
Bamboo floorings —

**Part 2:
Outdoor use**

*Planchers en bambou —
Partie 2: Utilisation en extérieur*

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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).

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

This document was prepared by Technical Committee ISO/TC 296, *Bamboo and rattan*.

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.

Bamboo floorings —

Part 2: Outdoor use

1 Scope

This document specifies the technical requirements, test methods and requirements for the handling, storage, packaging and marking of outdoor bamboo flooring.

It is applicable to outdoor bamboo flooring including bamboo laminated flooring and bamboo scrimber flooring.

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 9424, *Wood-based panels — Determination of dimensions of test pieces*

ISO 9426, *Wood-based panels — Determination of dimensions of panels*

ISO 9427, *Wood-based panels — Determination of density*

ISO 16978, *Wood-based panels — Determination of modulus of elasticity in bending and of bending strength*

ISO 16979, *Wood-based panels — Determination of moisture content*

ISO 17959, *General requirements for solid wood flooring*

ISO 20585:2005, *Wood-based panels — Determination of wet bending strength after immersion in water at 70 degrees C or 100 degrees C (boiling temperature)*

EN 17009:2019, *Flooring of lignified materials other than wood — Characteristics, assessment and verification of constancy of performance and marking*

3 Terms and definitions

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

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

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

3.1

bamboo flooring

assembled bamboo-based panel used as floor boards

[SOURCE: ISO 21625: 2020, 3.3.4]

**3.2
bamboo scrimber**

panel or lumber made of compressed bamboo fibre bundle strips or compressed bamboo fibre bundle sheet

[SOURCE: ISO 21625: 2020, 3.2.17]

**3.3
laminated bamboo flooring**

flooring product made from laminated bamboo strips

[SOURCE: ISO 21625: 2020, 3.3.4.2]

**3.4
bamboo scrimber flooring**

flooring product made of *bamboo scrimber* (3.2)

[SOURCE: ISO 21625: 2020, 3.3.4.3]

**3.5
bamboo outer layer**

hard, compact sheath of bamboo culm which is exposed to the external environment

[SOURCE: ISO 21625: 2020, 3.1.3]

**3.6
bamboo inner layer**

soft inside layer of the bamboo culm, serving as boundary to the hollow central portion of the culm

[SOURCE: ISO 21625: 2020, 3.1.4]

**3.7
squareness**

distance, d_1 , between the panel edge and the side of the other arm of the square

Note 1 to entry: The squareness is shown in [Figure 1](#).

Dimensions in millimetres

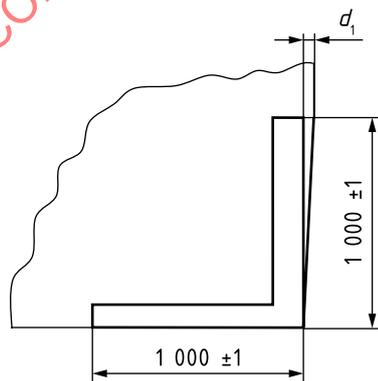


Figure 1 — Example of squareness

**3.8
decay**

decomposition of bamboo by fungi or other micro-organisms resulting in softening, progressive loss of mass and strength, and often a change of texture and colour

3.9

crack

lengthwise separation of the bamboo fibres caused chiefly by shrinkage in drying and/or mechanical damage

3.10

gap

opening on the face or bottom of the *bamboo flooring* (3.1) product

3.11

splinter

filament protrusion on the surface of *bamboo scrimber* (3.2)

4 Requirements

4.1 Appearance requirements

The material used for the bamboo flooring shall be free from physical damage, decay and insect attack. There may be variations from element to element, but the total impression of the installed flooring shall show a homogeneous character.

Any part of the material that hinders preservation, bonding and finishing shall be removed entirely.

As bamboo is a natural material, colour variations can occur naturally or due to exposure to light over time.

The appearance requirements of bamboo flooring for outdoor use are indicated in [Table 1](#).

