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# Wood-based panels — Oriented strand board (OSB) — Definitions, classification and specifications

*Panneaux à base de bois — Panneaux de lamelles minces, longues et orientées (OSB) — Définitions, classification et spécifications*

Reference number
ISO 16894:2009(E)

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# Foreword

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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.

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ISO 16894 was prepared by Technical Committee ISO/TC 89, *Wood-based panels*, Subcommittee SC 2, *Particle boards*.

# Wood-based panels — Oriented strand board (OSB) — Definitions, classification and specifications

## 1 Scope

This International Standard gives definitions, classifications and specifications for the manufacturing requirements of oriented strand board (OSB). The values given are used to classify OSB into one of four types, namely OSB type GP-REG, LB-REG, LB-MR or HLB-MR. The values are related to panel properties, but are not characteristic values to be used for design purposes.

NOTE 1 When OSB characteristic strength and stiffness values are required for design purposes, the properties can be established based on testing in accordance with ISO 16572, ASTM D7033-07 or EN 789.

NOTE 2 For specific load-bearing applications, such as walls, roofs, floors, I joist webs, the load-bearing OSB can meet the specific performance requirements for that intended application, in addition to the requirements of this International Standard.

NOTE 3 Information on supplementary properties is given in Annex C.

NOTE 4 This International Standard is the reference for OSB classifications and specifications. Other regional or national standards covering the performance of wood structural panels are given in the bibliography.

## 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 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 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 17064:2004, *Wood-based panels — Fibreboard, particleboard and oriented strand board (OSB) — Vocabulary*

# 3 Terms, definitions and abbreviated terms

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

## 3.1 Terms and definitions

**3.1.1**
**oriented strand board**
**OSB**
multi-layered board made from strands of wood of predetermined shape and thickness, together with a binder, by the application of heat and pressure, with the strands in the external layers aligned and parallel to the board length or width

NOTE Adapted from ISO 17064:2004, definition 2.3.

**3.1.2**
**major axis**
direction in the plane of the board, in which the bending properties have the higher values

**3.1.3**
**minor axis**
direction in the plane of the board at right angles to the major axis

**3.1.4**
**general purpose**
**GP**
non-load-bearing applications, interior fitments and furniture

**3.1.5**
**load-bearing**
**LB**
denotes a structural or designed application, such as building elements or use as a component in a structural element such as the webs of I-joists

NOTE Examples of building elements are walls, roof and floor.

**3.1.6**
**heavy duty load-bearing**
**HLB**
special load-bearing grade of OSB with increased properties for more demanding applications

**3.1.7**
**strand**
manufactured wood element of a predetermined shape with an average length of more than 50 mm and average thickness less than 2 mm

**3.1.8**
**regular**
**REG**
product suitable for applications in dry conditions

**3.1.9**
**moisture resistant**
**MR**
product suitable for applications involving humid conditions

### 3.2 Abbreviated terms

The following abbreviated terms apply.

| | | |
|---|---|---|
| regular | REG | for dry conditions only |
| moisture resistant | MR | for humid conditions |
| load bearing | LB | structural or load bearing |
| general purpose | GP | for applications not requiring the specific properties of furniture or load-bearing grades |
| heavy duty load-bearing | HLB | for humid conditions |

## 4 Classification of the OSB

Four types of board are classified and are distinguished as follows:

a) OSB GP-REG general purpose non-load-bearing OSB for interior fitments for use in dry conditions;

b) OSB LB-REG load-bearing OSB for use in dry conditions;

c) OSB LB-MR load-bearing OSB for use in humid conditions;

d) OSB HLB-MR heavy duty load-bearing OSB for use in humid conditions.

## 5 General requirements of all OSB types

All OSB types shall comply with the general requirements listed in Table 1 when dispatched from the producing factory.

**Table 1 — General requirements for all OSB types**

| No. | Property | Test method | Requirements |
|---|---|---|---|
| 1 | Tolerances on nominal dimensions | ISO 9426 | |
| | — thickness (sanded) within and between panels | | ± 0,3 mm |
| | — thickness (unsanded) within and between panels | | ± 0,8 mm |
| | — length and width | | ± 3,0 mm |
| 2 | Edge straightness tolerance | ISO 9426 | 1,5 mm/m |
| 3 | Squareness tolerance | ISO 9426 | 2,0 mm/m |
| 4 | Moisture content | ISO 16979 | 2 % to 12 % |
| 5 | Tolerance on the mean density within a board | ISO 9427 | ± 15 % |
| 6 | Formaldehyde release[ab] | | |
| | — emission value | ISO 12460-1 | 0,124 or less mg/m$^3$ |

[a] There are other tests which may be used to measure formaldehyde content or release (e.g. ISO 12460-3, ISO 12460-4 and EN 120, see Bibliography). These may be used, provided a correlation is established with the reference method, ISO 12460-1.

