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Bamboo-wood composite for container flooring

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Foreword

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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-wood composite for container flooring

1 Scope

This document specifies the classification, technical requirements, inspection methods, inspection rules, marking, packaging, transportation and storage of bamboo-wood composite for container flooring.

This document is applicable to the types of freight containers specified in ISO 1496-1:2013, ISO 1496-1:2013/Amd 1:2016 and ISO 1496-1:2013/Amd 2:2024.

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 1496-1:2013, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes*

ISO 1496-1:2013/Amd 1:2016, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes — Amendment 1*

ISO 1496-1:2013/Amd 2:2024, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes — Amendment 2*

ISO 2074, *Plywood — Vocabulary*

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 9426:2003, *Wood-based panels — Determination of dimensions of panels*

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

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

ISO 21625:2020, *Vocabulary related to bamboo and bamboo products*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2074, ISO 21625:2020 and the following 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-wood composite for container flooring
bamboo-wood composite made from bamboo element and wood element by gluing, hot pressing, used for container flooring

Note 1 to entry: A large range of raw materials for making bamboo-wood composite is included. The bamboo element is processed using a mechanical method with bamboo as the raw material (e.g. bamboo interlaced mat, bamboo curtain, flattened bamboo board, bamboo fibre bundle sheet and bamboo strand). "Wood element" refers to a sheet-like material processed from wood (e.g. wood veneer, wood strand).

[SOURCE: ISO 21625:2020, 3.3.4.9, modified — "for" added in the term. "bamboo element and wood element" replaced "wood veneer and bamboo curtain" in the definition. Note 1 to entry added.]

3.2
unfinished bamboo-wood composite for container flooring
bamboo-wood composite board without coating or special material applied to any exposed sides

3.3
finished bamboo-wood composite for container flooring
bamboo-wood composite board with coating or special material applied to any exposed sides or both sides

4 Classification

Bamboo-wood composite for container flooring shall be classified based on the surface treatment, as follows:

a) unfinished bamboo-wood composite for container flooring;

b) finished bamboo-wood composite for container flooring.

5 Technical requirements

5.1 Specifications

5.1.1 Size and tolerance

Product size and tolerance shall meet the requirements of Table 1.

Table 1 — Size and tolerance of bamboo-wood composite for container flooring

Items	Size mm	Tolerance mm
Length[a]	1 010, 1 388, 1 626, 1 967, 2 224, 2 400	+0, −1,0
Width[a]	636, 1 160	+0, −1,0
Thickness	28	±0,8
[a] Alternative length and width dimensions may be agreed between the buyer and seller.		

5.1.2 Diagonal difference

The diagonal difference shall not be greater than 2 mm.

5.1.3 Edge straightness

The edge straightness shall not be greater than 0,5 mm/m.

5.1.4 Degree of warping

The degree of warping in the length and width directions shall not be greater than 0,3 %, see 6.4.

NOTE Bamboo-wood composite for container flooring has been chamfered during the manufacturing process, therefore no additional requirements are necessary in this document.

5.2 Appearance quality

The appearance quality requirements for unfinished bamboo-wood composite for container flooring shall be in accordance with Tables 2 and 3. The appearance quality requirements for finished bamboo-wood composite for container flooring shall be in accordance with Table 4.

Table 2 — Appearance quality requirements for unfinished bamboo-wood composite for container flooring with wood veneer as surface layer