Table 1 — Appearance requirements

Types of defects	Laminated bamboo flooring	Bamboo scrimber flooring
Bamboo outer layer	Not permitted	Permitted if this does not impair the bonding strength between the bundles of the bamboo flooring ^a
Bamboo inner layer		
Splinter		Not permitted
Cracks		
Gaps		
^a If the bonding strength between the bundles of the bamboo flooring is impaired by outer layer and inner layer, they shall be removed.		

4.2 Dimension requirements

The dimension requirements of bamboo flooring for outdoor use are indicated in [Table 2](#).

Table 2 — Dimension requirements

Parameters	Test method	Common product dimensions		Requirements		
				Laminated bamboo flooring	Bamboo scrimber flooring	
L_s (mm)	ISO 9426	450 ~ 5 800	≤2 000	±1,0		
			>2 000	±2,0		
W_s (mm)	ISO 9426	60~220	≤200	±0,5		
			>200	±1,0		
e (mm)	ISO 9426	8 ~ 38	≤20	±0,5		
			>20	±1,0		
S_q (mm/m)	ISO 9426	—	—	≤0,2		
S_p (%)	ISO 9426			≤0,2		
C (%)	ISO 17959			convex	≤0,2	
				concave		
B (%)	ISO 17959	convex	≤1,0			
		concave	≤0,5			

Key

L_s = length (of surface layer)

W_s = width (of surface layer)

e = thickness

S_q = squareness

S_p = spring

C = cup

B = bow

NOTE Other specific dimensions of the product are permitted upon agreement of both supplier and buyer.

4.3 Property requirements

4.3.1 Physical and mechanical requirements

The physical and mechanical requirements of bamboo flooring for outdoor use are indicated in [Table 3](#).

Table 3 — Physical and mechanical requirements

Parameters	Test method	Unit	Laminated bamboo flooring	Bamboo scrimber flooring
w_M (%)	Annex A	%	$6,0 \leq w_M \leq w_{EM}$	
δ (kg/m ³)	ISO 9427	kg/m ³	≥500	≥800
e_s (%)	Annex B	%	N/A	≤10 %
W_s (%)	Annex B	%	N/A	≤2,0
B_q	Annex C	%	not exceed 1/3 ^c	N/A
M_{oR}^a	ISO 16978	MPa	≥60	≥60
M_{oE}^a	ISO 16978	MPa	≥6 000	≥6 000
F_{bs}	ISO 20585:2005, Method A	MPa	≥35	≥35
D_p (class)	EN 17009:2019, Annex B	N/A	DC 2 ^b	DC 2 ^b
Key w_M = moisture content w_{EM} = equilibrium moisture content δ = density e_s = thickness swelling W_s = width swelling B_q = bonding quality M_{oR} = modulus of rupture M_{oE} = modulus of elasticity F_{bs} = wet bending strength D_p = decay prevention ^a Modulus of rupture and modulus of elasticity shall be tested only for flooring installed on battens. ^b The durability class of bamboo flooring is defined as DC 1, DC 2, DC 3, DC 4, and DC5 based on the mass loss of bamboo flooring after laboratory decay tests. The mass loss is 5 % ~10 % for DC 2. ^c The cumulative ratio of delamination in each separate individual glueline on all sides shall not exceed 1/3 of the total length of glueline.				

4.3.2 Other declarations at the time of the first delivery

Where it is applicable, the following can be declared accordingly, if required by regulations: emissions and content of dangerous substances, reaction to fire, slip resistance and sound absorption quality.

5 Test samples

5.1 Sampling

Specimens shall be obtained at a distance of 20 mm from the edge of the flooring sample. The flooring sample with defects that affect the test precision shall be avoided.

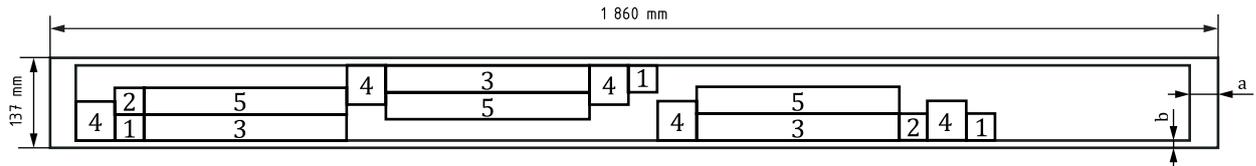
5.2 Dimensions and quantity

5.2.1 Laminated bamboo flooring

Laminated bamboo flooring specimens shall be made according to [Table 4](#) and [Figure 2](#). The schematic diagram of sampling ([Figure 2](#)) shows the flooring sample with a length of 1 860 mm and a width of 137 mm. If the product size is smaller than the specimen dimension requirement or the quantity requirement is not met, extra flooring samples shall be taken.