[b] OSB manufactured with phenolic and/or isocyanate resins have a history of low formaldehyde emission results, which meets the requirements of all International Standards.

## 6 Requirement values

The values given in Tables 2 to 7, and determined by the relevant test methods as listed in Clauses 7 to 10, shall be used for factory production control (FPC) purposes only and shall not be used in design calculations.

With the exception of the moisture resistance requirements in Tables 5 and 7 and swelling in thickness requirements in Tables 2, 3, 4 and 6, the values given in Tables 2 to 7 are characterized by moisture content in the material corresponding to a temperature of 20 °C and a relative humidity of the surrounding air of 65 %.

The values for the moisture resistance requirements in Tables 5 and 7 and swelling in thickness requirements in Tables 2, 3, 4 and 6 are characterized by moisture content in the material before the treatment corresponding to a temperature of 20 °C and a relative humidity of the surrounding air of 65 %.

The requirements in Tables 2 to 7 shall be met by the 5th percentile values (95th percentile values in the case of swelling in thickness), based on the mean values for individual panels and calculated in accordance with Annex A. In the case of swelling in thickness they shall be equal to or less than the values in the tables and in the case of all other properties, they shall be equal to or greater than the values given in the tables.

## 7 Requirements for general purpose non-load-bearing OSB for interior fitments for use in dry conditions (Type OSB GP-REG)

In addition to the requirements specified in Clause 5, this clause specifies the requirements for general purpose OSB, and OSB for interior fitments (including furniture), for use in dry conditions. Therefore, OSB of this type shall comply with the requirements given in Tables 1 and 2.

For definitions of values given in Table 2, see Clause 6.

**Table 2 — General purpose non-load-bearing OSB for interior fitments (including furniture) for use in dry conditions — Requirements for specified mechanical and swelling properties**

| Board type OSB GP-REG | Test method | Unit | Requirement | | |
|---|---|---|---|---|---|
| | | | Board thickness range nominal mm | | |
| Property | | | 6 to 10 | > 10 and < 18 | 18 to 25 |
| Bending strength — major axis | ISO 16978 | MPa | 20 | 18 | 16 |
| Bending strength — minor axis | ISO 16978 | MPa | 10 | 9 | 8 |
| Modulus of elasticity in bending — major axis | ISO 16978 | MPa | 2 500 | 2 500 | 2 500 |
| Modulus of elasticity in bending — minor axis | ISO 16978 | MPa | 1 200 | 1 200 | 1 200 |
| Internal bond | ISO 16984 | MPa | 0,30 | 0,28 | 0,26 |
| Swelling in thickness — 24 h | ISO 16983 | % | 25 | 25 | 25 |

## 8 Requirements for load-bearing OSB for use in dry conditions (Type OSB LB-REG)

In addition to the requirements specified in Clause 5, this clause specifies the requirements for load-bearing OSB for use in dry conditions. Therefore, OSB of this type shall comply with the requirements given in Tables 1 and 3.

For definitions of values given in Table 3, see Clause 6.

**Table 3 — Load-bearing OSB for use in dry conditions — Requirements for specified mechanical and swelling properties**

| Board type OSB LB-REG | Test method | Unit | Requirement | | | | |
|---|---|---|---|---|---|---|---|
| | | | Board thickness range nominal mm | | | | |
| Property | | | 6 to 10 | > 10 and < 18 | 18 to 25 | > 25 to 32 | > 32 to 40 |
| Bending strength — major axis | ISO 16978 | MPa | 22 | 20 | 18 | 16 | 14 |
| Bending strength — minor axis | ISO 16978 | MPa | 11 | 10 | 9 | 8 | 7 |
| Modulus of elasticity in bending — major axis | ISO 16978 | MPa | 3 500 | 3 500 | 3 500 | 3 500 | 3 500 |
| Modulus of elasticity in bending — minor axis | ISO 16978 | MPa | 1 400 | 1 400 | 1 400 | 1 400 | 1 400 |
| Internal bond | ISO 16984 | MPa | 0,34 | 0,32 | 0,30 | 0,29 | 0,26 |
| Swelling in thickness — 24 h | ISO 16983 | % | 20 | 20 | 20 | 20 | 20 |
| If it is known by the purchaser that the OSB is intended for specific use in flooring, walls or roofing, additional applicable performance requirements in the reference standards should be consulted (see Bibliography), as these additional requirements can apply. | | | | | | | |

## 9 Requirements for load-bearing OSB for use in humid conditions (Type OSB LB-MR)

### 9.1 General

In addition to the requirements specified in Clause 5, this clause specifies the requirements for load-bearing OSB for use in humid conditions. Therefore, OSB of this type shall comply with the requirements of Tables 1, 4 and 5.

