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Wood-based panels — Dry-process fibreboard

Panneaux à base de bois — Panneaux de fibres obtenus par procédé à sec

Reference number
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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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 89, *Wood-based panels*, Subcommittee SC 1, *Fibre boards*.

This first edition cancels and replaces ISO 16895-1:2008 and ISO 16895-2:2010, of which the product classification and specification have been technically revised.

Wood-based panels — Dry-process fibreboard

1 Scope

This International Standard specifies a classification matrix, related mandatory tests and thickness ranges for ultra-low-, low-, medium- and high-density dry process wood-based fibreboard. It then provides the manufacturing property requirements for these types of uncoated fibreboard.

The values listed in this International Standard relate to product properties used to classify fibreboards into one of four types (UDF, LDF, MDF and HDF, see Clause 3), one of four grades (GP, FN, BL and LB), for use in one of four service conditions (REG, MR1, MR2, and HMR). The values are not characteristic values to be used for design purposes.

NOTE Fibreboards are broadly divided into two groups based on the manufacturing process, namely the dry process group and the wet process group (see Clause 3). Wet process fibreboards lie outside the scope of this International Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3340, *Fibre building boards — Determination of sand content*

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 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 16985, *Wood-based panels — Determination of dimensional changes associated with changes in relative humidity*

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

ISO 27528, *Wood-based panels — Determination of resistance to axial withdrawal of screws*

3 Terms and definitions

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

3.1
dry process fibreboard
wood fibreboard with a forming line moisture content, as a mass fraction, of less than or equal to 20 % and whose primary bonding results from applied adhesives or resins

3.2
wet process fibreboard
wood fibreboard with a forming line moisture content, as a mass fraction, of greater than 20 % and whose primary bonding results from felting of wood fibres and their inherent adhesive properties

4 Symbols and abbreviated terms

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

BL building

DIY do-it-yourself

EXT exterior

F fungi resistant

FN furniture

FR fire retardant

GP general purpose

HDF high-density fibreboard

HMR highly moisture resistant

I insect resistant

LB load bearing

LDF low-density fibreboard

MDF medium-density fibreboard

MR1 moisture resistant — temperate

MR2 moisture resistant — tropical

REG regular

UDF ultra-low-density fibreboard

δ thickness

5 Classification, designation and coding

5.1 General

5.1.1 Classification matrices

Overall classification matrices, which include all major classes available at the time of publication, are shown in Tables 1 to 4. Tables 1 to 4 allow for future classes to be included as they become available on international markets.

Not all products in the matrices shown in Tables 1 to 4 are currently available or under development. Realistic property tables can only be developed for existing products. The remainder are potential future products and property tables will be developed when necessary.

Density ranges given in product descriptions in 5.2 to 5.5 are a guide. Manufacturers may classify a product as a particular type or grade if it meets all the property requirements of the nominated type or grade. For example, a thin fibreboard of density 830 kg/m^3 could be called MDF if it meets all property requirements of the particular MDF grade nominated.

5.1.2 Uses

Products specified in this International Standard have the following applications.

regular	REG	dry conditions only
moisture resistant — temperate	MR1	temperate humid conditions
moisture resistant — tropical	MR2	tropical humid conditions
highly moisture resistant	HMR	high humid conditions
exterior	EXT	exposed to weather conditions, above ground
general purpose	GP	applications not requiring the specific properties of furniture or load-bearing grades
furniture	FN	in furniture manufacture, cabinet making, fitments, joinery, bases for surface decorative treatment
building	BL	building applications requiring high dimensional stability
load bearing	LB	structural or load bearing
do-it-yourself	DIY	home projects done by residents rather than professional tradespersons

5.1.3 Additional classifications

If additional attribute classifications are used, such as fire retardant (FR), insect resistant (I) and fungi resistant (F), claimed performance shall be confirmed by appropriate testing. Relevant tests and performance requirements may be specified by national standards and regulations.

5.1.4 Structural grades

When a product is used in a load-bearing or structural application, additional information shall be available in the form of characteristic values derived from structural testing (see ISO 16572), experimental test results or history of use to validate its performance under the proposed conditions.

It should be noted that engineering design methods do not provide for design for high humid or exterior service conditions. The inclusion of the MDF-LB grade in the "high humid" section of the classification matrix (see Table 3) is on the basis that performance is validated by experimental test results or history of use.

5.2 Ultra-low-density fibreboard (UDF)

UDF has a nominal density less than 550 kg/m^3 and is classified according to Table 1.

Table 1 — UDF classification matrix

UDF type	Service conditions				
	Dry	Humid temperate	Humid tropical	High humid	Exterior
UDF-FN	REG furniture grade	No existing product	No existing product	No existing product	No existing product
Application examples	Light-duty partitions				

5.3 Low-density fibreboard (LDF)

LDF has a nominal density in the range 550 kg/m^3 to 650 kg/m^3 and is classified according to Table 2.

Table 2 — LDF classification matrix

LDF type	Service conditions				
	Dry	Humid temperate	Humid tropical	High humid	Exterior
LDF-GP	No existing product	MR1 general purpose	MR2 general purpose	No existing product	No existing product
Application examples		Roof underlay/sheathing, wall sheathing	Roof underlay/sheathing, wall sheathing		
LDF-FN	REG furniture grade	MR1 furniture grade	MR2 furniture grade	No existing product	No existing product
Application examples	Furniture, DIY uses, general uses, light-duty partitions	Furniture, DIY uses, general uses	Furniture, DIY uses, general uses		
LDF-BL	REG building grade	MR1 building grade	No existing product	No existing product	No existing product
Application examples	Window frames, door backs	Window frames, door backs			

5.4 Medium density fibreboard (MDF)

MDF has a nominal density in the range 650 kg/m^3 to 800 kg/m^3 and is classified according to Table 3.

