
**Wood-based panels — Particleboard —
Part 2:
Requirements**

*Panneaux à base de bois — Panneaux de particules —
Partie 2: Exigences*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16893-2 was prepared by Technical Committee ISO/TC 89, *Wood-based panels*, Subcommittee SC 2, *Particle boards*.

ISO 16893 consists of the following parts, under the general title *Wood-based panels — Particleboard*:

- *Part 1: Classifications*
- *Part 2: Requirements*

Wood-based panels — Particleboard —

Part 2: Requirements

1 Scope

This part of ISO 16893 provides the manufacturing property requirements for uncoated particleboard.

The values listed in this part of ISO 16893 relate to product properties used to classify particleboards into one of four types, P-GP, P-FN, P-LB or P-HLB (see Clause 3), for use in three service conditions, REG, MR and HMR. The values are not characteristic values to be used for design purposes.

2 Normative references

The following referenced documents are indispensable for the application 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 9426, *Wood-based panels — Determination of dimensions of panels*

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

ISO 12460-1, *Wood-based panels — Determination of formaldehyde release — Part 1: Formaldehyde emission by the 1-cubic-metre chamber method*

ISO 12460-2, *Wood-based panels — Determination of formaldehyde release — Part 2: Small-scale chamber method*

ISO 12460-3, *Wood-based panels — Determination of formaldehyde release — Part 3: Gas analysis method*

ISO 12460-4, *Wood-based panels — Determination of formaldehyde release — Part 4: Desiccator method*

ISO 12460-5, *Wood-based panels — Determination of formaldehyde release — Part 5: Perforator method*

ISO 16572, *Timber structures — Wood-based panels — Test methods for structural properties*

ISO 16893-1, *Wood-based panels — Particleboard — Part 1: Classifications*

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 16981, *Wood-based panels — Determination of surface soundness*

ISO 16983, *Wood-based panels — Determination of swelling in thickness after immersion in water*

ISO 16984, *Wood-based panels — Determination of tensile strength perpendicular to the plane of the panel*

ISO 16987, *Wood-based panels — Determination of moisture resistance under cyclic test conditions*

ISO 16998, *Wood-based panels — Determination of moisture resistance — Boil test*

ISO 17064, *Wood-based panels — Fibreboard, particleboard and oriented strand board (OSB) — Vocabulary*

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

3 Terms, definitions and abbreviations

For the purposes of this document, the terms and definitions given in ISO 17064 and ISO 16893-1 and the following abbreviations apply.

EXT	exterior
FN	furniture
GP	general purpose
HLB	heavy-duty load bearing
HMR	highly moisture resistant
LB	load bearing
MR	moisture resistant
REG	regular
UDF	ultra-low-density fibreboard

4 Expression of specification limits and general requirements

4.1 Expression of specification limits

This International Standard may be used to evaluate groups of panels or production batches. To evaluate a group of panels, this requires that:

- a) The mandatory tests of Table 2, ISO 16893-1, be applied to samples of the group. Conditioning of test specimens is required as specified in each test method; and
- b) The results of the tests be evaluated against the appropriate specification limits in Tables 1 to 14, according to the product type and thickness range of the panels. Tables 1 and 2 apply to all product types and thickness ranges of panels.

For density variation and dimensions (Table 1), specification limits are based on the mean values for individual panels (calculated in accordance with Annex A) and are maximum tolerances. For formaldehyde emission, Table 2 gives upper specification limits for individual panel results.

Specification limits in Tables 3 to 14 are based on 5 (lower) or 95 (upper) percentile expressions, according to 4.2 and 4.3.

Particleboard shall comply with the relevant requirements of this International Standard when despatched from the producing factory.

4.2 Lower specification limits

The requirements in Tables 3 to 14 are the lower specification limits for the following properties:

- a) bending strength (MOR);
- b) modulus of elasticity (MOE);
- c) internal bond strength;
- d) surface soundness;
- e) internal bond strength after cyclic test;
- f) internal bond strength after boil test;
- g) wet bending strength.

The 5-percentile values based on the mean values for individual panels and calculated in accordance with Annex A, shall be equal to or greater than the lower specification limits in Tables 3 to 14.

4.3 Upper specification limits

The requirements in Tables 3 to 14 are the upper specification limits for the following properties:

- a) thickness swell after 24 h; and
- b) thickness swell after cyclic test.

The 95-percentile values based on the mean values for individual panels and calculated in accordance with Annex A shall be equal to or less than the upper specification limits in Tables 3 to 14.