Nature of defects	Quality requirements	
	Surface layer	Bottom layer
Crack	The width of an individual crack shall be no greater than 2 mm. a) When the length of the crack is not greater than 100 mm, the number of cracks per metre of board width shall be no more than six. b) When the length of the crack is between 100 mm and 200 mm, the number of cracks per metre of board width shall be no more than four. c) When the length of the crack is between 200 mm and 300 mm, the number of cracks per metre of board width shall be no more than three.	The width of an individual crack shall be no greater than 3 mm. a) When the length of the crack is not greater than 200 mm, the number of cracks per metre of board width shall be no more than six. b) When the length of the crack is between 200 mm and 300 mm, the number of cracks per metre of board width shall be no more than four. c) When the length of the crack is between 300 mm and 400 mm, the number of cracks per metre of board width shall be no more than three.
	Cracks beyond the dimensions specified in the row directly above shall be patched. The cracks shall be repaired and levelled with putty which is similar in colour to the board surface. When the cracks of multiple lengths are present simultaneously, the total number shall not exceed the maximum limit specified for each type of crack.	
Live knot	The diameter of an individual live knot shall be no greater than 30 mm and the number of live knots on the entire surface layer shall be no more than three.	The diameter of an individual live knot shall be no greater than 50 mm and the number of live knots on the entire bottom layer shall be no more than six (provided that the live knot is not located within 200 mm of the edge).
Dead knot	The diameter of an individual dead knot shall be no greater than 6 mm and the number of dead knots on the entire surface layer shall be no more than five.	When the diameter of an individual dead knot is not greater than 15 mm, there is no limitation on the number of dead knots (provided that the dead knot is not located within 200 mm of the edge).
Chromatic aberration	No obvious colour difference	No restrictions
Discoloration	Not allowed	Allowed
Decay	Not allowed	

Table 2 *(continued)*

Nature of defects	Quality requirements	
	Surface layer	**Bottom layer**
Wormhole, dog holes, hole	Round hole	
	The diameter of an individual hole shall be less than 2 mm. The edge of the hole shall not be discoloured. Holes shall not be aggregated.	The diameter of an individual hole shall be less than 3 mm, and the holes shall not be aggregated; The diameter of an individual hole shall be less than 5 mm. The total number of holes on the entire bottom layer shall be no more than 10, and the distance between holes shall be greater than 100 mm.
	Linear wormhole	
	The length shall be less than 10 mm. The width shall be less than 1 mm. Any wormholes shall not be discoloured. Wormholes shall not be aggregated.	The length shall be less than 10 mm. The width shall be less than 1 mm and not located within 200 mm of the side. Wormholes shall not be aggregated.
	Other types of holes shall not be allowed. All holes shall be repaired and filled with putty.	
Bark pocket, resin canal	Not allowed	
Surface plate lamination	Not allowed	
Surface plate splicing	Not allowed	
Surface plate patched with slice or strip	Not allowed	Allowed
Stacking of long and medium plates	An individual width shall be no greater than 8 mm. Each layer shall be staggered.	
Cross-band veneer lamination	An individual veneer width shall be no greater than 5 mm.	
	Each layer's width per metre of board shall not exceed 3 strips.	
Veneer gap	An individual width not greater than 3 mm shall be filled with putty. An individual width between 3 mm and 10 mm shall be repaired by inserting strips. The gaps in each layer shall be staggered.	
Defects of cross-band veneer	a) When the depth is less than 10 mm and the width is less than 200 mm, there shall be no more than two gaps on the same side. b) When the depth is less than 5 mm, the width shall be ignored. c) The defect of cross-band veneer in the same location on each side shall not exceed two layers of veneer. Defects in the core shall be repaired and filled with putty.	
Grease	Not obvious	Slight, no obvious sticky feeling
Glitch and groove mark	Slight	Glitches and groove marks shall not penetrate the veneer. They shall be repaired and levelled with putty.
Sand through	Not allowed	Not serious
Sand leakage	Slight	
Glue penetration	Slight	Not serious
Sunken and bump	Not allowed	
Indentation	If aesthetics will not be affected after repair, it shall be permitted.	Allowed after repairing

Table 2 *(continued)*

Nature of defects	Quality requirements	
	Surface layer	Bottom layer
Bubbling and delamination	Not allowed	
Edge defect	The width shall be less than 1,5 mm. The depth shall be less than 2 mm. The cumulative length shall be less than 50 mm.	

Table 3 — Appearance quality requirements for unfinished bamboo-wood composite for container flooring with bamboo interlaced mat as surface layer

Nature of defects		Quality requirements	
		Surface layer	Bottom layer
Surface contamination		Not obvious	
Indentation and bump	Single maximum area	Not obvious	No greater than 50 mm^2
	Quantity per m^2	Not allowed	No more than two
	Depth of indentation	No greater than 1 mm	
Surface crack		The width of an individual crack shall be no greater than 2 mm.	The width of an individual crack shall be no greater than 3 mm.
		When the width ranges from 2 mm to 3 mm, and the length is not greater than 50 % of board, one piece/board is allowed.	When the width ranges from 3 mm to 4 mm, the cumulative length of no more than 2 000 mm is allowed.
		Cracks beyond the dimensions specified in the row directly above shall be patched. The total number of cracks shall not exceed six.	
Core layer crack		No greater than 5 mm	
Blister		Not allowed	
Delamination degumming		Not allowed	
Edge defect		Not allowed	