Table 3 — MDF classification matrix

MDF type	Service conditions				
	Dry	Humid temperate	Humid tropical	High humid	Exterior
MDF-GP	REG general purpose	MR1 general purpose	MR2 general purpose	No existing product	No existing product
Application examples	DIY uses, general uses, veneer grade	DIY uses, general uses, overlay floors	DIY uses, general uses, overlay floors		
MDF-FN	REG furniture grade	MR1 furniture/fitments grade	MR2 furniture/fitments grade	HMR furniture/fitments grade	No existing product
Application examples	Carcase, furniture, cabinets, substrate for any decorative finish	Carcase, furniture, cabinets for kitchen and bathroom, substrate for any decorative finish	Carcase, furniture, cabinets for kitchen and bathroom, substrate for any decorative finish	Fascias, window joinery, protected exterior construction	
MDF-LB	REG load bearing	MR1 load bearing	MR2 load bearing	No existing product	No existing product
Application examples	Domestic flooring, shelving, general construction	Domestic or industrial flooring, shelving, general construction	Domestic or industrial flooring, wall and roof sheathing, beams, toilet partitions		
MDF-BL	REG building grade	MR1 building grade	MR2 building grade	HMR building grade	No existing product
Application examples	Window frames, door linings, bearing walls	Window frames, door linings, bearing walls	Window frames, door linings, bearing walls, floor and roof sheathing, underlay	Window frames, door linings, bearing walls, floor and roof sheathing, underlay	

5.5 High-density fibreboard (HDF)

HDF has a nominal density greater than 800 kg/m^3 and is classified according to Table 4.

Table 4 — HDF classification matrix

HDF type	Service conditions				
	Dry	Humid temperate	Humid tropical	High humid	Exterior
HDF-GP	REG general purpose	MR1 general purpose	MR2 general purpose	No existing product	No existing product
Application examples	Composite flooring, machined articles, patterns, packaging	Composite flooring, wall panelling in public amenities, packaging	Composite flooring, wall panelling in public amenities		
HDF-BL	REG building grade	MR1 building grade	MR2 building grade	No existing product	No existing product
Application examples	Composite flooring	Composite flooring	Bearing walls		

6 Tests related to each grade

6.1 Mandatory tests

The mandatory tests shown in Tables 5 to 8 shall be applied to the various fibreboard grades identified in Tables 1 to 4, respectively. All property requirements shall be met at dispatch from the factory.

6.2 Optional tests

If information on additional properties is agreed between user and manufacturer, it shall be determined using the test method(s) nominated from ISO 3340, ISO 16985 and/or ISO 27528.

Table 5 — Tests relating to each UDF grade

Property	Method	UDF-FN
Dimensions	ISO 9426	REG
Density variation	ISO 9427	REG
Formaldehyde emission	ISO 12460-1	REG
Moisture content	ISO 16979	REG
Internal bond strength	ISO 16984	REG
Bending strength — Modulus of rupture (MOR)	ISO 16978	REG

Table 6 — Tests relating to each LDF grade

Property	Method	LDF-GP	LDF-FN	LDF-BL
Dimensions	ISO 9426	MR1 MR2	REG MR1 MR2	REG MR1
Density variation	ISO 9427	MR1 MR2	REG MR1 MR2	REG MR1
Formaldehyde emission	ISO 12460-1	MR1 MR2	REG MR1 MR2	REG MR1
Moisture content	ISO 16979	MR1 MR2	REG MR1 MR2	REG MR1
Internal bond strength	ISO 16984	MR1 MR2	REG MR1 MR2	REG MR1
Bending strength — Modulus of rupture (MOR)	ISO 16978	MR1 MR2	REG MR1 MR2	REG MR1
Bending stiffness — Modulus of elasticity (MOE)	ISO 16978	MR1 MR2	REG MR1 MR2	REG MR1
Thickness swelling	ISO 16983	MR1 MR2	REG MR1 MR2	REG MR1
Surface soundness	ISO 16981	—	MR1 MR2	—
Moisture resistance	ISO 16987 ISO 16998 ISO 20585	MR1 MR2	MR1 MR2	—
Moisture resistance — Wet bending strength	ISO 20585	—	—	MR1

Table 7 — Tests relating to each MDF grade

Property	Method	MDF-GP	MDF-FN	MDF-BL	MDF-LB
Dimensions	ISO 9426	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Density variation	ISO 9427	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Formaldehyde emission	ISO 12460–1	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Moisture content	ISO 16979	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Internal bond strength	ISO 16984	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Bending strength — Modulus of rupture (MOR)	ISO 16978	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2

Table 7 *(continued)*

Property	Method	MDF-GP	MDF-FN	MDF-BL	MDF-LB
Bending stiffness — Modulus of elasticity (MOE)	ISO 16978	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Thickness swelling	ISO 16983	REG MR1 MR2	REG MR1 MR2 HMR	REG MR1 MR2 HMR	REG MR1 MR2
Surface soundness	ISO 16981	—	REG MR1 MR2 HMR	—	—
Moisture resistance	ISO 16987 ISO 16998 ISO 20585	MR1 MR2	MR1 MR2 HMR	—	MR1 MR2
Moisture resistance — Wet bending strength	20585	—	—	MR1 MR2 HMR	—

Table 8 — Tests relating to each HDF grade

Property	Method	HDF-GP	HDF-BL
Dimensions	ISO 9426	REG MR1 MR2	REG MR1
Density variation	ISO 9427	REG MR1 MR2	REG MR1
Formaldehyde emission	ISO 12460-1	REG MR1 MR2	REG MR1
Moisture content	ISO 16979	REG MR1 MR2	REG MR1
Internal bond strength	ISO 16984	REG MR1 MR2	REG MR1
Bending strength — Modulus of rupture (MOR)	ISO 16978	REG MR1 MR2	REG MR1
Bending stiffness — Modulus of elasticity (MOE)	ISO 16978	REG MR1 MR2	REG MR1
Thickness swelling	ISO 16983	MR1 MR2	REG MR1
Surface soundness	ISO 16981	REG MR1 MR2	—
Moisture resistance	ISO 16987 ISO 16998 ISO 20585	MR1 MR2	—
Moisture resistance — Wet bending strength	ISO 20585	—	MR1 MR2

7 Thickness ranges

Specification values shall be related to the ranges of thickness, δ, shown. The specification of a particular thickness of product shall be determined by consulting the correct thickness range.