4.4 Moisture resistance requirement options

Requirements for moisture resistance are dependent upon the test method employed to assess this property. Three alternative sets of requirements (Option 1, Option 2 and Option 3) are set out in Tables 7 to 14 corresponding to the three principal recognized methods of evaluation. It is necessary to show compliance with only one of these three options, as follows:

- *Option 1:* Requirements apply to those particleboards subjected to a cyclic accelerated ageing test, followed by the determination of thickness swell and internal bond strength, as described in ISO 16987.
- *Option 2:* Requirements apply to those particleboards subjected to an accelerated ageing test, consisting of immersion in boiling water followed by determination of internal bond strength, as described in ISO 16998.
- *Option 3:* Requirements apply to those particleboards subjected to an accelerated ageing test consisting of immersion in water at 70 °C followed by determination of the wet bending strength (MOR) as described in Method A of ISO 20585.

4.5 Density variation, dimension and moisture content requirements

At least 95 % of the mean values of the individual panels shall be within the maximum tolerances stated in Table 1.

Table 1 — Requirements for density variation, dimensions and moisture content

Property	Test method	Requirement
Density variation within panel	ISO 9427	±10 % max from mean
Length and width	ISO 9426	±2 mm/m, max. ±5 mm
Squareness	ISO 9426	< 2 mm/m
Thickness	ISO 9426	Thickness range (mm, nominal)
		≤ 12 ≥ 12
— Unsanded board		-0,3 -0,5 +1,5 +1,7
— Sanded board		±0,3 ±0,3
Moisture content (advisory only)	ISO 16979	5 to 13 %

4.6 Formaldehyde requirements

Compliance with formaldehyde requirements may be confirmed by applying only one test method of those listed in Table 2. The reference chamber method can take up to four weeks for each test to be completed. The other tests are designated production control methods because one test may be completed within 24 h. Each individual panel result shall comply with the specification limits stated in Table 2 for the selected method.

Table 2 — Maximum emission limits of formaldehyde for particleboard

Test method and units				
Reference chamber method	Production control methods			
	Small chamber method	Gas analysis method	Desiccator method	Perforator method
ISO 12460-1	ISO 12460-2	ISO 12460-3	ISO 12460-4	ISO 12460-5
Emission	Emission	Emission	Emission	Content
mg/m ³	ppm	mg/m ² /h	mg/L	mg/100 g
0,124	^a	3,5	0,7	8
NOTE National regulations may impose restrictions on the use of boards of particular formaldehyde emission levels.				
^a If the small chamber method or any other method is used for production control, correlations should be established with the reference chamber method to determine the emission value that is equivalent to the chamber method limit value stated in this table. Correlations may be regional, national, company or plant specific as appropriate.				

4.7 Requirements for load bearing particleboard for use in dry conditions (P-LB REG)

When particleboard is classified P-LB or P-HLB and nominated for load bearing applications, the characteristic strength and stiffness values shall be established based upon testing in accordance with ISO 16572 or equivalent ASTM or EN standards. Alternatively, for specific load bearing applications (e.g. walls, roofs, floors, joist webs) the load bearing particleboard shall meet the specific performance requirements for that intended application.

5 Specific property requirements

5.1 Requirements for general purpose particleboard for use in dry conditions (P-GP REG)

The requirements for P-GP REG particleboard are listed in Table 3.

Table 3 — Requirements for P-GP REG particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	11,5	10,5	10,0	9,5	8,5	6,0
Internal bond strength	ISO 16984	MPa	0,30	0,28	0,24	0,18	0,16	0,14

5.2 Requirements for furniture type particleboard for use in dry conditions (P-FN REG)

The requirements for P-FN REG particleboard are listed in Table 4.

Table 4 — Requirements for P-FN REG particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	12,0	11,0	11,0	10,5	9,5	7,0
Modulus of elasticity (MOE)	ISO 16978	MPa	1 900	1 800	1 600	1 500	1 350	1 050
Internal bond strength	ISO 16984	MPa	0,45	0,40	0,35	0,30	0,25	0,20
Surface soundness	ISO 16981	MPa	0,8	0,8	0,8	0,8	0,8	0,8

The requirements for P-LB REG particleboard are listed in Table 5.

Table 5 — Requirements for P-LB REG particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	15	15	15	13	11	8
Modulus of elasticity (MOE)	ISO 16978	MPa	2 200	2 200	2 100	1 900	1 700	1 200
Internal bond strength	ISO 16984	MPa	0,45	0,40	0,35	0,30	0,25	0,20
24 h thickness swell	ISO 16983	%	22	19	16	16	16	15

5.3 Requirements for heavy-duty load bearing particleboard for use in dry conditions (P-HLB REG)

The requirements for P-HLB REG particleboard are listed in Table 6.

