5 Characteristics

The characteristics for different applications of ceramic tiles are given in Table 2.

6 Sampling and basis for acceptance

The sampling and basis for acceptance shall be in accordance with that presented in ISO 10545-1.

7 Requirements

Dimensional and surface quality requirements and physical and chemical properties shall be as given in the relevant/specific annex, of Annexes A to H and Annexes J to M, for each tile class.

NOTE Annexes I, O and Q are intentionally left blank. This is as a convenience to producers in order to avoid changes to packaging and related costs. In addition, at the time of publication, the market offers consumers various products identified by the matching annex headings of this document.

8 Marking and specifications

8.1 Marking

Tiles and/or their packaging are required to bear the following marking:

a) manufacturer's mark and/or trademark and the country where the tile was manufactured (i.e. country of origin, as determined by the relevant international regulation);

b) indication of first quality;

c) type of tile and reference to the appropriate group and/or annex of Annexes A to H and Annexes J to M covering the specific group of tile;

d) nominal and work sizes, and "M" if modular;

e) nature of the surface, i.e. glazed (GL) or unglazed (UGL);

f) any surface treatment applied after firing;

g) total number of tiles in the package;

h) manufacturer's production run or batch number;

i) an indication of colour consistency, as defined by the manufacturer;

j) total dry weight which the tiles and their packaging shall not exceed.

EXAMPLE 1

The ABC Tile Co., Made in China, Ceramic Tile of First Quality
Extruded tile, ISO 13006:2018, Annex A, Group AI_b, Precision
M, 25 cm × 12,5 cm (S_w 240 mm × 115 mm × 12,5 mm), UGL, Protective Sealer Added
20 pcs/box, batch A50, 0100-Gray, Max dry weight: 20 kg

EXAMPLE 2

The 123 Tile Co., Made in Spain, Ceramic Tile of First Quality
Dry-pressed porcelain tile, ISO 13006:2018, Annex G, Group BI_a, Rectified
60 cm × 60 cm (S_w 598 mm × 598 mm × 10 mm) UGL
3 pcs/box, batch B52, 0590-Slate, Max dry weight: 16 kg

EXAMPLE 3

The XYX Tile Co., Made in Indonesia, Ceramic Tile of First Quality
Dry-pressed tile, ISO 13006:2018, Annex H, Group BI_b Non-rectified
30 cm × 30 cm (S_w 299 mm × 299 mm × 10 mm) GL
10 pcs/box, batch C60, 0320-Ivory, Max dry weight: 20 kg

Each tile conforming to this document is required to bear on its reverse side or edge, the country where it was manufactured.

8.2 Product literature

Product literature for tiles intended for use on floors shall state the abrasion class or the place of use of glazed tiles.

8.3 Specifications

Tiles shall be designated by the following:

a) the method of shaping;

b) the relevant group and/or annex of Annexes A to H and Annexes J to M covering the specific group of tile

c) nominal and work sizes, and "M" if modular;

d) the nature of the surface, i.e. glazed (GL) or unglazed (UGL);

e) the addition of back feet, if required.

EXAMPLE 1 Precision extruded tile, ISO 13006:2018, Annex M, AIa M 25 cm × 12,5 cm (S_w 240 mm × 115 mm × 10 mm) GL.

EXAMPLE 2 Natural extruded tile, ISO 13006:2018, Annex A, AIb 15 cm × 15 cm (S_w 150 mm × 150 mm × 12,5 mm) UGL.

EXAMPLE 3 Dry-pressed tile, ISO 13006:2018, Annex G, BI_a M 25 cm × 12,5 cm (S_w 240 mm × 115 mm × 10 mm) GL.

EXAMPLE 4 Dry-pressed tile, ISO 13006:2018, Annex L, BIII 15 cm × 15 cm (S_w 150 mm × 150 mm × 12,5 mm) UGL.

9 Ordering

Each time that an order is placed, items, such as size, thickness, type of surface, colour, profile, abrasion class for glazed tiles and other properties, shall be agreed upon by the parties concerned.

Table 1 — Classification of ceramic tiles with respect to water absorption and shaping

Shaping	**Group I** $E_v \leq 3$ %	**Group II_a** 3 % < $E_v \leq 6$ %	**Group II_b** 6 % < $E_v \leq 10$ %	**Group III** $E_v > 10$ %
A Extruded	Group AI_a $E_v \leq 0{,}5$ % (see Annex M)	Group $AII_{a\text{-}1}$[a] (see Annex B)	Group $AII_{b\text{-}1}$[a] (see Annex D)	Group AIII (see Annex F)
	Group AI_b 0,5 % < $E_v \leq 3$ % (see Annex A)	Group $AII_{a\text{-}2}$[a] (see Annex C)	Group $AII_{b\text{-}2}$[a] (see Annex E)	
B Dry pressed	Group BI_a $E_v \leq 0{,}5$ % (see Annex G)	Group BII_a (see Annex J)	Group BII_b (see Annex K)	Group BIII[b] (see Annex L)
	Group BI_b 0,5 % < $E_v \leq 3$ % (see Annex H)			

[a] Groups AII_a and AII_b are divided into two subgroups (Parts 1 and 2) with different product specifications.

[b] Group BIII covers glazed tiles only. There is a low quantity of dry-pressed unglazed tiles produced with water absorption greater than 10 % mass fraction, which is not covered by this product group.