0 mm $< \delta \leq$ 2,5 mm

>2,5 mm $< \delta \leq$ 4,0 mm

>4,0 mm $< \delta \leq$ 6,0 mm

>6,0 mm $< \delta \leq$ 9,0 mm

>9,0 mm $< \delta \leq$ 12 mm

>12 mm $< \delta \leq$ 19 mm

>19 mm $< \delta \leq$ 30 mm

>30 mm $< \delta \leq$ 45 mm

$\delta >$ 45 mm

8 Expression of specification limits and general requirements

8.1 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 Tables 5 to 8 be applied to samples of the group. Conditioning of test specimens is required and is specified in each test method, and

b) the results of the tests be evaluated against the appropriate specification limits in Tables 9 to 38 according to the product types, grades and thickness ranges. Tables 9 and 10 apply to all product types and thickness ranges of panels.

For density variation and dimensions (see Table 9), 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 10 gives upper specification limits for individual panel results.

Specification limits in Tables 11 to 38 are based on 5 (lower) or 95 (upper) percentile expressions, according to 8.2 and 8.3.

8.2 Lower specification limits

The requirements in Tables 11 to 38 are the lower specification limits for the following properties:

a) bending strength — modulus of rupture (MOR);

b) bending stiffness — 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 11 to 38.

8.3 Upper specification limits

The requirements in Tables 11 to 38 are the upper specification limits for the following properties:

a) thickness swelling after 24 h;

b) thickness swelling 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 11 to 38.

8.4 Moisture resistance requirement options

There are no moisture resistant test requirements for dry condition products (REG).

Requirements for moisture resistant products are dependent on the test method employed to assess this property. Three alternative sets of requirements (Option 1, Option 2 and Option 3) apply to MR1, MR2 and HMR products as indicated in the relevant tables.

It is necessary to show compliance with only one of these three options, as follows.

— Option 1: Requirements apply to those fibreboards subjected to a cyclic accelerated ageing test, followed by the determination of thickness swelling and internal bond, as described in ISO 16987.

— Option 2: Requirements apply to those fibreboards subjected to an accelerated ageing test, consisting of immersion in boiling water followed by determination of internal bond, as described in ISO 16998.

— Option 3: Requirements apply to those fibreboards subjected to an accelerated ageing test consisting of determination of the wet bending strength following immersion in water at 70 °C or immersion in boiling water for exterior grade products, as described in ISO 20585, Method A or Method B.

BL product types have only Option 3 specified.

NOTE Moisture resistance testing is not intended to prove durability of a new resin system, but to confirm the correct processing of panels made from a resin system proven to provide the required durability.

8.5 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 9.

Density ranges given for each product type in Clause 5 are a guide only and not a mandatory specification. Products may be designated as a particular type if they meet the specified requirements for that type.

Table 9 — 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		
		<8	≥8 to ≤12	>12
—Unsanded panel		−0,3 +1,5	−0,3 +1,5	−0,5 +1,7
—Sanded panel		±0,2	±0,3	±0,3
Moisture content (advisory only)	ISO 16979	5 % to 14 % (see Note)		

NOTE This International Standard applies internationally. Wood products attain a moisture content according to the temperature and relative humidity of their environment. The upper limits of this moisture content range will only apply in hot, humid areas.

8.6 Formaldehyde requirements

Compliance with formaldehyde requirements can be confirmed by applying one test method only of those listed in Table 10. 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 can be completed within 24 h. Each individual panel result shall comply with the specification limits stated in Table 10 for the selected method.

Table 10 — Maximum limits of formaldehyde emission/content

Property	Method[a]	Unit	Requirement
Emission	ISO 12460-1	mg/m^3	0,124
Emission	ISO 12460-2	mg/m^3	[a]
Emission	ISO 12460-3	$mg/m^2/h$	3,5
Emission	ISO 12460-4	mg/L	0,7
Content	ISO 12460-5	mg/100 g	8,0

NOTE National regulations may impose restrictions on the use of panels of particular formaldehyde emission levels.

[a] If this 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.

8.7 Load bearing fibreboard

When fibreboard is classified as “load bearing” (LB) and nominated for structural applications, 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, I-joist webs), the load bearing fibreboard shall meet the specific performance requirements for that intended application.

9 Specific property requirements for ultra-low-density fibreboard (UDF-FN REG)

Ultra low-density fibreboards have a nominal density of less than 550 kg/m^3.

Requirements for UDF-FN REG fibreboard are listed in Table 11.

Table 11 — Requirements for UDF-FN REG

Property	Test method	Units	Requirement Thickness ranges mm, nominal				
			>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	18	14	13	12	12
Internal bond strength	ISO 16984	MPa	0,35	0,35	0,30	0,30	0,30
24 h thickness swelling	ISO 16983	%	18	16	14	12	12

10 Specific property requirements for low-density fibreboard

10.1 General

Low-density fibreboards have a nominal density of 550 kg/m^3 to 650 kg/m^3.