Table 6 — Requirements for P-HLB REG particleboard

Property	Test method	Units	Requirement				
			Thickness ranges (mm, nominal)				
			> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	20	18	16	15	13
Modulus of elasticity (MOE)	ISO 16978	MPa	3 100	2 900	2 550	2 400	2 100
Internal bond strength	ISO 16984	MPa	0,60	0,50	0,40	0,35	0,25
24 h thickness swell	ISO 16983	%	16	15	15	15	14

5.4 Requirements for general purpose particleboard for use in humid conditions (P-GP MR)

The requirements for P-GP MR particleboard are listed in Table 7.

Table 7 — Requirements for P-GP MR particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	13	13	12	11	10	7
Internal bond strength	ISO 16984	MPa	0,30	0,28	0,24	0,20	0,17	0,14
24 h thickness swell	ISO 16983	%	23	18	15	13	13	12
Moisture resistance								
Option 1:								
Internal bond strength after cyclic test	ISO 16987	MPa	0,14	0,13	0,11	0,08	0,07	0,06
Thickness swell after cyclic test		%	23	21	20	18	17	15
Option 2:								
Internal bond strength after boil test	ISO 16998	MPa	0,09	0,08	0,07	0,06	0,05	0,04
Option 3:								
Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	4,9	4,6	4,2	3,9	3,5	2,5

5.5 Requirements for furniture type particleboard for use in humid conditions (P-FN MR)

The requirements for P-FN MR particleboard are listed in Table 8.

Table 8 — Requirements for P-FN MR particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	14	14	13	12	11	8
Modulus of elasticity (MOE)	ISO 16978	MPa	1 900	1 900	1 900	1 700	1 400	1 200
Internal bond strength	ISO 16984	MPa	0,45	0,45	0,40	0,35	0,30	0,25
Surface soundness	ISO 16981	MPa	0,8	0,8	0,8	0,8	0,8	0,8
24 h thickness swell	ISO 16983	%	20	16	14	13	13	12
Moisture resistance								
Option 1: Internal bond strength after cyclic test	ISO 16987	MPa	0,18	0,15	0,13	0,12	0,10	0,09
Thickness swell after cyclic test		%	20	18	16	14	13	11
Option 2: Internal bond strength after boil test	ISO 16998	MPa	0,09	0,09	0,08	0,07	0,07	0,06
Option 3: Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	5,6	4,9	4,5	4,2	3,9	3,2

5.6 Requirements for load bearing particleboard for use in humid conditions (P-LB MR)

The requirements for P-LB MR particleboard are listed in Table 9.

Table 9 — Requirements for P-LB MR particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	18	17	16	14	12	9
Modulus of elasticity (MOE)	ISO 16978	MPa	2 450	2 450	2 400	2 100	1 900	1 550
Internal bond strength	ISO 16984	MPa	0,50	0,45	0,40	0,35	0,30	0,30
24 h thickness swell	ISO 16983	%	16	13	11	11	11	10
Moisture resistance								
Option 1: Internal bond strength after cyclic test	ISO 16987	MPa	0,23	0,20	0,20	0,18	0,16	0,14
Thickness swell after cyclic test		%	16	15	13	12	11	10
Option 2: Internal bond strength after boil test	ISO 16998	MPa	0,15	0,14	0,14	0,12	0,10	0,09
Option 3: Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	6,7	6,4	5,6	4,9	4,2	3,5

5.7 Requirements for heavy-duty load bearing particleboard for use in humid conditions (P-HLB MR)

The requirements for P-HLB MR particleboard are listed in Table 10.

Table 10 — Requirements for P-HLB MR particleboard

Property	Test method	Units	Requirement				
			Thickness ranges (mm, nominal)				
			> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	21	19	18	16	14
Modulus of elasticity (MOE)	ISO 16978	MPa	3 000	2 900	2 700	2 400	2 200
Internal bond strength	ISO 16984	MPa	0,75	0,70	0,65	0,60	0,45
24 h thickness swell	ISO 16983	%	10	10	10	10	9
Moisture resistance							
Option 1: Internal bond strength after cyclic test	ISO 16987	MPa	0,34	0,32	0,29	0,27	0,20
Thickness swell after cyclic test		%	11	10	10	10	8
Option 2: Internal bond strength after boil test	ISO 16998	MPa	0,23	0,21	0,20	0,18	0,14
Option 3: Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	7,7	7,0	6,3	6,0	5,6

5.8 Requirements for general purpose particleboard for use in high humid conditions (P-GP HMR)

The requirements for P-GP HMR particleboard are listed in Table 11.