Table 2 — Characteristics required for different applications

Characteristics	**Floor**		**Wall**		**Test**
Dimensions and surface quality	**Interior**	**Exterior**	**Interior**	**Exterior**	**Reference**
Length and width	X	X	X	X	ISO 10545-2
Thickness	X	X	X	X	ISO 10545-2
Straightness of sides	X	X	X	X	ISO 10545-2
Rectangularity	X	X	X	X	ISO 10545-2
Surface flatness (curvature and warpage)	X	X	X	X	ISO 10545-2
Surface quality	X	X	X	X	ISO 10545-2
Back feet (if specified)[a]				X	Figure 3
Physical property	**Interior**	**Exterior**	**Interior**	**Exterior**	**Reference**
Water absorption	X	X	X	X	ISO 10545-3
Breaking strength	X	X	X	X	ISO 10545-4
Modulus of rupture	X	X	X	X	ISO 10545-4
Resistance to deep abrasion — unglazed tiles	X	X			ISO 10545-6
Resistance to surface abrasion — glazed tiles	X	X			ISO 10545-7
Linear thermal expansion[b]	X	X	X	X	ISO 10545-8
Resistance to thermal shock[b]	X	X	X	X	ISO 10545-9
Resistance to crazing — glazed tiles	X	X	X	X	ISO 10545-11
Frost resistance [c]		X		X	ISO 10545-12
Moisture expansion[b]	X	X	X	X	ISO 10545-10
Small colour differences[b]	X	X	X	X	ISO 10545-16

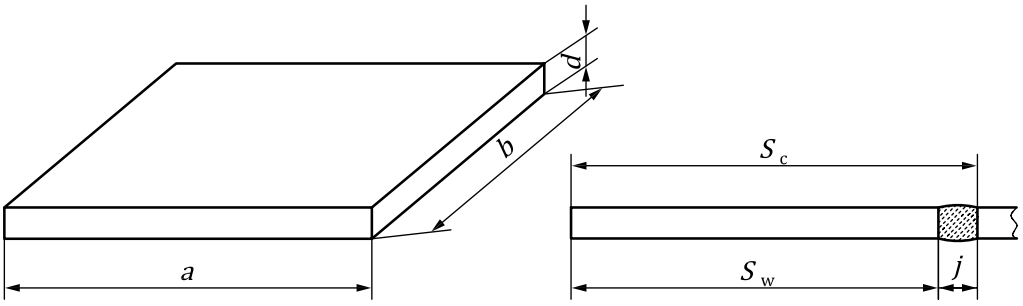
Table 2 *(continued)*

Characteristics	Floor		Wall		Test
Dimensions and surface quality	**Interior**	**Exterior**	**Interior**	**Exterior**	**Reference**
Impact resistance[b]	X	X			ISO 10545-5
Chemical property	**Interior**	**Exterior**	**Interior**	**Exterior**	**Reference**
Resistance to staining					ISO 10545-14
— glazed tiles	X	X	X	X	ISO 10545-14
— unglazed tiles[b]	X	X	X	X	ISO 10545-14
Resistance to low concentrations of acids and alkalis	X	X	X	X	ISO 10545-13
Resistance to high concentrations of acids and alkalis[b]	X	X	X	X	ISO 10545-13
Resistance to household cleaners and swimming pool salts	X	X	X	X	ISO 10545-13
Lead and cadmium release — glazed tiles[b]	X	X	X	X	ISO 10545-15

[a] For application to exterior tiles installed by cement mortar, including tunnels, where back feet are specified.

[b] Test method is available.

[c] For tiles intended to be used in situations where frost conditions apply.



Key

a, *b* dimensions of the tile

d thickness

j joint

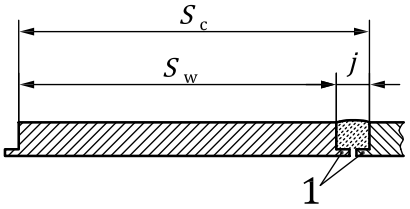
S_c coordinating size

S_w work size

$S_c = S_w + j$

$S_w = a, b, d$

Figure 1 — Tile



Key

1 spacer lugs

j joint

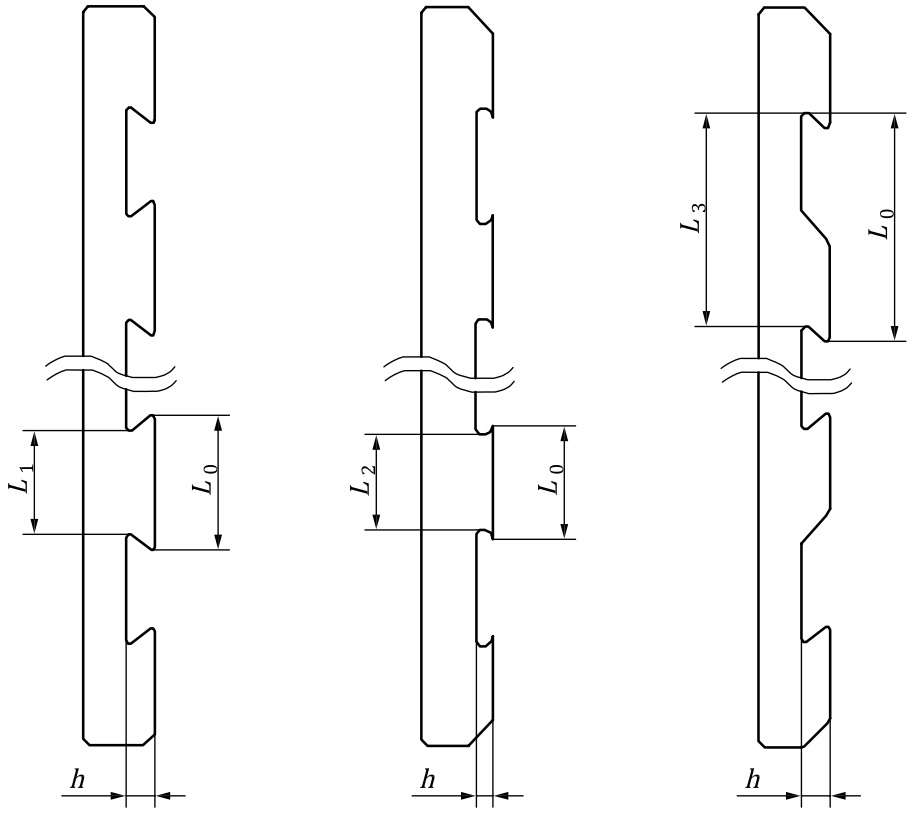
S_c coordinating size

S_w work size

$S_c = S_w + j$

$S_w = a, b, d$

Figure 2 — Tile with spacer lug



a) Example 1 **b) Example 2** **c) Example 3**

Key

h height

L length

Figure 3 — Back feet — Examples

Annex A
(normative)

