

You see things; and you say, 'Why?' But I dream things that never were; and I say, "Why not?"  
- George Bernard Shaw

# Highlight of Changes in ISO 13006:2012

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# Highlight of Changes in ISO 13006

- Group A1a for extruded porcelain tiles
- New definitions for porcelain tiles and rectified tiles
- New post-firing surface application marking requirement
- Inclusion of back-feet
- Limited recognition of amended test methods, eliminated material
- Tighter dimensional tolerances for Group Bla

# Presumed basis

- Familiar with ISO 13006:1998
- Tiles categorised on basis of:
  - Method of manufacture
  - Water absorption
  - Precision or natural (Group A only)
  - Glazed or Unglazed
- Group C, tiles made by other processes, deleted

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

Shaping	Group I $E \leq 3 \%$	Group II <sub>a</sub> $3 \% \leq E < 6 \%$	Group II <sub>b</sub> $6 \% \leq E < 10 \%$	Group III $E > 10 \%$
A Extruded	Group AI (see annex A)	Group AII <sub>a-1</sub> <sup>1)</sup> (see annex B)	Group AII <sub>b-1</sub> <sup>1)</sup> (see annex D)	Group AIII (see annex F)
		Group AII <sub>a-2</sub> <sup>1)</sup> (see annex C)	Group AII <sub>b-2</sub> <sup>1)</sup> (see annex E)	
B Dry pressed	Group BI <sub>a</sub> $E \leq 0,5 \%$ (see annex G)	Group BII <sub>a</sub> (see annex J)	Group BII <sub>b</sub> (see annex K)	Group BIII <sup>2)</sup> (see annex L)
	Group BI <sub>b</sub> $0,5 \% < E \leq 3 \%$ (see annex H)			
1998 C Tiles made by other processes	Group CI <sup>3)</sup>	Group CII <sub>a</sub> <sup>3)</sup>	Group CII <sub>b</sub> <sup>3)</sup>	Group CIII <sup>3)</sup>

1) Groups AII<sub>a</sub> and AII<sub>b</sub> are divided into two parts (Parts 1 and 2) with different product specifications.

2) Group BIII covers glazed tiles only. There is a low quantity of dry-pressed unglazed tiles produced with water absorption greater than 10 % that is not covered by this product group.

3) These tiles are not covered in this International Standard.

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

Shaping	Group I $E_b \leq 3\%$	Group II <sub>a</sub> $3\% < E_b \leq 6\%$	Group II <sub>b</sub> $6\% < E_b \leq 10\%$	Group III $E_b > 10\%$
A Extruded	Group AI <sub>a</sub> $E_b \leq 0,5\%$ (see Annex M)	Group AII <sub>a-1</sub> <sup>1)</sup> (see Annex B)	Group AII <sub>b-1</sub> <sup>1)</sup> (see Annex D)	Group AIII (see Annex F)
	Group AI <sub>b</sub> $0,5\% < E_b \leq 3\%$ (see Annex A)	Group AII <sub>a-2</sub> <sup>1)</sup> (see Annex C)	Group AII <sub>b-2</sub> <sup>1)</sup> (see Annex E)	
B Dry pressed	Group BI <sub>a</sub> $E_b \leq 0,5\%$ (see Annex G)	Group BII <sub>a</sub> (see Annex J)	Group BII <sub>b</sub> (see Annex K)	Group BIII <sup>2)</sup> (see Annex L)
	Group BI <sub>b</sub> $0,5\% < E_b \leq 3\%$ (see Annex H)			

a) Groups AII<sub>a</sub> and AII<sub>b</sub> are divided into two parts (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% that is not covered by this product group.