10.2 Requirements for furniture grade low-density fibreboard for use in dry conditions (LDF-FN REG)

Requirements for LDF-FN REG fibreboard are listed in Table 12.

Table 12 — Requirements for LDF-FN REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal					
			>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	20	20	18	15	14	14
Modulus of elasticity (MOE)	ISO 16987	MPa	1 700	1 700	1 600	1 500	1 400	1 200
Internal bond strength	ISO 16984	MPa	0,45	0,45	0,45	0,45	0,40	0,40
24 h thickness swelling	ISO 16983	%	20	16	14	12	11	11

10.3 Requirements for building grade low-density fibreboard for use in dry conditions (LDF-BL REG)

Requirements for LDF-BL REG fibreboard are listed in Table 13.

Table 13 — Requirements for LDF-BL REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal				
			>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30
Bending strength (MOR)	ISO 16978	MPa	15	15	15	15	—
Modulus of elasticity (MOE)	ISO 16987	MPa	1 500	1 500	1 500	1 400	—
Internal bond strength	ISO 16984	MPa	0,30	0,30	0,30	0,30	—
24 h thickness swelling	ISO 16983	%	20	13	12	8	—

10.4 Requirements for general purpose low-density fibreboard for use in temperate humid conditions (LDF-GP MR1)

Requirements for LDF-GP MR1 fibreboard are listed in Table 14.

Table 14 — Requirements for LDF-GP MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal					
			>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	20	20	18	16	16	14
Modulus of elasticity (MOE)	ISO 16987	MPa	1 700	1 700	1 600	1 500	1 400	1200
Internal bond strength	ISO 16984	MPa	0,45	0,45	0,45	0,45	0,40	0,40
24 h thickness swelling	ISO 16983	%	18	16	13	12	11	10
Moisture resistance								
Option 1: Cyclic test								
Internal bond strength Thickness swelling	ISO 16987	MPa %	0,25 19	0,18 16	0,16 15	0,13 15	0,10 15	0,10 15
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,12	0,09	0,09	0,09	0,08	0,07
Option 3: Wet bending strength	ISO 20585, Method A	MPa	6,0	5,5	4,5	3,5	3,0	3,0

10.5 Requirements for furniture grade low-density fibreboard for use in temperate humid conditions (LDF-FN MR1)

Requirements for LDF-FN MR1 fibreboard are listed in Table 15.

Table 15 — Requirements for LDF-FN MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal					
			>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	22	22	20	17	15	15
Modulus of elasticity (MOE)	ISO 16987	MPa	1 800	1 800	1 700	1 500	1 400	1 400
Internal bond strength	ISO 16984	MPa	0,50	0,50	0,45	0,40	0,38	0,38
24 h thickness swelling	ISO 16983	%	16	13	11	10	10	10
Surface soundness	ISO 16981	MPa	0,7	0,7	0,8	0,8	0,8	0,8
Moisture resistance								
Option 1: Cyclic test Internal bond strength Thickness swelling	ISO 16987	 MPa %	 0,30 19	 0,25 16	 0,20 15	 0,15 15	 0,10 15	 0,10 15
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,15	0,15	0,12	0,12	0,10	0,10
Option 3: Wet bending strength	ISO 20585, Method A	MPa	6,5	6,0	5,0	4,0	3,5	3,5

10.6 Requirements for building grade low-density fibreboard for use in temperate humid conditions (LDF-BL MR1)

Requirements for LDF-BL MR1 fibreboard are listed in Table 16.

Table 16 — Requirements for LDF-BL MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal				
			>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30
Bending strength (MOR)	ISO 16978	MPa	22	22	22	21	—
Modulus of elasticity (MOE)	ISO 16987	MPa	1 800	1 800	1 800	1 700	—
Internal bond strength	ISO 16984	MPa	0,30	0,30	0,30	0,30	—
24 h thickness swelling	ISO 16983	%	14,0	9,0	8,0	5,5	—
Moisture resistance — Wet bending strength	ISO 20585, Method A	MPa	10,0	10,0	10,0	9,0	—

10.7 Requirements for general purpose low-density fibreboard for use in tropical humid conditions (LDF-GP MR2)

Requirements for LDF-GP MR2 fibreboard are listed in Table 17.

Table 17 — Requirements for LDF-GP MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal		
			>9,0 to ≤12	>12 to ≤19	>19 to ≤30
Bending strength (MOR)	ISO 16978	MPa	20	18	17
Modulus of elasticity (MOE)	ISO 16987	MPa	1 700	1 600	1 550
Internal bond strength	ISO 16984	MPa	0,45	0,45	0,45
24 h thickness swelling	ISO 16983	%	12	10	9
Moisture resistance					
Option 1: Cyclic test Internal bond strength Thickness swell	ISO 16987	MPa %	0,20 15	0,20 15	0,20 15
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,10	0,10	0,10
Option 3: Wet bending strength	ISO 20585, Method A	MPa	10	9	8

10.8 Requirements for furniture grade low-density fibreboard for use in tropical humid conditions (LDF-FN MR2)

Requirements for LDF-FN MR2 fibreboard are listed in Table 18.

Table 18 — Requirements for LDF-FN MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal			
			>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45
Bending strength (MOR)	ISO 16978	MPa	22	20	18	17
Modulus of elasticity (MOE)	ISO 16978	MPa	1 800	1 700	1 600	1 500
Internal bond strength	ISO 16984	MPa	0,50	0,45	0,45	0,40
24 h thickness swelling	ISO 16983	%	12	10	9	8
Surface soundness	ISO 16981	MPa	0,7	0,8	0,8	0,8
Moisture resistance						
Option 1: Cyclic test Internal bond strength Thickness swell	ISO 16987	MPa %	0,28 14	0,22 14	0,20 14	0,17 14
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,18	0,15	0,15	0,12
Option 3: Wet bending strength	ISO 20585, Method A	MPa	11	10	9	8

11 Specific property requirements for medium-density fibreboard

11.1 General

Medium-density fibreboards have a nominal density of 650 kg/m^3 to 800 kg/m^3.