Table 4 — Appearance quality requirements for finished bamboo-wood composite for container flooring

Nature of defects	Quality requirements	
Gloss unevenness	Scattered punctate gloss: The scattered area shall not exceed one third of the board's total area.	
	Bulk gloss: One bulk gloss with an area of 400 mm^2 and two bulk glosses with an area of 100 mm^2 are allowed. The area of bulk gloss shall be no greater than 5 % of the board area.	
Surface contamination	Not obvious	
Linear depression	The width shall be no greater than 2 mm.	
	The length shall be no greater than 60 mm.	
	When the width of board is greater than 636 mm, the number of linear depressions shall be no more than six.	When the width of board is not greater than 636 mm, the number of linear depressions shall be no more than four.
	All linear depressions shall be closely combined with the substrate, exhibiting uniform gloss.	

Table 4 *(continued)*

Nature of defects	Quality requirements
Bulk depression	All bulk depressions shall be closely combined with the substrate, exhibiting uniform gloss. When the diameter of a bulk depression is not greater than 30 mm, the number of such depressions on the whole board shall be no more than two.
Arc depression	All arc depressions shall be closely combined with the substrate, exhibiting uniform gloss. When the width of arc depression is not greater than 2 mm and the length of an individual arc depression is not greater than 200 mm, the number of such depressions on the whole board shall be no more than three.
Frosting and water mark	The total area shall not exceed 5 % of the board surface.
Crack	Not allowed
Wrinkle	Not allowed
Delamination	Not allowed
Blister/bump	Not allowed
Defects at the edges of the finished surface	a) Defects with a width not exceeding 2 mm shall be filled and levelled, located near the side of the bottom middle beam. b) Defects with a width not exceeding 4 mm shall be filled and levelled, located near the side of the bottom side beam.
Scratches at the surface	a) Slight scratches, with no obvious substrate colour, shall be allowed. b) Relatively serious scratches, with the substrate colour being visible, shall not be allowed.
Surface fuzzing	a) Fuzziness shall not be allowed in the middle of the surface layer and the edge of bottom middle beam. b) Fuzziness in the edge of the bottom side beam shall be allowed after repairing and levelling.

5.3 Physical and mechanical properties

Bamboo-wood composite for container flooring shall meet the requirements in Table 5.

Table 5 — Physical and mechanical properties requirements

Inspection items		Index value
Moisture content (%)		6,0 to 12,0
Density (kg/m^3)		≥ 750
Concentrated load (N)		Central: ≥ 65 000
Bond durability	strand not included[a]	The continuous delamination of any adhesive layer on each side (except for the gap naturally formed by bamboo unit and the adhesive failure of longitudinal outermost first bamboo slice) shall not exceed one third of the length of the adhesive layer.
	strand included[a]	The continuous delamination on each side shall not exceed half of the side length of the specimen. No more than two points of delamination along each side of the thickness of the board shall be allowed.
Short span bending force (N)	strand not included[a]	Longitudinal: ≥ 9 000
	strand included [a]	Longitudinal: ≥ 8 500

NOTE The property requirements for side concentrated load can be determined by agreement between the buyer and the seller.

[a] The mechanical properties (e.g. bond durability, short span bending force) requirements are different when the raw materials of the bamboo-wood composite for container flooring include strand and when they do not include strand.

5.4 Floor strength

Bamboo-wood composite for container flooring shall conform to the floor strength test requirements specified in ISO 1496-1:2013, ISO 1496-1:2013/Amd 1:2016 and ISO 1496-1:2013/Amd 2:2024.

5.5 Anti-insect and antiseptic treatments

Based on the specific application requirements of bamboo-wood composite for container flooring, the insect and mildew repellent shall be determined by agreement between the buyer and the seller.

NOTE BICON Australian Biosafety Import Regulations sets out provisions on anti-insect and antiseptic treatments.

6 Inspection methods

6.1 Size specification

The thickness, length and width shall be measured in accordance with ISO 9426:2003, 8.1 and 8.2.