Extruded ceramic tiles with low water absorption 0,5 < E_v ≤ 3 % Group AI_b

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table A.1.

Table A.1 — Requirements for extruded ceramic tiles — Group AI_b, 0,5 < E_v ≤ 3 %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±1,0 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,0 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[g]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[g]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±0,5 %	±0,6 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±0,5 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±0,5 %	±1,5 %	ISO 10545-2

Table A.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to the diagonal calculated from the work sizes.	±0,8 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction	0,5 < E_v ≤ 3,0 % Individual maximum 3,3 %	0,5 < E_v ≤ 3,0 % Individual maximum 3,3 %	ISO 10545-3
Breaking strength, in Newtons			
a) Thickness ≥7,5 mm	Not less than 1 100	Not less than 1 100	ISO 10545-4
b) Thickness <7,5 mm	Not less than 600	Not less than 600	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 23 Individual minimum 18	Minimum 23 Individual minimum 18	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 275	Maximum 275	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance	Required	Required	ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	**Precision**	**Natural**	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14

Table A.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths shall be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case, the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex B
(normative)

Extruded ceramic tiles 3 % < E_v ≤ 6 % Group AII$_a$ — Subgroup (Part) 1

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table B.1.

Table B.1 — Requirements for extruded ceramic tiles — Group AII$_{a-1}$, 3 % < E_v≤ 6 %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±1,25 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,0 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[g]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[g]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±0,5 %	±0,6 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±0,5 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±0,5 %	±1,5 %	ISO 10545-2

Table B.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to diagonal calculated from the work sizes.	±0,8 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction	3,0 % < E_v ≤ 6,0 % Individual maximum 6,5 %	3,0 % < E_v ≤ 6,0 % Individual maximum 6,5 %	ISO 10545-3
Breaking strength, in Newtons			
a) Thickness ≥7,5 mm	Not less than 950	Not less than 950	ISO 10545-4
b) Thickness <7,5 mm	Not less than 600	Not less than 600	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 20 Individual minimum 18	Minimum 20 Individual minimum 18	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 393	Maximum 393	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance[e]	Test method available	Test method available	ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	**Precision**	**Natural**	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14

Table B.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as “test method available”.

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex C
(normative)

Extruded ceramic tiles 3 % < E_v ≤ 6 % Group AII$_a$ — Subgroup (Part) 2

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table C.1.

Table C.1 — Requirements for extruded ceramic tiles — Group AII$_{a\text{-}2}$, 3 % < E_v ≤ 6 %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±1,5 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,5 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[g]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[g]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±1,0 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±1,0 %	±1,5 %	ISO 10545-2

Table C.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to diagonal calculated from the work sizes.	±1,5 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction	3,0 % < E_v ≤ 6,0 % Individual maximum 6,5 %	3,0 % < E_v ≤ 6,0 % Individual maximum 6,5 %	ISO 10545-3
Breaking strength, in Newtons			
a) Thickness ≥7,5 mm	Not less than 800	Not less than 800	ISO 10545-4
b) Thickness <7,5 mm	Not less than 600	Not less than 600	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 13 Individual minimum 11	Minimum 13 Individual minimum 11	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 541	Maximum 541	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance[e]	Test method available	Test method available	ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	**Precision**	**Natural**	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14

Table C.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex D
(normative)

Extruded ceramic tiles 6 % < E_v ≤ 10 % Group AII$_b$ — Subgroup (Part) 1

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table D.1.

Table D.1 — Requirements for extruded ceramic tiles — Group AII$_{b-1}$, 6 % < E_v ≤ 10 %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±2,0 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,5 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[g]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[g]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±1,0 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±1,0 %	±1,5 %	ISO 10545-2

Table D.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to diagonal calculated from the work sizes.	±1,5 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction	6 % < E_v ≤ 10 % Individual maximum 11 %	6 % < E_v ≤ 10 % Individual maximum 11 %	ISO 10545-3
Breaking strength, in Newtons	Not less than 900	Not less than 900	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 17,5 Individual minimum 15	Minimum 17,5 Individual minimum 15	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 649	Maximum 649	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance[e]	Test method available	Test method available	ISO 10545-12
Moisture expansion, in millimetres per metre	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	Precision	Natural	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14
Resistance to chemicals			

Table D.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex E
(normative)

Extruded ceramic tiles 6 % < E_v ≤ 10 % Group AII$_b$ — Subgroup (Part) 2

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table E.1.

Table E.1 — Requirements for extruded ceramic tiles — Group AII$_{b-2}$, 6 % < E_v ≤ 10 %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) or non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±2,0 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,5 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[g]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[g]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±1,0 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±1,0 %	±1,5 %	ISO 10545-2

Table E.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to diagonal calculated from the work sizes.	±1,5 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction	6 % < E_v ≤ 10 % Individual maximum 11 %	6 % < E_v ≤ 10 % Individual maximum 11 %	ISO 10545-3
Breaking strength, in Newtons	Not less than 750	Not less than 750	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N.	Minimum 9 Individual minimum 8	Minimum 9 Individual minimum 8	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 1 062	Maximum 1 062	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors [d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance[e]	Test method available	Test method available	ISO 10545-12
Moisture expansion, in millimetres per metre	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16

Table E.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	**Precision**	**Natural**	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as “test method available”.