# Extruded porcelain tile classification

- New Annex M for Group A1a
  - extruded tiles with W.A. less than 0,5%
  - Compliance requirements consistent with CEN

**Annex M**  
(normative)

**Extruded ceramic tiles with low water absorption**  
 $E_b \leq 0,5 \%$   
**Group A<sub>1a</sub>**

**M.1 Requirements**

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 A<sub>1a</sub>,  $E_b < 0,5 \%$

Dimensions and surface quality	Precision	Natural	Test
<b>Length and width</b>			
The manufacturer is to 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 <sup>1)</sup> ; 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 (2 or 4 sides) from the work size ( <i>W</i> ).	± 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 (2 or 4 sides) from the average size of the 10 test specimens (20 or 40 sides).	± 1,0 %	± 1,5 %	ISO 10545-2
<b>Thickness</b>			
a) The thickness is to be specified by the manufacturer. <sup>5)</sup>			
b) The deviation, in percent, of the average thickness of each tile from the work size thickness. <sup>6)</sup>	± 10 %	± 10 %	ISO 10545-2
<b>Straightness of sides<sup>2)</sup> (facial sides)</b>			
The maximum deviation from straightness, in percent, related to the corresponding work sizes.	± 0,5 %	± 0,6 %	ISO 10545-2
<b>Rectangularity<sup>2)</sup></b>			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes.	± 1,0 %	± 1,0 %	ISO 10545-2

Table M.1 (continued)

Dimensions and surface quality	Precision	Natural	Test
<b>Surface flatness</b>			
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
c) warpage, related to diagonal calculated from the work sizes.	± 0,8 %	± 1,5 %	ISO 10545-2
<b>Back feet (if specified)</b>			
a) Height ( <i>h</i> ), for tiles of surface area ( <i>S</i> )			
49 cm <sup>2</sup> ≤ <i>S</i> < 60 cm <sup>2</sup>	Minimum <i>h</i> = 0,7 mm; Maximum <i>h</i> = 3,5 mm		Figure 3
<i>S</i> ≥ 60 cm <sup>2</sup>	Minimum <i>h</i> = 1,5 mm; Maximum <i>h</i> = 3,5 mm		Figure 3
b) Shape	Back feet as specified by manufacturer and as per 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
<b>Surface quality<sup>3)</sup></b>	A minimum of 95 % of the tiles are to be free from visible defects that would impair the appearance of a major area of tiles		ISO 10545-2
<b>Physical properties</b>	<b>Precision</b>	<b>Natural</b>	<b>Test</b>
<b>Water absorption</b> Percent mass fraction <sup>7)</sup>	$E_b \leq 0,5 \%$ Individual maximum 0,6 %	$E_b \leq 0,5 \%$ Individual maximum 0,6 %	ISO 10545-3
<b>Breaking strength, in Newtons</b>			
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
<b>Modulus of rupture, in Newtons per square millimetre</b> Not applicable to tiles with breaking strength ≥ 3 000 N.	Minimum 28 Individual minimum 21	Minimum 28 Individual minimum 21	ISO 10545-4
<b>Abrasion resistance</b>			
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 <sup>4)</sup> .	Report abrasion class and cycles passed	Report abrasion class and cycles passed	ISO 10545-7
<b>Coefficient of linear thermal expansion<sup>9)</sup></b>			
From ambient temperature to 100 °C.	Test method available	Test method available	ISO 10545-8



Table M.1 (concluded)