6.2 Diagonal difference

The length of the two diagonals of the board shall be measured with a steel tape. The difference between the two diagonals shall be calculated to an accuracy of 1 mm.

6.3 Edge straightness

The edge straightness shall be measured in accordance with ISO 9426:2003, 8.4.

6.4 Degree of warping

The concave surface of the board shall be placed upward on a flat horizontal surface without any external force. The string line shall be tightened on board surface along the length and width directions. The maximum chordal height shall be measured between the board surface and the string line with a steel rule, to the nearest 1 mm. At the same time, the length and width shall be measured with a steel tape, to the nearest 1 mm. The degree of warping is the ratio of the maximum chord height to the corresponding length or width, which is calculated in accordance with Formula (1) and expressed in per cent to an accuracy of 0,1 %:

$$W = \frac{B_{\max}}{L} \times 100 \quad (1)$$

where

W is the degree of warping, expressed in per cent;

$B_{\max}$ is the maximum chord height at the direction of length or width, expressed in millimetres (mm);

L is the length or width, expressed in millimetres (mm).

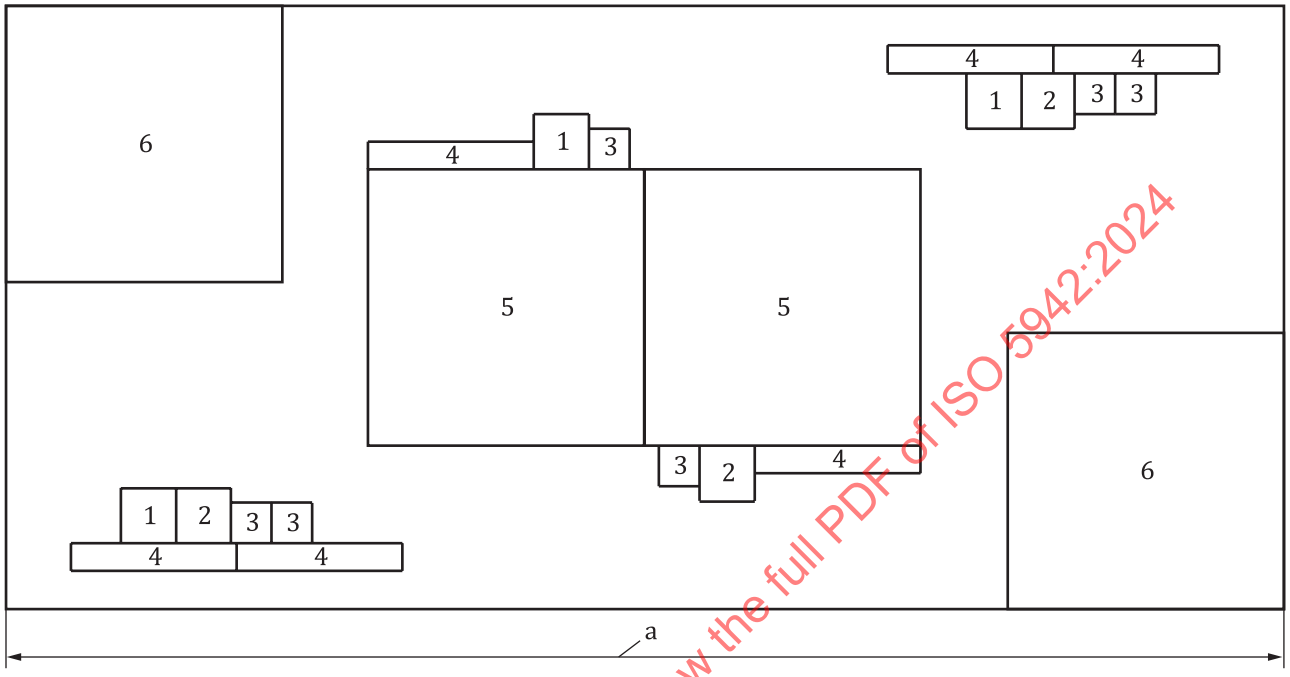
6.5 Appearance quality

The appearance quality is generally measured by visual inspection. If necessary, it shall be measured by a vernier calliper, steel rule, steel tape or feeler gauge.