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex F
(normative)

Extruded ceramic tiles E_v > 10 % Group AIII

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table F.1.

Table F.1 — Requirements for extruded ceramic tiles — Group AIII, E_v > 10 %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±2,0 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,5 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[g]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[g]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±1,0 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±1,0 %	±1,5 %	ISO 10545-2

Table F.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to diagonal calculated from the work sizes.	±1,5 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction	E_v > 10 %	E_v > 10 %	ISO 10545-3
Breaking strength, in Newtons	Not less than 600	Not less than 600	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 8 Individual minimum 7	Minimum 8 Individual minimum 7	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 2 365	Maximum 2 365	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance[e]	Test method available	Test method available	ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16

Table F.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	**Precision**	**Natural**	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as “test method available”.

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex G
(normative)

Dry-pressed ceramic tiles with low water absorption $E_v \leq 0,5$ % Group BI_a

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table G.1.

Table G.1 — Requirements for dry-pressed ceramic tiles with low water absorption — Group BI_a, $E_v \leq 0,5$ %

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Length and width		whichever is less is applicable		
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 2 mm and 5 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±2 % (max. ±5 mm).				
For non-rectified, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,9	±0,6	±2,0	ISO 10545-2
For rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,4	±0,3	±1,0	ISO 10545-2
Thickness				
a) The thickness shall be specified by the manufacturer[h]				
b) The deviation of the average thickness of each tile from the work size thickness[h]	±0,5	±5	±0,5	ISO 10545-2
Straightness of sides[b] (facial sides)				
For non-rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,8	±0,5	±1,5	ISO 10545-2
For rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,4	±0,3	± 0,8	ISO 10545-2
Rectangularity[b, i]				
For non-rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,8	±0,5	±2,0	ISO 10545-2

Table G.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
For rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,4	±0,3	±1,5	ISO 10545-2
Surface flatness		whichever is less is applicable		
The maximum deviation from flatness:				
a) for non-rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
b) for rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
c) for non-rectified tiles, edge curvature, related to the corresponding work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
d) for rectified tiles, edge curvature, related to the corresponding work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
e) for non-rectified tiles, warpage, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
f) for rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,6	±0,4	±1,8	ISO 10545-2
Back feet (if specified)				
a) Height, h, for tiles of surface area, A				
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm			Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm			Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3			Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$			Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$			Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$			Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles			ISO 10545-2
Physical property	**Requirements**			**Test**
Water absorption Percent mass fraction[g]	E_v ≤ 0,5 % Individual maximum 0,6 %			ISO 10545-3
Breaking strength, in Newtons				
a) Thickness ≥7,5 mm	Not less than 1 300			ISO 10545-4
b) Thickness <7,5 mm	Not less than 700			ISO 10545-4

Table G.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 35 Individual minimum 32			ISO 10545-4
Abrasion resistance				
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 175			ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed			ISO 10545-7
Coefficient of linear thermal expansion[e]				
From ambient temperature to 100 °C	Test method available			ISO 10545-8
Thermal shock resistance[e]	Test method available			ISO 10545-9
Crazing resistance: glazed tiles[f]	Required			ISO 10545-11
Frost resistance	Required			ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available			ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: $\Delta E < 0{,}75$ UGL: $\Delta E < 1{,}0$			ISO 10545-16
Impact resistance[e]	Test method available			ISO 10545-5
Chemical property	**Requirements**			**Test**
Resistance to staining				
a) Glazed tiles	Minimum class 3			ISO 10545-14
b) Unglazed tiles[e]	Test method available			ISO 10545-14
Resistance to chemicals				
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification			ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available			ISO 10545-13

Table G.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Resistance to household chemicals and swimming pool salts	Minimum B			ISO 10545-13
Lead and cadmium release[e]	Test method available			ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] A fully vitrified tile is a tile with water absorption of a maximum individual value of 0,5 % (porcelain tile).

[h] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

[i] For oblong tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only d_L and percent deviation $\mathbf{d}_L/S$ are applicable. See ISO 10545-2

Annex H
(normative)

Dry-pressed ceramic tiles with low water absorption 0,5 % < E_v ≤ 3 % Group BI_b

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table H.1.

Table H.1 — Requirements for dry-pressed ceramic tiles with low water absorption — Group BI_b, 0,5 % < E_v ≤ 3 %

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Length and width		whichever is less is applicable		
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 2 mm and 5 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±2 % (max. ±5 mm).				
For non-rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,9	±0,6	±2,0	ISO 10545-2
For rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,4	±0,3	±1,0	ISO 10545-2
Thickness				
a) The thickness shall be specified by the manufacturer[g]				
b) The deviation of the average thickness of each tile from the work size thickness[g]	±0,5	±5	±0,5	ISO 10545-2
Straightness of sides[b] (facial sides)				
For non-rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,8	±0,5	±1,5	ISO 10545-2
For rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,4	±0,3	± 0,8	ISO 10545-2
Rectangularity[b, h]				
For non-rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,8	±0,5	±2,0	ISO 10545-2