11.2 Requirements for general purpose medium-density fibreboard for use in dry conditions (MDF-GP REG)

Requirements for MDF-GP REG fibreboard are listed in Table 19.

Table 19 — Requirements for MDF-GP REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	21	21	21	21	20	18	16	16	14
Modulus of elasticity (MOE)	ISO 16978	MPa	—	—	2 500	2 500	2 300	2 000	1 900	1 700	1 500
Internal bond strength	ISO 16984	MPa	0,60	0,60	0,60	0,60	0,50	0,45	0,45	0,45	0,40
24 h thickness swelling	ISO 16983	%	50	40	35	18	16	13	12	10	8

11.3 Requirements for furniture grade medium-density fibreboard for use in dry conditions (MDF-FN REG)

Requirements for MDF-FN REG fibreboard are listed in Table 20.

Table 20 — Requirements for MDF-FN REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	23	23	23	23	22	20	18	17	15
Modulus of elasticity (MOE)	ISO 16978	MPa	—	—	2 700	2 700	2 500	2 200	2 100	1 900	1 700
Internal bond strength	ISO 16984	MPa	0,65	0,65	0,65	0,65	0,60	0,55	0,55	0,50	0,50
24 h thickness swelling	ISO 16983	%	45	35	30	17	15	12	10	8	6
Surface soundness	ISO 16981	MPa	0,6	0,6	0,6	0,6	0,6	0,9	0,9	0,9	0,8

11.4 Requirements for building grade medium-density fibreboard for use in dry conditions (MDF-BL REG)

Requirements for MDF-BL REG fibreboard are listed in Table 21.

Table 21 — Requirements for MDF-BL REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal						
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30
Bending strength (MOR)	ISO 16978	MPa	25	25	27	27	25	25	25
Modulus of elasticity (MOE)	ISO 16978	MPa	2 100	2 100	2 300	2 300	2 000	2 000	2 000
Internal bond strength	ISO 16984	MPa	0,50	0,50	0,50	0,50	0,40	0,40	0,40
24 h thickness swelling	ISO 16983	%	35	30	25	18	12	9	6

11.5 Requirements for load bearing medium-density fibreboard for use in dry conditions (MDF-LB REG)

Requirements for MDF-LB REG fibreboard are listed in Table 22.

Table 22 — Requirements for MDF-LB REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	29	29	29	29	27	25	23	21	19
Modulus of elasticity (MOE)	ISO 16978	MPa	3 000	3 000	3 000	3 000	2 800	2 500	2 300	2 100	1 900
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,70	0,65	0,60	0,60	0,55	0,50
24 h thickness swelling	ISO 16983	%	45	35	30	17	15	12	10	8	6

11.6 Requirements for general purpose medium-density fibreboard for use in temperate humid conditions (MDF-GP MR1)

Requirements for MDF-GP MR1 fibreboard are listed in Table 23.

Table 23 — Requirements for MDF-GP MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	25	25	25	25	24	22	20	15	14
Modulus of elasticity (MOE)	ISO 16978	MPa	2 500	2 500	2 500	2 500	2 300	2 200	2 100	2 000	1 900
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,80	0,80	0,75	0,75	0,70	0,60
24 h thickness swelling	ISO 16983	%	35	30	18	12	10	8	7	7	6
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swelling	ISO 16987	MPa %	0,35 50	0,35 40	0,35 25	0,30 19	0,25 16	0,20 15	0,15 15	0,10 15	0,10 15
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,20	0,20	0,18	0,15	0,15	0,12	0,12	0,10	0,10
Option 3: Wet bending strength	ISO 20585 Method A	MPa	8,0	7,5	7,0	7,0	6,0	5,0	4,0	4,0	3,5

11.7 Requirements for furniture grade medium-density fibreboard for use in temperate humid conditions (MDF-FN MR1)

Requirements for MDF-FN MR1 fibreboard are listed in Table 24.

Table 24 — Requirements for MDF-FN MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	27	27	27	27	26	24	22	17	15
Modulus of elasticity (MOE)	ISO 16978	MPa	2 700	2 700	2 700	2 700	2 500	2 400	2 300	2 200	2 000
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,80	0,80	0,75	0,75	0,70	0,60
24 h thickness swelling	ISO 16983	%	35	30	18	12	10	8	7	7	6
Surface soundness	ISO 16981	MPa	0,6	0,7	0,7	0,8	0,9	0,9	0,9	0,9	0,8

Table 24 — *(continued)*

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swelling	ISO 16987	MPa %	0,35 50	0,35 40	0,35 25	0,30 19	0,25 16	0,20 15	0,15 15	0,10 15	0,10 15
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,20	0,20	0,18	0,15	0,15	0,12	0,12	0,10	0,10
Option 3: Wet bending strength	ISO 20585 Meth-od A	MPa	8,0	7,5	7,0	7,0	6,0	5,0	4,0	4,0	3,5

11.8 Requirements for building grade medium-density fibreboard for use in temperate humid conditions (MDF-BL MR1)

Requirements for MDF-BL MR1 fibreboard are listed in Table 25.