6.6 Physical and mechanical properties

6.6.1 Specimen preparation

The specimen should be prepared in accordance with Figure 1. The edge of the specimen shall be straight, and the adjacent sides shall be at right angles. The size, quantity and label shall be as indicated in Table 6. The numbers in Figure 1 correspond to the label numbers in Table 6.



[a] Board length.

Figure 1 — Schematic diagram of specimen preparation

Table 6 — Specimen size and quantity of bamboo-wood composite for container flooring

Items	Size mm	Quantity no. of pieces	Label
Moisture content	100 × 100	3	1
Density	100 × 100	3	2
Bond durability	75 × 75	6	3
Short span bending force	305 × 50	6 longitudinal specimens	4
Concentrated load	500 × 500	2 specimens from centre	5
		2 specimens from side	6

6.6.2 Standard conditioning

All test specimens shall be conditioned to a constant mass in an atmosphere of temperature (20 ± 2) °C and relative humidity (65 ± 5) %. Constant mass is attained when the results of two successive weighings, carried out at intervals of 24 h, differ by less than 0,1 % of the mass.

6.6.3 Density

Density shall be measured in accordance with ISO 9427.

6.6.4 Moisture content

Moisture content shall be measured in accordance with ISO 16979.

6.6.5 Bond durability

The treatment towards specimens shall be made in accordance with bonding class I: immersion for 4 h in boiling water, then drying in the ventilated drying oven for 20 h at (63 ± 3) °C, then immersion in boiling water for 4 h, followed by drying in the ventilated drying oven at (63 ± 3) °C for 3 h. After the treatment, the length of delamination in each glue line on the four sides of the test piece shall be measured. If the delamination on one side contains several segments, the sum shall be accumulated to an accuracy of 1 mm.