Table H.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
For rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,4	±0,3	±1,5	ISO 10545-2
Surface flatness		whichever is less is applicable		
The maximum deviation from flatness:				
a) for non-rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
b) for rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
c) for non-rectified tiles, edge curvature, related to the corresponding work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
d) for rectified tiles, edge curvature, related to the corresponding work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
e) for non-rectified tiles, warpage, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
f) for rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,6	±0,4	±1,8	ISO 10545-2
Back feet (if specified)				
a) Height, h, for tiles of surface area, A				
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm			Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm			Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3			Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$			Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$			Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$			Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles			ISO 10545-2
Physical property	**Requirements**			**Test**
Water absorption Percent mass fraction	0,5 % < E_v ≤ 3 % Individual maximum 3,3 %			ISO 10545-3
Breaking strength, in Newtons				
a) Thickness ≥7,5 mm	Not less than 1 100			ISO 10545-4
b) Thickness <7,5 mm	Not less than 700			ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 30 Individual minimum 27			ISO 10545-4
Abrasion resistance				
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 175			ISO 10545-6

Table H.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed			ISO 10545-7
Coefficient of linear thermal expansion[e]				
From ambient temperature to 100 °C	Test method available			ISO 10545-8
Thermal shock resistance[e]	Test method available			ISO 10545-9
Crazing resistance: glazed tiles[f]	Required			ISO 10545-11
Frost resistance	Required			ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available			ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: $\Delta E < 0{,}75$ UGL: $\Delta E < 1{,}0$			ISO 10545-16
Impact resistance[e]	Test method available			ISO 10545-5
Chemical property	**Requirements**			**Test**
Resistance to staining				
a) Glazed tiles	Minimum class 3			ISO 10545-14
b) Unglazed tiles[e]	Test method available			ISO 10545-14
Resistance to chemicals				
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification			ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available			ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B			ISO 10545-13
Lead and cadmium release[e]	Test method available			ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

[h] For rectangular tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only d_L and percent deviation d_L/S are applicable. See ISO 10545-2

Annex I
(informative)

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This annex is intentionally left blank. This is as a convenience to producers in order to avoid changes to packaging and related costs. In addition, at the time of publication, the market offers consumers various products identified by the matching annex headings of this document.

Annex J
(normative)

Dry-pressed ceramic tiles 3 % < E_v ≤ 6 % Group BII$_a$

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table J.1.

Table J.1 — Requirements for dry-pressed ceramic tiles — Group BII$_a$, 3 % < E_v ≤ 6 %

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Length and width		whichever is less is applicable		
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 2 mm and 5 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±2 % (max. ±5 mm).				
For non-rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,9	±0,6	±2,0	ISO 10545-2
For rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,4	±0,3	±1,0	ISO 10545-2
Thickness				
a) The thickness shall be specified by the manufacturer[g]				
b) The deviation of the average thickness of each tile from the work size thickness[g]	±0,5	±5	±0,5	ISO 10545-2
Straightness of sides[b] (facial sides)				
For non-rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,8	±0,5	±1,5	ISO 10545-2
For rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,4	±0,3	± 0,8	ISO 10545-2
Rectangularity[b, h]				
For non-rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,8	±0,5	±2,0	ISO 10545-2
For rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,4	±0,3	±1,5	ISO 10545-2

Table J.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Surface flatness		whichever is less is applicable		
The maximum deviation from flatness:				
a) for non-rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
b) for rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
c) for non-rectified tiles, edge curvature, related to the corresponding work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
d) for rectified tiles, edge curvature, related to the corresponding work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
e) for non-rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,8	±0,5	±2,0	ISO 10545-2
f) for rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,6	±0,4	±1,8	ISO 10545-2
Back feet (if specified)				
a) Height, h, for tiles of surface area, A				
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm			Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm			Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3			Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$			Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$			Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$			Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles			ISO 10545-2
Physical property	**Requirements**			**Test**
Water absorption Percent mass fraction	3 % < E_v ≤ 6 % Individual maximum 6,5 %			ISO 10545-3
Breaking strength, in Newtons				
a) Thickness ≥7,5 mm	Not less than 1 000			ISO 10545-4
b) Thickness <7,5 mm	Not less than 600			ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 22 Individual minimum 20			ISO 10545-4
Abrasion resistance				
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 345			ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed			ISO 10545-7
Coefficient of linear thermal expansion[e]				

Table J.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
From ambient temperature to 100 °C	Test method available			ISO 10545-8
Thermal shock resistance[e]	Test method available			ISO 10545-9
Crazing resistance: glazed tiles[f]	Required			ISO 10545-11
Frost resistance[e]	Test method available			ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available			ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: $\Delta E < 0{,}75$ UGL: $\Delta E < 1{,}0$			ISO 10545-16
Impact resistance[e]	Test method available			ISO 10545-5
Chemical property	**Requirements**			**Test**
Resistance to staining				
a) Glazed tiles	Minimum class 3			ISO 10545-14
b) Unglazed tiles[e]	Test method available			ISO 10545-14
Resistance to chemicals				
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification			ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available			ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B			ISO 10545-13
Lead and cadmium release[e]	Test method available			ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

[h] For rectangular tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only d_L and percent deviation d_L/S are applicable. See ISO 10545-2

Annex K
(normative)

Dry-pressed ceramic tiles 6 % < E_v ≤ 10 % Group BII$_b$

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table K.1.