Table 25 — Requirements for MDF-BL MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal						
			0 to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30
Bending strength (MOR)	ISO 16978	MPa	28	28	28	28	28	26	26
Modulus of elasticity (MOE)	ISO 16978	MPa	2 400	2 400	2 400	2 400	2 400	2 000	2 000
Internal bond strength	ISO 16984	MPa	0,50	0,50	0,50	0,50	0,50	0,40	0,40
24 h thickness swelling	ISO 16983	%	20	16	14	11	8	7	6
Moisture resistance — Wet bending strength	ISO 20585 Method A	MPa	12,5	12,5	12,5	12,5	12,5	12,5	12,5

11.9 Requirements for load bearing medium-density fibreboard for use in temperate humid conditions (MDF-LB MR1)

Requirements for MDF-LB MR1 fibreboard are listed in Table 26.

Table 26 — Requirements for MDF-LB MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	34	34	34	34	32	30	28	21	19
Modulus of elasticity (MOE)	ISO 16978	MPa	3 000	3 000	3 000	3 000	2 800	2 700	2 600	2 400	2 200
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,80	0,80	0,75	0,75	0,70	0,60
24 h thickness swelling	ISO 16983	%	35	30	18	12	10	8	7	7	6
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swelling	ISO 16987	MPa %	0,35 50	0,35 40	0,35 25	0,30 19	0,25 16	0,20 15	0,15 15	0,10 15	0,10 15
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,20	0,20	0,20	0,15	0,15	0,12	0,12	0,10	0,10
Option 3: Wet bending strength	ISO 20585 Method A	MPa	9,0	8,0	8,0	8,0	8,0	6,0	4,0	4,0	3,5

11.10 Requirements for general purpose medium-density fibreboard for use in tropical humid conditions (MDF-GP MR2)

Requirements for MDF-GP MR2 fibreboard are listed in Table 27.

Table 27 — Requirements for MDF-GP MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	28	28	27	27	26	24	22	18	16
Modulus of elasticity (MOE)	ISO 16978	MPa	2 800	2 800	2 700	2 700	2 500	2 400	2 300	2 000	1 800
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,70	0,65	0,65	0,60	0,55	0,50
24 h thickness swelling	ISO 16983	%	20	16	14	12	10	7	6	5	5

Table 27 — *(continued)*

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swell	ISO 16987	MPa %	0,45 25	0,42 22	0,40 20	0,35 17	0,30 15	0,25 11	0,20 9	0,18 7	0,15 6
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,25	0,22	0,20	0,20	0,18	0,15	0,12	0,12	0,10
Option 3: Wet bending strength	ISO 20585 Method A	MPa	14	14	13	13	13	12	11	9	8

11.11 Requirements for furniture grade medium-density fibreboard for use in tropical humid conditions (MDF-FN MR2)

Requirements for MDF-FN MR2 fibreboard are listed in Table 28.

Table 28 — Requirements for MDF-FN MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	28	28	27	27	26	24	23	21	19
Modulus of elasticity (MOE)	ISO 16978	MPa	2 800	2 800	2 700	2 700	2 500	2 400	2 300	2 000	1 900
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,70	0,65	0,65	0,60	0,55	0,50
24 h thickness swelling	ISO 16983	%	20	16	14	11	9	7	6	5	5
Surface soundness	ISO 16981	MPa	0,6	0,7	0,7	0,7	0,8	0,9	0,9	0,9	0,8
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swell	ISO 16987	MPa %	0,45 25	0,42 22	0,40 20	0,35 17	0,30 15	0,25 11	0,20 9	0,18 7	0,15 6
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,25	0,22	0,20	0,20	0,18	0,15	0,12	0,12	0,10
Option 3: Wet bending strength	ISO 20585 Method A	MPa	14	14	13	13	13	12	11	10	9

11.12 Requirements for building grade medium-density fibreboard for use in tropical humid conditions (MDF-BL MR2)

Requirements for MDF-BL MR2 fibreboard are listed in Table 29.

Table 29 — Requirements for MDF-BL MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal						
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12,0	>12,0 to ≤19,0	>19,0 to ≤30,0
Bending strength (MOR)	ISO 16978	MPa	30	30	30	30	30	30	30
Modulus of elasticity (MOE)	ISO 16978	MPa	2 500	2 500	2 500	2 500	2 500	2 500	2 500
Internal bond strength	ISO 16984	MPa	0,50	0,50	0,50	0,50	0,50	0,50	0,50
24 h thickness swelling	ISO 16983	%	15	15	12	10	7	5	4
Moisture resistance — Wet bending strength	ISO 20585 Method A	MPa	15,0	15,0	15,0	15,0	15,0	15,0	15,0

11.13 Requirements for load bearing medium-density fibreboard for use in tropical humid conditions (MDF-LB MR2)

Requirements for MDF-LB MR2 fibreboard are listed in Table 30.

Table 30 — Requirements for MDF-LB MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	36	35	34	34	34	30	28	23	21
Modulus of elasticity (MOE)	ISO 16978	MPa	3 100	3 050	3 000	3 000	2 800	2 700	2 500	2 200	2 000
Internal bond strength	ISO 16984	MPa	0,75	0,70	0,70	0,70	0,70	0,65	0,60	0,60	0,55
24 h thickness swelling	ISO 16983	%	20	16	14	11	9	7	6	5	5
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swell	ISO 16987	MPa %	0,45 25	0,42 22	0,40 20	0,35 17	0,35 15	0,30 11	0,27 9	0,25 7	0,20 6
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,25	0,222	0,20	0,20	0,18	0,15	0,12	0,10	0,10
Option 3: Wet bending strength	ISO 20585 Method A	MPa	18	17	17	17	17	15	14	11	10

11.14 Requirements for fitments grade medium-density fibreboard for use in high humid conditions (MDF-FN HMR)

Requirements for MDF-FN HMR fibreboard are listed in Table 31.