Table 4 — Dimensions and quantity of test samples

Parameters	Test sample dimension (mm)	Quantity (piece)
δ	50 × 50	6
w_M	50 × 50	4
M_{oR}^a	$W: (50 \pm 1)^b$	6
M_{oE}^a	$l: 20 \times e + 50^c$	
B_q	75 × 75	10
F_{bs}	$W: (50 \pm 1)^b$ $l: 20 \times e + 50^c$	6
Key δ = density w_M = moisture Content M_{oR} = modulus of rupture M_{oE} = modulus of elasticity B_q = bonding quality F_{bs} = wet bending strength W = width l = length e = thickness ^a The tongues and grooves of specimens for modulus of rupture and modulus of elasticity test shall be removed. ^b The width, W , shall be (50 ± 1) mm. ^c The length shall be at least 20 times the nominal thickness plus 50 mm.		



Key

- 1 density
- 2 moisture content
- 3 modulus of rupture and modulus of elasticity
- 4 bonding quality
- 5 wet bending strength
- a Outer edge trimmed in length of 50 mm.
- b Outer edge trimmed in width of 5 mm.

NOTE This figure shows the flooring sample with a length of 1 860 mm and a width of 137 mm.

Figure 2 — Schematic diagram of sampling

5.2.2 Bamboo scrimber flooring

The bamboo scrimber flooring specimens shall be taken according to [Table 5](#) and [Figure 3](#). If the product size is smaller than the specimen dimension requirement or the quantity requirement is not met, extra flooring samples shall be taken.

Table 5 — Dimensions and quantity of test samples

Parameters	Test sample dimension (mm)	Quantity (piece)
δ	50 × 50	6
w_M	50 × 50	4
e_s	50 × 50	8
W_s	50 × 50	

Key

δ = density
 w_M = moisture Content
 e_s = thickness swelling
 W_s = width swelling
 M_{oR} = modulus of rupture
 M_{oE} = modulus of elasticity
 B_q = bonding quality
 F_{bs} = wet bending strength
 w = width
 l = length
 e = thickness

a The tongues and grooves of specimens for modulus of rupture and modulus of elasticity test shall be removed.
b The width, W , shall be (50 ± 1) mm.
c The length shall be at least 20 times the nominal thickness plus 50 mm.

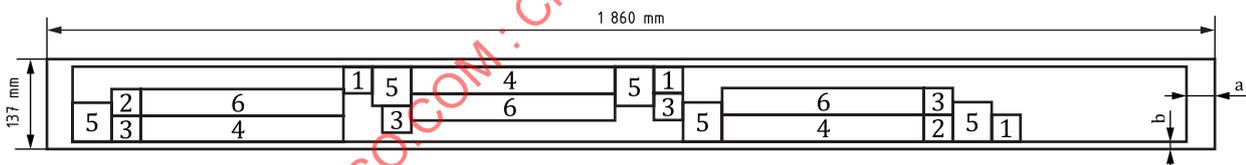
Table 5 (continued)

Parameters	Test sample dimension (mm)	Quantity (piece)
M_{oR}^a	$W: (50 \pm 1)^b$	6
M_{oE}^a	$l: 20 \times e + 50^c$	
B_q	75 × 75	10
F_{bs}	$W: (50 \pm 1)^b$ $l: 20 \times e + 50^c$	6

Key

δ = density
 w_M = moisture Content
 e_s = thickness swelling
 W_s = width swelling
 M_{oR} = modulus of rupture
 M_{oE} = modulus of elasticity
 B_q = bonding quality
 F_{bs} = wet bending strength
 w = width
 l = length
 e = thickness

^a The tongues and grooves of specimens for modulus of rupture and modulus of elasticity test shall be removed.
^b The width, W , shall be (50 ± 1) mm.
^c The length shall be at least 20 times the nominal thickness plus 50 mm.