Table K.1 — Requirements for dry-pressed ceramic tiles — Group BII$_b$, 6 % < E_v ≤ 10 %

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Length and width		whichever is less is applicable		
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 2 mm and 5 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±2 % (max. ±5 mm).				
For non-rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,9	±0,6	±2,0	ISO 10545-2
For rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,4	±0,3	±1,0	ISO 10545-2
Thickness				
a) The thickness shall be specified by the manufacturer[g]				
b) The deviation of the average thickness of each tile from the work size thickness[g]	±0,5	±5	±0,5	ISO 10545-2
Straightness of sides[b] (facial sides)				
For non-rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,8	±0,5	±1,5	ISO 10545-2
For rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,4	±0,3	± 0,8	ISO 10545-2
Rectangularity[b, h]				
For non-rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,8	±0,5	±2,0	ISO 10545-2
For rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,4	±0,3	±1,5	ISO 10545-2
Surface flatness		whichever is less is applicable		

Table K.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
The maximum deviation from flatness:				
a) for non-rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
b) for rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
c) for non-rectified tiles, edge curvature, related to the corresponding work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
d) for rectified tiles, edge curvature, related to the corresponding work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
e) for non-rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,8	±0,5	±2,0	ISO 10545-2
f) for rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,6	±0,4	±1,8	ISO 10545-2
Back feet (if specified)				
a) Height, h, for tiles of surface area, A				
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm			Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm			Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3			Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$			Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$			Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$			Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles			ISO 10545-2
Physical property	**Requirements**			**Test**
Water absorption Percent mass fraction	6 % < E_v ≤ 10 % Individual maximum 11 %			ISO 10545-3
Breaking strength, in Newtons				
a) Thickness ≥7,5 mm	Not less than 800			ISO 10545-4
b) Thickness <7,5 mm	Not less than 500			ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 18 Individual minimum 16			ISO 10545-4
Abrasion resistance				
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 540			ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed			ISO 10545-7
Coefficient of linear thermal expansion[e]				
From ambient temperature to 100 °C	Test method available			ISO 10545-8
Thermal shock resistance[e]	Test method available			ISO 10545-9
Crazing resistance: glazed tiles[f]	Required			ISO 10545-11

Table K.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Frost resistance[e]	Test method available			ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available			ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: $\Delta E < 0{,}75$ UGL: $\Delta E < 1{,}0$			ISO 10545-16
Impact resistance[e]	Test method available			ISO 10545-5
Chemical property	**Requirements**			**Test**
Resistance to staining				
a) Glazed tiles	Minimum class 3			ISO 10545-14
b) Unglazed tiles[e]	Test method available			ISO 10545-14
Resistance to chemicals				
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification			ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available			ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B			ISO 10545-13
Lead and cadmium release[e]	Test method available			ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

[h] For rectangular tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only d_L and percent deviation d_L/S are applicable. See ISO 10545-2

Annex L
(normative)

Dry-pressed ceramic tiles E_V > 10 % Group BIII

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table L.1.

Table L.1 — Requirements for dry-pressed ceramic tiles — Group BIII, E_V > 10 %

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Length and width		whichever is less is applicable		
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 1,5 mm and 5 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±2 % (max. ±5 mm).				
For non-rectified tiles, the deviation of the average size for each tile (two or four sides) from the work size, S_w	±0,9	±0,6	±2,0	ISO 10545-2
For rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,4	±0,3	± 1,0	ISO 10545-2
Thickness				
a) The thickness shall be specified by the manufacturer[h]				
b) The deviation of the average thickness of each tile from the work size thickness[h]	±0,5	±10	±0,5	ISO 10545-2
Straightness of sides[b] (facial sides)				
For non-rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,8	±0,5	±1,5	ISO 10545-2
For rectified tiles, the maximum deviation from straightness related to the corresponding work sizes	±0,4	±0,3	± 0,8	ISO 10545-2
Rectangularity[b, i]				
For non-rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,8	±0,5	±2,0	ISO 10545-2
For rectified tiles, the maximum deviation from rectangularity related to the corresponding work sizes	±0,4	±0,3	±1,5	ISO 10545-2

Table L.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Surface flatness		whichever is less is applicable		
The maximum deviation from flatness:				
a) for non-rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
b) for rectified tiles, centre curvature, related to diagonal calculated from the work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
c) for non-rectified tiles, edge curvature, related to the corresponding work sizes;	±0,8	±0,5	±2,0	ISO 10545-2
d) for rectified tiles, edge curvature, related to the corresponding work sizes;	±0,6	±0,4	±1,8	ISO 10545-2
e) for non-rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,8	±0,5	±2,0	ISO 10545-2
f) for rectified tiles, warpage, related to diagonal calculated from the work sizes.	±0,6	±0,4	±1,8	ISO 10545-2
Back feet (if specified)				
a) Height, h, for tiles of surface area, A				
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm			Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm			Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3			Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$			Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$			Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$			Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles			ISO 10545-2
Physical property	**Requirements**			**Test**
Water absorption Percent mass fraction	E_v > 10 %. Where the average exceeds 20 %, this shall be indicated by the manufacturer Individual minimum value 9 %			ISO 10545-3
Breaking strength, in Newtons [g]				
a) Thickness ≥7,5 mm	Not less than 600			ISO 10545-4
b) Thickness <7,5 mm	Not less than 200			ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N				ISO 10545-4
a) Thickness ≥7,5 mm	Minimum 12			ISO 10545-4
b) Thickness <7,5 mm	Minimum 15			ISO 10545-4
Abrasion resistance				
Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed			ISO 10545-7
Coefficient of linear thermal expansion[e]				
From ambient temperature to 100 °C	Test method available			ISO 10545-8

Table L.1 *(continued)*

Dimensions and surface quality	Nominal size N			Test
	7 cm ≤ N < 15 cm	N ≥ 15 cm		
	mm	%	mm	
Thermal shock resistance[e]	Test method available			ISO 10545-9
Crazing resistance: glazed tiles[f]	Required			ISO 10545-11
Frost resistance[e]	Test method available			ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available			ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: $\Delta E < 0{,}75$ UGL: $\Delta E < 1{,}0$			ISO 10545-16
Impact resistance[e]	Test method available			ISO 10545-5
Chemical property	**Requirements**			**Test**
Resistance to staining				
a) Glazed tiles	Minimum class 3			ISO 10545-14
Resistance to chemicals				
Resistance to low concentrations of acids and alkalis	Test method available			ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available			ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B			ISO 10545-13
Lead and cadmium release[e]	Test method available			ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] Tiles with breaking strength less than 400 N are intended for use on walls only and the manufacturer is required to specify the intended use.