Physical properties	Precision	Natural	Test
Thermal shock resistance <sup>5)</sup>	Test method available	Test method available	ISO 10545-9
Crazing resistance: glazed tiles <sup>6)</sup>	Required	Required	ISO 10545-11
Frost resistance	Required	Required	ISO 10545-12
Coefficient of friction			
Tiles intended for use on floors.	Where required	Where required	Declare test method(s)
Moisture expansion, in millimetres per metre <sup>5)</sup>	Test method available	Test method available	ISO 10545-10
Small colour differences <sup>5)</sup>	Plain coloured tiles only where required GL: $\Delta E < 0.75$ UGL: $\Delta E < 1.0$	Plain coloured tiles only where required GL: $\Delta E < 0.75$ UGL: $\Delta E < 1.0$	ISO 10545-16
Impact resistance <sup>5)</sup>	Test method available	Test method available	ISO 10545-5
Chemical properties	Precision	Natural	Test
Resistance to staining			
a) Glazed tiles.	Minimum Class 3	Minimum Class 3	ISO 10545-14
b) Unglazed tiles <sup>5)</sup> .	Test method available	Test method available	ISO 10545-14
Resistance to chemicals			
Resistance to low concentrations of acids and alkalis:			
a) glazed tiles;	Manufacturer to state classification	Manufacturer to state classification	ISO 10545-13
b) unglazed tiles.			
Resistance to high concentrations of acids and alkalis <sup>5)</sup>	Test method available	Test method available	ISO 10545-13
Resistance to household chemicals and swimming pool salts:			
a) glazed tiles;	Minimum GB Minimum UB	Minimum GB Minimum UB	ISO 10545-13
b) unglazed tiles.			
Lead and cadmium release <sup>5)</sup>	Test method available	Test method available	ISO 10545-15

<sup>a)</sup> Similar joint widths are to be used to apply to traditional systems based on non-metric sizes.

<sup>b)</sup> Not applicable for tiles having curved shapes.

<sup>c)</sup> Because 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.

<sup>d)</sup> Reference is to be made to Annex N of this European Standard for the abrasion resistance classification for all glazed tiles intended for use on floors.

<sup>e)</sup> Reference is to be made to Annex P of this European Standard for information regarding requirements which are non-compulsory but which are listed "test method available".

<sup>f)</sup> Certain decorative effects may have a tendency to craze. They are to be identified by the manufacturer, in which case the crazing test given in EN ISO 10545-11 is not applicable.

<sup>g)</sup> A fully vitrified tile is a tile with water absorption of a maximum individual value of 0,5 % (porcelain tile).

<sup>h)</sup> Where applicable, tile thickness is to include the addition of back feet heights, as measured per Figure 3.

## Compliance basis

- Test method available
- Required
- Where required
- Manufacturer to state
- Intentional/unintentional



# Bla tighter flatness requirements

1998

Dimensions and surface quality	Surface $S$ of the product (cm <sup>2</sup> )			
	$S \leq 90$	$90 < S \leq 190$	$190 < S \leq 410$	$S > 410$
<b>Rectangularity</b> <sup>2)</sup>				
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes.	± 1,0 %	± 0,6 %	± 0,6 %	± 0,6 %
<b>Surface flatness</b>				
The maximum deviation from flatness, in percent:				
a) centre curvature, related to diagonal calculated from the work sizes;	± 1,0 %	± 0,5 %	± 0,5 %	± 0,5 %
b) edge curvature, related to the corresponding work sizes;	± 1,0 %	± 0,5 %	± 0,5 %	± 0,5 %
c) warpage, related to diagonal calculated from the work sizes.	± 1,0 %	± 0,5 %	± 0,5 %	± 0,5 %

2011

Dimensions and surface quality	Nominal size $N$		
	$7\text{cm} \leq N < 15\text{cm}$	$N \geq 15\text{ cm}$	
	(mm)	(%)	(mm)
<b>Rectangularity</b> <sup>2)</sup>			
The maximum deviation from rectangularity, in percent, related to the corresponding work sizes.	± 0,75	± 0,5	± 2,0
<b>Surface flatness</b>			
The maximum deviation from flatness, in percent:			
a) centre curvature, related to diagonal calculated from the work sizes;	± 0,75	± 0,5	± 2,0
b) edge curvature, related to the corresponding work sizes;	± 0,75	± 0,5	± 2,0
c) warpage, related to diagonal calculated from the work sizes.	± 0,75	± 0,5	± 2,0



# New Definitions

- Porcelain Tile - A fully vitrified tile with water absorption of 0,5% or less (groups A1a and B1a)
- Rectified Tile - Ceramic tile that, after firing, is subjected to a precise mechanical grinding of the edges
  - NOTE Rectified tile have tighter dimensional criteria for length and width, straightness of sides, and rectangularity than given in the annexes included in this international standard.