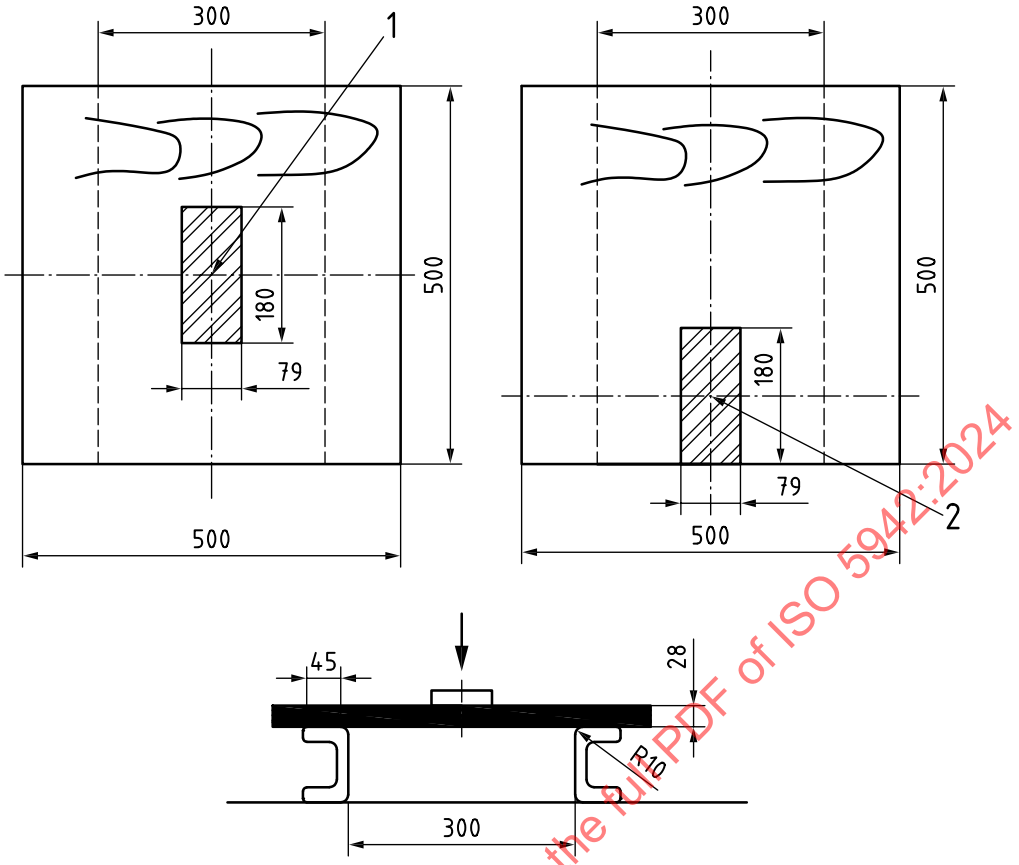
6.6.6 Short span bending force

The specimens shall be tested over a 254 mm span using an applicable load support. A loading block with a radius of 6,35 mm shall be used to apply a constant load at the centre span of the test specimen. The loading block shall also contact the entire width of the test specimens at the centre point. Each test specimen shall be tested using a constant loading block rate of motion of 2 mm/min until maximum load is attained and failure has occurred. Record the maximum load upon test specimen failure.

6.6.7 Concentrated load

The specimens shall be tested over a 300 mm span using an applicable load support. A loading block with a size of 180 mm × 79 mm × 20 mm shall be pressed at the centre (or side if desired) of the test specimen and loaded vertically at a speed of 10 mm/min until the test specimen is damaged. A load-deflection curve shall be drawn in accordance with the deflection in the middle of test specimen and the corresponding load value. The texture direction of the test specimen shall be perpendicular to the direction of the back-up roll. The "C"-shaped support frame with a chamfer R of 10 mm, a length not less than 500 mm and a contact width with specimen of 45 mm shall be used, as shown in Figure 2. The maximum concentrated load of specimen within the elastic range shall be determined to an accuracy of 10 N by load-deflection curve as shown in Figure 3.

Dimensions in millimetres

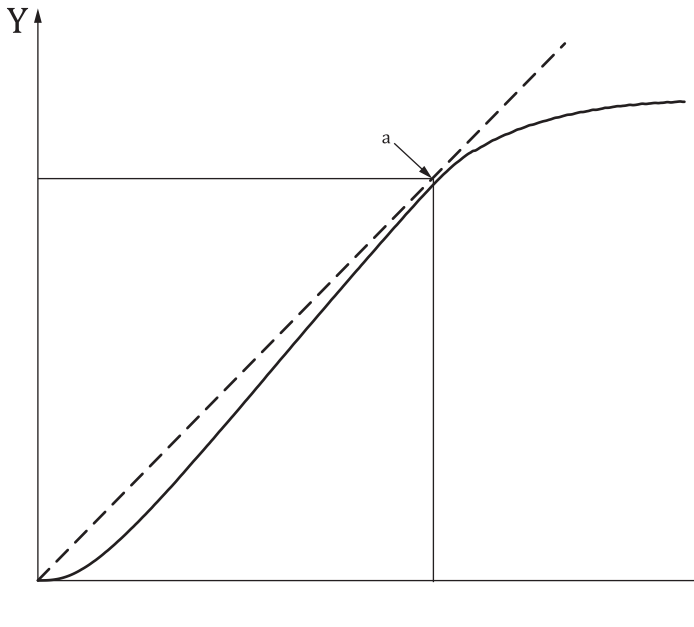


Key

1 central loading position

2 side loading position

Figure 2 — Schematic diagram of concentrated load test



Key

X deflection (mm)

Y load (N)

[a] Maximum concentrated load.

Figure 3 — Load-deflection curve

6.6.8 Floor strength

Floor strength shall be measured in accordance with ISO 1496-1:2013/Amd 2:2024, 6.9.2.

When there are no specific requirements from the buyer, the simulated container base underframe for the floor strength test given in Annex A may be used.

7 Inspection rules

7.1 Inspection category

7.1.1 General

Product inspection includes delivery inspection and type inspection.

7.1.2 Delivery inspection

The delivery inspection shall include the following items: specifications (see 6.1, 6.2, 6.3 and 6.4), appearance quality (see 6.5), density (see 6.6.3), moisture content (see 6.6.4), bond durability (see 6.6.5) and short span bending force (see 6.6.6).

7.1.3 Type inspection

In addition to all the items of delivery inspection, the type inspection shall include the item of concentrated load (see 6.6.7).

Within normal production, the inspection shall be carried out at least twice a year. A type inspection shall be carried out in any of the following circumstances:

a) major changes occur in raw and auxiliary materials and in the production process;

b) production is resumed after a long shutdown;

c) type inspection requirements are put forward by a quality supervision organization.