[h] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

[i] For rectangular tiles with longer edge ≥60 cm, and ratio between longer edge and shorter edge ≥3, only d_L and percent deviation d_L/S are applicable. See ISO 10545-2

Annex M
(normative)

Extruded ceramic tiles with low water absorption $E_v \leq 0,5$ % Group AI_a

Dimensional and surface quality requirements and physical and chemical properties are required to be in accordance with Table M.1.

Table M.1 — Requirements for extruded ceramic tiles — Group AI_a, $E_v < 0,5$ %

Dimensions and surface quality	Precision	Natural	Test
Length and width			
The manufacturer shall choose the work size as follows: a) for modular tiles in order to allow a nominal joint width of between 3 mm and 11 mm[a]; b) for non-modular tiles so that the difference between the work size and the nominal size is not more than ±3 mm.			
The deviation, in percent, of the average size for each tile (two or four sides) from the work size, S_w	±1,0 % to a maximum of ±2 mm	±2,0 % to a maximum of ±4 mm	ISO 10545-2
The deviation, in percent, of the average size for each tile (two or four sides) from the average size of the 10 test specimens (20 or 40 sides)	±1,0 %	±1,5 %	ISO 10545-2
Thickness			
a) The thickness shall be specified by the manufacturer[h]			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness[h]	±10 %	±10 %	ISO 10545-2
Straightness of sides[b] (facial sides)			
The maximum deviation from straightness, in percent, related to the corresponding work sizes	±0,5 %	±0,6 %	ISO 10545-2
Rectangularity[b]			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes	±1,0 %	±1,0 %	ISO 10545-2
Surface flatness			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	±0,5 %	±1,5 %	ISO 10545-2
b) edge curvature, related to the corresponding work sizes;	±0,5 %	±1,5 %	ISO 10545-2

Table M.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
c) warpage, related to diagonal calculated from the work sizes.	±0,8 %	±1,5 %	ISO 10545-2
Back feet (if specified)			
a) Height, h, for tiles of surface area, A			
49 cm^2 ≤ A < 60 cm^2	Minimum h = 0,7 mm; Maximum h = 3,5 mm		Figure 3
A ≥ 60 cm^2	Minimum h = 1,5 mm; Maximum h = 3,5 mm		Figure 3
b) Shape	Back feet as specified by the manufacturer and as shown in one of the examples in Figure 3		Figure 3
Example 1 (see Figure 3)	$L_0 - L_1 > 0$		Figure 3
Example 2 (see Figure 3)	$L_0 - L_2 > 0$		Figure 3
Example 3 (see Figure 3)	$L_0 - L_3 > 0$		Figure 3
Surface quality[c]	A minimum of 95 % of the tiles are to be free from visible defects which can impair the appearance of a major area of tiles		ISO 10545-2
Physical property	**Precision**	**Natural**	**Test**
Water absorption Percent mass fraction[g]	E_v ≤ 0,5 % Individual maximum 0,6 %	E_v ≤ 0,5 % Individual maximum 0,6 %	ISO 10545-3
Breaking strength, in Newtons			
a) Thickness ≥7,5 mm	Not less than 1 300	Not less than 1 300	ISO 10545-4
b) Thickness <7,5 mm	Not less than 600	Not less than 600	ISO 10545-4
Modulus of rupture, in Newtons per square millimetre Not applicable to tiles with breaking strength ≥3 000 N	Minimum 28 Individual minimum 21	Minimum 28 Individual minimum 21	ISO 10545-4
Abrasion resistance			
a) Resistance to deep abrasion of unglazed tiles: removed volume, in cubic millimetres	Maximum 275	Maximum 275	ISO 10545-6
b) Resistance to surface abrasion of glazed tiles intended for use on floors[d]	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
Coefficient of linear thermal expansion[e]			
From ambient temperature to 100 °C	Test method available	Test method available	ISO 10545-8
Thermal shock resistance[e]	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles[f]	Required	Required	ISO 10545-11
Frost resistance	Required	Required	ISO 10545-12
Moisture expansion, in millimetres per metre[e]	Test method available	Test method available	ISO 10545-10
Small colour differences[e]	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	Plain coloured tiles only where required GL: ΔE < 0,75 UGL: ΔE < 1,0	ISO 10545-16
Impact resistance[e]	Test method available	Test method available	ISO 10545-5
Chemical property	**Precision**	**Natural**	**Test**
Resistance to staining			
a) Glazed tiles	Minimum class 3	Minimum class 3	ISO 10545-14
b) Unglazed tiles[e]	Test method available	Test method available	ISO 10545-14

Table M.1 *(continued)*

Dimensions and surface quality	Precision	Natural	Test
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis	Manufacturer is to state classification	Manufacturer is to state classification	ISO 10545-13
Resistance to high concentrations of acids and alkalis[e]	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts	Minimum B	Minimum B	ISO 10545-13
Lead and cadmium release[e]	Test method available	Test method available	ISO 10545-15

[a] Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

[b] Not applicable to tiles having curved shapes.

[c] As a result of firing, slight variations from this standard colour are unavoidable. This does not apply to intentional irregularities of colour variation of the face of tiles (which can be unglazed, glazed or partly glazed) or to the colour variation over a tile area which is characteristic for this type of tile and desirable. Spots or coloured dots which are introduced for decorative purposes are not considered a defect.

[d] Use Annex N for the abrasion resistance classification for all glazed tiles intended for use on floors.

[e] Annex P gives information regarding requirements which are non-compulsory but which are listed as "test method available".