Why were such higher requirements delayed??

**No definition of glazed tile:** Modern tile manufacturing technology makes it too difficult to define what is glazed and what is unglazed

# Nano-treatment declaration

## Surface Applications

- Section 8.1—Marking

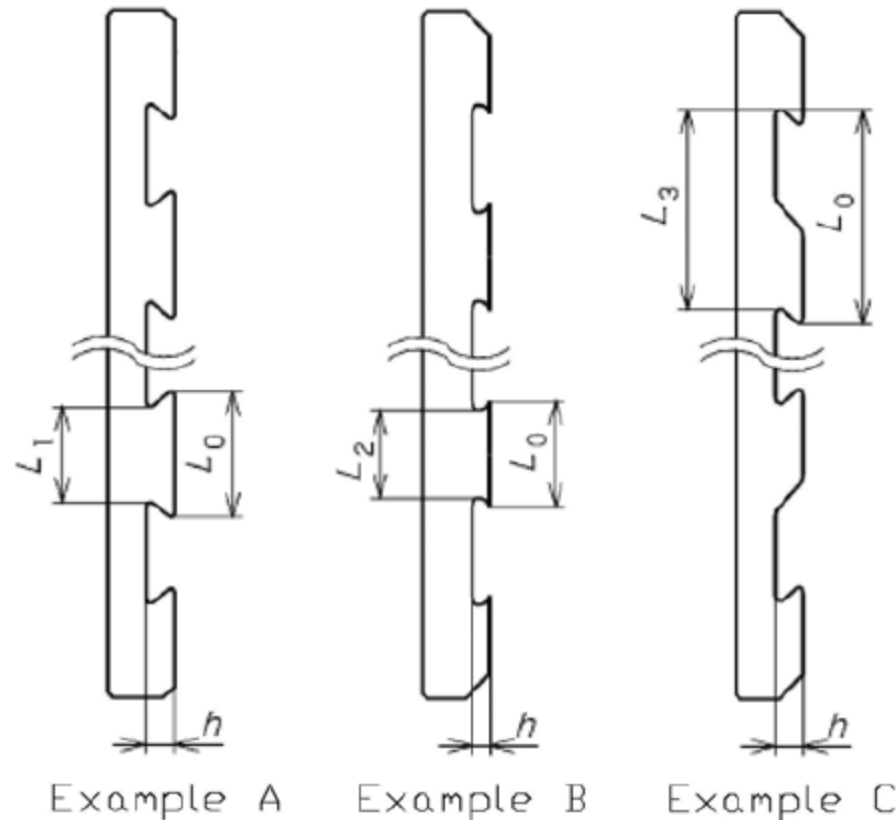
- “Tiles and or their packaging shall bear the following marking . . . any surface treatment applied after firing”

- **Intended** to communicate product’s long-term stain resistance to consumers

- **Intended** to assist in determination of stain resistance testing protocol

# Inclusion of back-feet criteria

- Back-Feet: New criteria for tiles in which back-feet are specified; most commonly in exterior applications (especially earthquake zones) with cement mortar



# Consideration of future revisions

- Establishment of dimensional specifications for Rectified Tile
- Discussion around whether or not to establish product category for “Technical Porcelain” (W.A.  $\leq 0.1\%$ )
- Discussion around whether or not to establish weight categories and pictorial indicators for tile cartons (to assist with user OHS concerns)

# Consumer satisfaction survey

- Why have a Standard reflecting the 1970s lowest common denominator rather than contemporary product quality?
- Why the inability to define 'glazed tile'?
- Why the focus on ex-factory characteristics rather than in-service performance?
  - European Construction Product Regulations sensibly require adequate performance at the end of an economically reasonable life cycle

# Reality check

- Practical difficulties in harmonisation where there are existing national standards [CEN]
- ISO bureaucratic protocol hindering timing of simultaneous publication of ISO 13006 and the ISO 10545 test methods that determine the tile characteristics
- Difficulties in predicting ultimate exposure conditions and simulating accelerated wear
- Bowman 2005 paper series partially revisited

# An old European solution

The European Federation of Ceramic Wall and Floor Tile Producers had reached an agreement in November 1990 that dealt with tiles that were not first class. Second class tiles had to conform with the quality requirements in the published document. All other tiles were considered third class. The agreement included provision for having second quality Section 2 specific products, such as terre cuite.