Table 31 — Requirements for MDF-FN HMR fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal								
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30	>30 to ≤45	>45
Bending strength (MOR)	ISO 16978	MPa	34	32	30	30	28	26	23	21	20
Modulus of elasticity (MOE)	ISO 16978	MPa	2 800	2 700	2 600	2 500	2 400	2 400	1 800	1 800	1 700
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,70	0,65	0,60	0,55	0,50	0,45
24 h thickness swelling	ISO 16983	%	15	14	12	10	7	5	4	4	4
Moisture resistance											
Option 1: Cyclic test Internal bond strength Thickness swelling	ISO 16987	 MPa %	 0,50 20	 0,45 18	 0,40 16	 0,35 12	 0,35 12	 0,30 10	 0,25 8	 0,22 6	 0,20 6
Option 2: Boil test Internal bond strength	ISO 16998	 MPa	 0,30	 0,28	 0,25	 0,22	 0,22	 0,20	 0,20	 0,18	 0,15
Option 3: Wet bending strength	ISO 20585 Method B	MPa	12,0	12,0	12,0	12,0	12,0	10,0	9,0	8,0	7,5

11.15 Requirements for building grade medium-density fibreboard for use in high humid conditions (MDF-BL HMR)

Requirements for MDF-BL HMR fibreboard are listed in Table 32.

Table 32 — Requirements for MDF-BL HMR fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal		
			>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19
Bending strength (MOR)	ISO 16978	MPa	30	30	30
Modulus of elasticity (MOE)	ISO 16978	MPa	2 500	2 500	2 500
Internal bond strength	ISO 16984	MPa	0,50	0,50	0,50
24 h thickness swelling	ISO 16983	%	8	6	4
Moisture resistance — Wet bending strength	ISO 20585 Method B	MPa	15,0	15,0	15,0

12 Specific property requirements for high-density fibreboard

12.1 General

High-density fibreboards have a nominal density of greater than 800 kg/m^3.

12.2 Requirements for general purpose high-density fibreboard for use in dry conditions (HDF-GP REG)

Requirements for HDF-GP REG fibreboard are listed in Table 33.

Table 33 — Requirements for HDF-GP REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal						
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30
Bending strength (MOR)	ISO 16978	MPa	38	38	37	36	35	35	33
Modulus of elasticity (MOE)	ISO 16978	MPa	3 900	3 800	3 800	3 600	3 500	3 200	3 000
Internal bond strength	ISO 16984	MPa	0,95	0,90	0,90	0,85	0,80	0,80	0,80
Surface soundness	ISO 16981	MPa	0,8	0,9	0,9	1,0	1,2	1,2	1,1

12.3 Requirements for building grade high-density fibreboard for use in dry conditions (HDF-BL REG)

Requirements for HDF-BL REG fibreboard are listed in Table 34.

Table 34 — Requirements for HDF-BL REG fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal					
			to 2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to 19
Bending strength (MOR)	ISO 16978	MPa	28	28	30	30	29	29
Modulus of elasticity (MOE)	ISO 16978	MPa	2 600	2 600	2 900	2 900	2 700	2 700
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,70	0,50	0,50
24 h thickness swelling	ISO 16983	MPa	30	25	23	16	10	8

12.4 Requirements for general purpose high-density fibreboard for use in temperate humid conditions (HDF-GP MR1)

Requirements for HDF-GP MR1 fibreboard are listed in Table 35.

Table 35 — Requirements for HDF-GP MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal						
			1,5 to ≤2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30
Bending strength (MOR)	ISO 16978	MPa	42	42	42	42	40	38	36
Modulus of elasticity (MOE)	ISO 16978	MPa	3 900	3 800	3 800	3 600	3 500	3 200	3 000
Internal bond strength	ISO 16984	MPa	1,20	1,20	1,20	1,20	1,00	1,00	0,90
24 h thickness swelling	ISO 16983	%	16	15	14	12	10	6	5
Surface soundness	ISO 16981	MPa	0,8	0,8	0,9	1,0	1,2	1,2	1,0
Moisture resistance									
Option 1: Cyclic test Internal bond strength Thickness swelling	ISO 16987	 MPa %	 0,40 18	 0,40 17	 0,40 16	 0,40 14	 0,35 11	 0,35 11	 0,30 10
Option 2: Boil test Internal bond strength	ISO 16998	 MPa	 0,40	 0,40	 0,40	 0,40	 0,30	 0,30	 0,25
Option 3: Wet bending strength	ISO 20585 Method A	MPa	15	15	15	15	15	13	12

12.5 Requirements for building grade high-density fibreboard for use in temperate humid conditions (HDF-BL MR1)

Requirements for HDF-BL MR1 fibreboard are listed in Table 36.

Table 36 — Requirements for HDF-BL MR1 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal					
			>1,5 to ≤2,5	>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19
Bending strength (MOR)	ISO 16978	MPa	32	32	32	32	31	31
Modulus of elasticity (MOE)	ISO 16978	MPa	3 000	3 000	2 900	2 900	2 900	2 800
Internal bond strength	ISO 16984	MPa	0,70	0,70	0,70	0,70	0,70	0,70
24 h thickness swelling	ISO 16983	%	20	13	11	9,0	6,5	5,0
Moisture resistance — Wet bending strength	ISO 20585 Method A	MPa	14	14	14	13	13	13

12.6 Requirements for general purpose high-density fibreboard for use in high humid conditions (HDF-GP MR2)

Requirements for HDF-GP MR2 fibreboard are listed in Table 37.