Table 11 — Requirements for P-GP HMR particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	14	13	12	11	10	7
Internal bond strength	ISO 16984	MPa	0,30	0,28	0,24	0,20	0,17	0,14
24 h thickness swell	ISO 16983	%	14	12	12	10	10	10
Moisture resistance								
Option 1:								
Internal bond strength after cyclic test	ISO 16987	MPa	0,18	0,17	0,14	0,11	0,10	0,08
Thickness swell after cyclic test		%	15	13	12	11	10	9
Option 2:								
Internal bond strength after boil test	ISO 16998	MPa	0,15	0,14	0,12	0,09	0,08	0,07
Option 3:								
Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	8,4	7,8	7,2	6,6	5,4	4,2

5.9 Requirements for furniture type particleboard for use in high humid conditions (P-FN HMR)

The requirements for P-FN HMR particleboard are listed in Table 12.

Table 12 — Requirements for P-FN HMR particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	18	16	15	13	12	10
Modulus of elasticity (MOE)	ISO 16978	MPa	2 200	2 000	1 900	1 700	1 600	1 400
Internal bond strength	ISO 16984	MPa	0,50	0,45	0,40	0,35	0,30	0,25
Surface soundness	ISO 16981	MPa	0,8	0,8	0,8	0,8	0,8	0,8
24 h thickness swell	ISO 16983	%	14	12	12	10	10	10
Moisture resistance								
Option 1:								
Internal bond strength after cyclic test	ISO 16987	MPa	0,28	0,22	0,18	0,16	0,14	0,12
Thickness swell after cyclic test		%	13	12	11	10	9	8
Option 2:								
Internal bond strength after boil test	ISO 16998	MPa	0,25	0,22	0,20	0,17	0,15	0,12
Option 3:								
Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	11,2	9,6	9,0	7,8	7,2	6,0

5.10 Requirements for load bearing particleboard for use in high humid conditions (P-LB HMR)

The requirements for P-LB HMR particleboard are listed in Table 13.

Table 13 — Requirements for P-LB HMR particleboard

Property	Test method	Units	Requirement					
			Thickness ranges (mm, nominal)					
			≤ 6	> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	19	18	16	15	14	12
Modulus of elasticity (MOE)	ISO 16978	MPa	2 600	2 600	2 400	2 100	1 900	1 700
Internal bond strength	ISO 16984	MPa	0,55	0,50	0,45	0,40	0,35	0,30
24 h thickness swell	ISO 16983	%	13	12	10	10	10	9
Moisture resistance								
Option 1: Internal bond strength after cyclic test	ISO 16987	MPa	0,30	0,25	0,22	0,20	0,17	0,15
Thickness swell after cyclic test		%	10	10	9	9	8	8
Option 2: Internal bond strength after boil test	ISO 16998	MPa	0,30	0,28	0,20	0,17	0,15	0,12
Option 3: Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	11,4	10,8	9,6	9,0	8,4	7,2

5.11 Requirements for heavy-duty load bearing particleboard for use in high humid conditions (P-HLB HMR)

The requirements for P-HLB HMR particleboard are listed in Table 14.

Table 14 — Requirements for P-HLB HMR particleboard

Property	Test method	Units	Requirement				
			Thickness ranges (mm, nominal)				
			> 6 to 13	> 13 to 20	> 20 to 25	> 25 to 34	> 34
Bending strength (MOR)	ISO 16978	MPa	22	20	18	17	16
Modulus of elasticity (MOE)	ISO 16978	MPa	3 350	3 100	2 900	2 800	2 600
Internal bond strength	ISO 16984	MPa	0,75	0,70	0,65	0,60	0,55
24 h thickness swell	ISO 16983	%	9	8	8	8	7
Moisture resistance							
Option 1: Internal bond strength after cyclic test	ISO 16987	MPa	0,45	0,42	0,39	0,36	0,33
Thickness swell after cyclic test		%	10	9	9	8	7
Option 2: Internal bond strength after Boil test	ISO 16998	MPa	0,37	0,35	0,32	0,30	0,27
Option 3: Wet bending strength after immersion in water at 70 °C	ISO 20585	MPa	13,2	12,0	10,8	10,2	9,6

6 Marking

Each panel or pack of panels shall be marked by the manufacturer either by direct indelible printing or by an adhesive label with at least the following information:

- manufacturer's name, trademark or identification mark specific to the production facility;
- reference to ISO 16893-2;
- panel type, e.g. P-FN MR;
- nominal thickness;
- formaldehyde classification;
- batch number or production week and year;
- additional attributes such as resistance to fire, insects or decay.