## 2<sup>nd</sup> class solutions?

While this agreement was suitable for European purposes, most tile merchants would have been unfamiliar with the contents of the document. The Australian Tile Council, or the Ceramic Industry Club of ASEAN, or other bodies could come to a similar agreement or publish an advisory note to clarify such technical matters. However, **it would be preferable to have an ISO standard that could be universally applied.**

When evaluating the **surface quality** of second class European tiles, the tiles were viewed from a distance of 2 m, rather than 1 m.

When considering the **dimensional tolerances**, the tolerances were increased by 25% for second quality tiles.

When assessing physical and chemical properties, the acceptable limits for a second class tile were often the requirements for first class tile of the immediately following group in the EN classification.

# What is the current need?

For example, for second class tile in group BI, the required prerequisites were those for first quality tile in group BII<sub>a</sub>.

While this agreement was fundamentally simple and amenable to further refinement, it provided a much needed basis for trade.

However, the current need is for more demanding requirements that enable consumers' expectations to be fulfilled.

# Secondary classifications

There are a number of secondary classifications in the ISO standards. For instance, all Groups of extruded tiles are further subdivided into “precision” and “natural” tiles, with precision tiles being manufactured to tighter dimensional tolerances.

To a great extent, this has provided manufacturers much latitude. Occasional batches of tiles that deviate from the normal production quality might be classified as natural tiles rather than precision tiles, or as Part 2 rather than Part 1 tiles.

However, extruded tiles now represent a relatively small percentage of the tiles manufactured.

Dry pressed tiles are not as well catered for in terms of accommodating product variability. The dimensional requirements for Group BI and BII tiles are based on the size of the product.

The surface flatness of Group BIII tiles with spacer lugs is based on a measurement in mm rather than a percentage figure. This approach might be sensibly taken with other products.

*A maximum of 2 mm planarity deviation is now used in the Group B1 requirements for large tiles. Spacer lugs no longer feature in ISO 13006:2012.*

# Class advantages

- The current Standards development should consider such end use applications of test data, as it will facilitate more appropriate and greater use of ceramic tile.
- Consumers expect a durable low maintenance surface that retains its attractive appearance. It should not be too difficult to rewrite the ceramic tile standards to fulfil this expectation.

The table below reflects the proposed redefinition of Group AI to recognise the development of extruded porcelain tiles.

**Perhaps** we should be considering the elimination of Groups AII<sub>a-2</sub> and AII<sub>b-2</sub>, together with the introduction of changed requirements for first class tile and new requirements for second class tile?

Shaping	Group I <sub>a</sub> E ≤ 0.5%	Group I <sub>b</sub> 0.5 < E ≤ 3%	Group II <sub>a</sub> 3 < E ≤ 6%	Group II <sub>b</sub> 6 < E ≤ 10%	Group III E > 10%
A Extruded	Group AI <sub>a</sub>	Group AI <sub>b</sub>	Group AII <sub>a-1</sub>	Group AII <sub>b-1</sub>	Group AIII
			Group AII <sub>a-2</sub>	Group AII <sub>b-2</sub>	
B Dry pressed	Group BI <sub>a</sub>	Group BI <sub>b</sub>	Group BII <sub>a</sub>	Group BII <sub>b</sub>	Group BIII

# And as for the future??

- The current published ISO/TC 189 business plan dates to 2005. There is no progressively updated road map or working plan.
- Should the WCTF have a working group to consider Standards development issues and provide input to ISO/TC 189?
- Do you know how or why your national delegate will vote on specific issues?
- How should we achieve improved user friendly product standards?