7.1.4 Floor strength inspection

The floor strength test (see 6.6.8) shall be determined and implemented by the container manufacturer.

7.2 Group principle

A batch shall consist of the same type, shift and specification of product.

7.3 Sampling methods

7.3.1 General

For the product quality inspection of bamboo-wood composite for container flooring, samples shall be taken from the same batch of products in accordance with Tables 7, 8 and 9. The samples shall be taken from the products stored for more than 72 h after production, and inspected one by one.

7.3.2 Appearance quality inspection

The single sampling plan in ISO 2859-1 shall be adopted, with an inspection level of II and acceptance quality limit (AQL) of 4.0. The judgement of acceptance and rejection of inspection lot is shown in Table 7.

Table 7 — Sampling plan of appearance quality inspection

Dimensions in number of boards

Lot size	Sample size	Acceptance number	Rejection number
51 to 90	13	1	2
91 to 150	20	2	3
151 to 280	32	3	4
281 to 500	50	5	6
501 to 1 200	80	7	8
1 201 to 3 200	125	10	11
3 201 to 10 000	200	14	15
10 001 to 35 000	315	21	22

7.3.3 Specifications inspection

The single sampling plan in ISO 2859-1 shall be adopted, with the inspection level of S-4 and AQL of 6.5. The judgement of acceptance and rejection of inspection lot is shown in Table 8.

Table 8 — Sampling plan of specification size inspection

Dimensions in number of boards

Lot size	Sample size	Acceptance number	Rejection number
51 to 90	5	1	2
91 to 150	8	1	2
151 to 280	13	2	3
281 to 500	13	2	3
501 to 1 200	20	3	4
1 201 to 3 200	32	5	6
3 201 to 10 000	32	5	6
10 001 to 35 000	50	7	8

7.3.4 Physical and mechanical properties inspection

Samples shall be randomly selected from each batch of products, and the sampling plan is shown in Table 9. If there is a certain index unqualified in the results of the original inspection, a reinspection is allowed. Double the number of samples shall be taken from the same batch of products for the reinspection of the unqualified items. If all the unqualified items are qualified after the reinspection, it is judged as qualified. If there is one unqualified item, it is judged as unqualified.

Table 9 — Sampling plan of physical and mechanical properties inspection

Dimensions in number of boards

Lot size	Sample size for original inspection	Sample size for reinspection
≤ 1 200	1	2
1 201 to 3 200	2	4
3 201 to 10 000	3	6
≥ 10 001	4	8

7.4 Comprehensive judgement

7.4.1 Determination of test results

If the mean values of density (see 6.6.3), moisture content (see 6.6.4), short span bending force (see 6.6.6) and concentrated load (6.6.7) of bamboo-wood composite for container flooring specimen meet the requirements of this document, the corresponding performance of the bamboo-wood composite for container flooring is qualified. If these requirements are not met, it is unqualified.

If the number of qualified test pieces for bond durability (see 6.6.5) within each sample of bamboo-wood composite for container flooring is five or more, it is qualified, and if the number is less than five, it is unqualified.

7.4.2 Comprehensive judgement

When the appearance quality, specifications, physical and mechanical properties of the products meet the corresponding requirements, the batch of products is qualified. If these requirements are not met, it is unqualified.

8 Marking, packaging, transportation and storage

8.1 Marking

8.1.1 Product marking

The product name, manufacturer name, product standard number, production date, inspection and floor strength marking shall be marked on the appropriate parts of the product.

8.1.2 Packaging label

The package label shall include the product name, manufacturer name and address, reference to this document (i.e. ISO 5942), production date, quantity, floor strength, “keep away from moisture” and “keep away from sunlight”.

8.2 Packaging

Products shall be packed separately in accordance with specifications, categories and the batch number when leaving the factory. The package shall be free from bumps, scratches and stains.

Packaging requirements can also be determined by agreement between the buyer and the seller.

8.3 Transportation and storage

Products shall be stacked flat neatly during transport and storage. Product contamination, dampness, rain and sun exposure shall be avoided.

During storage, products shall be stacked separately in accordance with specifications and categories, and each pile shall be marked accordingly.