[f] Certain decorative effects can have a tendency to craze. These are to be identified by the manufacturer, in which case the crazing test given in ISO 10545-11 is not applicable.

[g] A fully vitrified tile is a tile with water absorption of a maximum individual value of 0,5 % (porcelain tile).

[h] Where applicable, tile thickness shall include the addition of back feet heights, as measured in accordance with Figure 3.

Annex N
(informative)

Classification of glazed tiles for floors according to their abrasion resistance

This approximate classification is given for guidance only (see ISO 10545-7). It is not to be taken to provide accurate product specifications for specific requirements.

Class 0 Glazed tiles in this class are not recommended for use on floors.

Class 1 Floor coverings in areas which are walked on, essentially with soft-soled footwear or bare feet without scratching dirt (for example residential bathrooms and bedrooms without direct access from the outside).

Class 2 Floor coverings in areas which are walked on by soft-soled or normal footwear, with, at the most, occasional small amounts of scratching dirt (for example rooms in the living areas of homes, but with the exception of kitchens, entrances and other rooms which can have a lot of traffic). This does not apply to abnormal footwear, for example hobnailed boots.

Class 3 Floor coverings in areas which, with normal footwear, are walked on more often with small amounts of scratching dirt (for example residential kitchens, halls, corridors, balconies, loggias and terraces). This does not apply to abnormal footwear, for example hobnailed boots.

Class 4 Floor coverings which are walked on by regular traffic with some scratching dirt so that the conditions are more severe than class 3 (for example entrances, commercial kitchens, hotel, exhibition and sale rooms).

Class 5 Floor coverings which are subjected to severe pedestrian traffic over sustained periods with some scratching dirt, so that the conditions are the most severe for which glazed floor tiles are to be suitable (for example public areas, such as shopping centres, airport concourses, hotel foyers, public walkways and industrial applications).

This classification is valid for the given applications under normal conditions. Consideration should be given to the footwear, type of traffic and cleaning methods expected, and the floors should be adequately protected against scratching dirt at the entrances to buildings by interposing footwear cleaning devices. In extreme cases of very heavy traffic and quantities of scratching dirt, unglazed floor tiles and quarries from Group I may be considered.

Annex O
(informative)

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This annex is intentionally left blank. This is as a convenience to producers in order to avoid changes to packaging and related costs. In addition, at the time of publication, the market offers consumers various products identified by the matching annex headings of this document.

Annex P
(informative)

Test methods

A number of test methods that are included in this International Standard are available on request, but do not form part of the compulsory test requirements. The purpose of this annex is to provide explanatory comments on the inclusion of these tests and other pertinent information.

ISO 10545-5: This test is intended only for testing tiles which are used in areas where impact resistance is considered to be of particular importance. The normal requirement for light-duty installations is a coefficient of restitution of 0,55. For heavier duty applications, a higher figure is required.

ISO 10545-8: Most ceramic tiles have low levels of linear thermal expansion. This test is intended for tiles which are installed in conditions of high thermal variation.

ISO 10545-9: All ceramic tiles withstand high temperatures. This test is to be applied to any ceramic tile which is subjected to localized thermal shock.

ISO 10545-10: The majority of glazed and unglazed tiles have negligible moisture expansion, which does not contribute to tiling problems if tiles are correctly fixed (installed). However, with unsatisfactory fixing practices or in certain climatic conditions, moisture expansion in excess of 0,06 % (0,6 mm/m) can contribute to problems.

ISO 10545-12: This test is compulsory only for products which are intended to be specified for use where frost can apply. The test is not required for product groups which are generally unsuitable for use where frost is present.

ISO 10545-13: Ceramic tiles are normally resistant to common chemicals. The test for high concentrations of acids and alkalis is intended for ceramic tiles which are to be used in potentially corrosive conditions.

ISO 10545-14: This test is compulsory for glazed tiles. For unglazed tiles, where staining is a problem, it is recommended that the manufacturer be consulted. This method does not address the temporary colour changes which can occur in certain types of glazed tile due to the absorption of water in the body under the glaze.

ISO 10545-15: This test is intended for glazed tiles which are used on worktops and on wall surfaces where food preparation takes place, and in cases where food is to be in direct contact with the glazed tile surface. For indicative limits, see Directive 2005/31/EC.

ISO 10545-16: This test is only applicable to plain coloured glazed or unglazed tiles and is considered to be of importance in certain specialized circumstances. It is to be used only where small colour differences between plain coloured tiles are important in a specification.

Annex Q
(informative)

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Annex R
(informative)

Symbols recommended for use

The use of symbols on packaging and/or literature is not a requirement except where stated; however, the symbols shown in Table R.1 are recommended to indicate intended use.

Table R.1 — Recommended symbols

Symbol	Description/application	ISO/IEC registration number
	ceramic tile suitable for use on floors	ISO_7000_3622
	ceramic tile suitable for use on walls	ISO_7000_3623
	glazed tile intended for use on floors according to its abrasion resistance (see Annex N)	Not applicable
	frost-resistant ceramic tile	ISO_7000_3624

Bibliography

[1] European Commission, European Commission Directive 2005/31/EC of 29 April 2005 amending Council Directive 84/500/EEC as regards a declaration of compliance and performance criteria of the analytical method for ceramic articles intended to come into contact with foodstuffs

[2] ISO 7000, *Graphical symbols for use on equipment — Registered symbols*[1)]

1) The graphical symbol collection of ISO 7000 can be previewed and purchased on the Online Browsing Platform (OBP), www.iso.org/obp

ICS 01.040.91; 91.100.23

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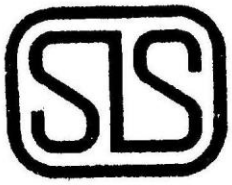

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