Table 37 — Requirements for HDF-GP MR2 fibreboard

Property	Test method	Unit	Requirement Thickness ranges mm, nominal					
			>2,5 to ≤4,0	>4,0 to ≤6,0	>6,0 to ≤9,0	>9,0 to ≤12	>12 to ≤19	>19 to ≤30
Bending strength (MOR)	ISO 16978	MPa	42	41	40	40	38	36
Modulus of elasticity (MOE)	ISO 16978	MPa	3 800	3 700	3 600	3 500	3 200	3 000
Internal bond strength	ISO 16984	MPa	1,20	1,20	1,20	1,00	1,00	0,90
24 h thickness swelling	ISO 16983	%	12	11	10	8	5	5
Surface soundness	ISO 16981	MPa	0,9	0,9	1,0	1,2	1,5	1,0
Moisture resistance								
Option 1: Cyclic test Internal bond strength Thickness swell	ISO 16987	 MPa %	 0,50 14	 0,50 13	 0,50 12	 0,45 10	 0,45 9	 0,40 8
Option 2: Boil test Internal bond strength	ISO 16998	MPa	0,50	0,50	0,50	0,40	0,40	0,35
Option 3: Wet bending strength	ISO 20585 Method A	MPa	21	20	20	20	19	18

12.7 Requirements for building grade high-density fibreboard for use in tropical humid conditions (HDF-BL MR2)

Requirements for HDF-BL MR2 fibreboard are listed in Table 38.

Table 38 — Requirements for HDF-BL MR2 fibreboard

Property	Test method	Units	Requirement Thickness ranges mm, nominal	
			>6,0 to ≤9,0	>9,0 to ≤12
Bending strength (MOR)	ISO 16978	MPa	30	30
Modulus of elasticity (MOE)	ISO 16978	MPa	2 500	2 500
Internal bond strength	ISO 16984	MPa	0,50	0,50
24 h thickness swelling	ISO 16983	%	11	8
Moisture resistance — Wet bending strength	ISO 20585 Method A	MPa	15	15

13 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:

a) the manufacturer's name, trademark or identification mark specific to the production facility;

b) a reference to this International Standard, i.e. ISO 16895;

c) the panel type, e.g. MDF-FN MR1;

d) the nominal thickness;

e) the formaldehyde classification;

f) the batch number or production week and year;

g) the additional attributes such as resistance to fire, insects or decay.

Annex A
(normative)

Calculation of 5-percentile and 95-percentile values

A.1 General

This Annex specifies a method of calculating the 5-percentile and 95-percentile values, as given in A.3.

A.2 Notation symbols

Some general notation symbols used in this Annex are as follows.

m number of test pieces cut from each single panel of the sample, in each direction

n number of panels taken as sample, i.e. size of the sample

$x_{5\ \%}$ lower 5-percentile values of the sample

s estimate of the standard deviation calculated from test values or measurements

$s_{w,j}$ estimate of the standard deviation within a panel, j, of the sample

$s_{\bar{x}}$ estimate of the standard deviation between panel means

$\bar{s}_w$ estimate of the mean standard deviation between panels

t_n single-sided 5 %-t-value of a normally distributed sample of n panels (see Table A.1)

$x_{95\ \%}$ upper 95-percentile values of the sample

x_{ij} single test value or measurement

$\bar{x}_j$ mean value (arithmetic mean) of the m single test values, or measurements, obtained from a single panel, j

$\bar{\bar{x}}$ grand mean, i.e. mean value (arithmetic mean) of all ($m \times n$) test values, or measurements, obtained from a sample

A.3 Calculations

A.3.1 Mean value of each individual panel (panel mean)

For each group of test pieces, or measurements, the mean value of each individual panel shall be calculated in accordance with Formula (A.1).

$$\bar{x}_j = \sum_{i=1}^{m} x_{ij} / m \qquad \text{(A.1)}$$

A.3.2 Standard deviation within each panel

For each group of test pieces, or measurements, the standard deviation within each panel shall be calculated in accordance with Formula (A.2).

$$s_{w,j} = \sqrt{\sum_{i=1}^{m} (x_{ij} - \bar{x}_j)^2 / (m-1)} \quad \text{(A.2)}$$

A.3.3 Grand mean (mean of panel means)

The grand mean of all test pieces, or all of a group of test values from the sample shall be calculated in accordance with Formula (A.3).

$$\bar{\bar{x}} = \sum_{j=1}^{n} \sum_{i=1}^{m} x_{ij} / mn = \sum_{j=1}^{n} \bar{x}_j / n \quad \text{(A.3)}$$

A.3.4 Standard deviation of panel means

The standard deviation between panel means shall be calculated in accordance with Formula (A.4).

$$\bar{s}_w = \sqrt{\sum_{j=1}^{n} (\bar{x}_j - \bar{\bar{x}})^2 / (n-1)} \quad \text{(A.4)}$$

A.3.5 Mean standard deviation of the test values within panels

The mean standard deviation of the test values within panels shall be calculated in accordance with Formula (A.5).

$$\bar{s}_w = \sum_{j=1}^{n} \bar{s}_{w,j} / n \quad \text{(A.5)}$$

A.3.6 5- and 95-percentile of a normally distributed panel property

The 5-percentile of a normally distributed panel property shall be calculated in accordance with Formulae (A.6) and (A.7).

$$x_{5\%} = \bar{\bar{x}} - t_n \, s_{\bar{x}} \quad \text{(A.6)}$$

$$x_{95\%} = \bar{\bar{x}} + t_n \, s_{\bar{x}} \quad \text{(A.7)}$$

Table A.1 — Single-sided *t*-values in relation to the sample size, *n*

Sample size, *n*	4	6	8	10	12	15	20	25	30	35	40	60	100
t_n	2,35	2,02	1,89	1,83	1,80	1,76	1,72	1,71	1,70	1,69	1,68	1,67	1,65
NOTE t_n values for sample sizes between those in Table A.1 may be determined by linear interpolation.													

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