Key

- 1 density
- 2 moisture content
- 3 thickness swelling and width swelling
- 4 modulus of rupture and modulus of elasticity
- 5 bonding quality
- 6 wet bending strength
- ^a Outer edge trimmed in length of 50 mm.
- ^b Outer edge trimmed in width of 5 mm.

NOTE This figure shows the flooring sample with a length of 1 860 mm and a width of 137 mm.

Figure 3 — Schematic diagram of sampling

6 Handling, storage, packaging and marking

6.1 Handling, storage and packaging

The manufacturer shall provide procedures and methods for product handling and packaging as well as suitable storage areas to prevent product damage.

6.2 Marking

By agreement between buyer and supplier, the package shall be clearly marked with the following information as a minimum:

- name and address of manufacturer or supplier;
- trade name;
- a reference to this document (i.e. ISO 21629-2);
- dimensions;
- bamboo species;
- date of production and/or batch number;
- quantity of products and/or covered surface.

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Annex A (normative)

Determination of moisture content

A.1 Principle

In case of dispute, the moisture content of laminated bamboo flooring shall be determined by the oven drying method in accordance with ISO 16979. For bamboo scrimber flooring, the following modified method shall apply.

A.2 Method (modified)

- The oven-dry test shall begin with 48 hours of continuous drying.
- After the 48-hour period, weigh the specimen with an interval of 6 hours.
- Weigh the specimen until a difference in mass between two successive weighings separated by an interval of 6 hours is less than 0,1 %.

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Annex B (normative)

Test method of thickness and width swelling

B.1 Principle

Swelling in thickness and width is determined by measuring the increase in thickness and width of the test piece after complete immersion in water.

B.2 Apparatus

B.2.1 Micrometer, as specified in ISO 9424.

B.2.2 Thermostatically controlled water bath, capable of maintaining a temperature of 100 °C (boiling temperature) and in which the test pieces can be maintained in the conditions specified in [B.5.2](#).

B.3 Dimensions

The test pieces shall be square with a side length of (50 ± 1) mm.

B.4 Conditioning

Test pieces shall be conditioned to constant mass in an atmosphere with a mean relative humidity of (65 ± 5) % and a temperature of (20 ± 2) °C. Constant mass is considered as having been reached when the difference between two successive weighing carried out at an interval of 24 h is no more than 0,1 % of the mass of the test pieces.

B.5 Method

B.5.1 Thickness and width measurement

Measure the thickness and width of each test specimen before and after immersion to an accuracy of 0,01 mm in accordance with ISO 9424.

B.5.2 Immersion

Immerse the test pieces vertically in clean water with a pH value of 7 ± 1 and a temperature of 100 °C (boiling temperature) for 4 h. This temperature shall be maintained throughout the test period. During the test, the test pieces shall be separated from each other and from the bottom and sides of the water bath by at least 15 mm. The upper edges of the test pieces shall be covered by (25 ± 5) mm of water throughout the test. The water shall be changed after each test.

B.5.3 Further procedure

After the immersion is completed, take the test pieces out of the water bath, remove excess water and measure the thickness and width of each test piece within 10 min.

B.6 Expression of results

B.6.1 Test piece

The swelling in thickness, G_t , and width of each test piece, G_W , expressed as a percentage of the original width, shall be calculated according to the following Formulae:

$$G_e = \frac{e_2 - e_1}{e_1} \times 100$$

where

e_1 is the thickness of the test piece before immersion, in millimetres (mm);

e_2 is the thickness of the test piece after immersion, in millimetres (mm).

$$G_W = \frac{W_2 - W_1}{W_1} \times 100$$

where

W_1 is the width of the test piece before immersion, in millimetres (mm);

W_2 is the width of the test piece after immersion, in millimetres (mm).

B.6.2 Panel

The swelling in thickness and width of a panel is the arithmetic mean of the results of all test pieces taken from that panel. Express these values, as a percentage, to one decimal place.