For definitions of values given in Tables 4 and 5, see Clause 6.

### 9.2 Mechanical and swelling properties

**Table 4 — Load-bearing OSB for use in humid conditions — Requirements for specified mechanical and swelling properties**

| Board type OSB LB-MR | Test method | Unit | Requirement | | | | |
|---|---|---|---|---|---|---|---|
| | | | Board thickness range nominal mm | | | | |
| Property | | | 6 to 10 | > 10 and < 18 | 18 to 25 | > 25 to 32 | > 32 to 40 |
| Bending strength — major axis | ISO 16978 | MPa | 22 | 20 | 18 | 16 | 14 |
| Bending strength — minor axis | ISO 16978 | MPa | 11 | 10 | 9 | 8 | 7 |
| Modulus of elasticity in bending — major axis | ISO 16978 | MPa | 3 500 | 3 500 | 3 500 | 3 500 | 3 500 |
| Modulus of elasticity in bending — minor axis | ISO 16978 | MPa | 1 400 | 1 400 | 1 400 | 1 400 | 1 400 |
| Internal bond | ISO 16984 | MPa | 0,34 | 0,32 | 0,30 | 0,29 | 0,26 |
| Swelling in thickness — 24 h | ISO 16983 | % | 20 | 15 | 15 | 15 | 15 |
| If it is known by the purchaser that the OSB is intended for specific use in flooring, walls or roofing, additional applicable performance requirements in the reference standards should be consulted (see Bibliography), as these additional requirements can apply. | | | | | | | |

### 9.3 Moisture resistance

For the requirements for moisture resistance, three options are given in Table 5, corresponding to the three principal recognized methods of evaluation. The manufacturer shall show compliance with only one of these options.

a) The Option 1 requirements apply to OSB subjected to an accelerated aging test, called the cyclic test, in accordance with ISO 16987.

b) The Option 2 requirements apply to OSB subjected to the boil test in accordance with ISO 16998.

c) The Option 3 requirements apply to OSB subjected to an accelerated moisture cycle that has been used in national standards for OSB in North America[26].

For Option 1, there are two alternative sets of requirements, either through measuring the internal bond after the cyclic test (alternative A) or through measuring the bending strength after the cyclic test (alternative B). The manufacturer shall show compliance with only one of these two alternatives.

**Table 5 — Load-bearing OSB for use in humid conditions — Requirements for moisture resistance**

| **Board type OSB LB-MR** | **Test method** | **Unit** | **Requirement** | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Board thickness range** nominal mm | | | | |
| **Property** | | | **6 to 10** | **> 10 and < 18** | **18 to 25** | **> 25 to 32** | **> 32 to 40** |
| Option 1 — alternative A, internal bond after cyclic test | ISO 16987 | MPa | 0,18 | 0,15 | 0,13 | 0,10 | 0,08 |
| — alternative B, bending strength after cyclic test in major axis | ISO 16987 ISO 16978 | MPa | 9 | 8 | 7 | 6 | 6 |
| Option 2 — Internal bond after boil test | ISO 16998 | MPa | 0,15 | 0,13 | 0,12 | 0,06 | 0,05 |
| Option 3 — Bending strength after vacuum soak/re-dry cycle | Annex B | MPa | 16,5 | 15 | 13,5 | 12 | 10,5 |

## 10 Requirements for heavy duty load-bearing OSB for use in humid conditions (Type OSB HLB-MR)

### 10.1 General

In addition to the requirements specified in Clause 5, this clause specifies the requirements for heavy duty load-bearing OSB for use in humid conditions. Therefore, OSB of this type shall comply with the requirements of Tables 1, 6 and 7.

For definitions of values given in Tables 6 and 7, see Clause 6.

## 10.2 Mechanical and swelling properties

**Table 6 — Heavy duty load-bearing OSB for use in humid conditions — Requirements for specified mechanical and swelling properties**

| Board type OSB HLB-MR | Test method | Unit | Requirement | | | | |
|---|---|---|---|---|---|---|---|
| | | | Board thickness range nominal mm | | | | |
| Property | | | 6 to 10 | > 10 and < 18 | 18 to 25 | > 25 to 32 | > 32 to 40 |
| Bending strength — major axis | ISO 16978 | MPa | 30 | 28 | 26 | 24 | 22 |
| Bending strength — minor axis | ISO 16978 | MPa | 16 | 15 | 14 | 13 | 12 |
| Modulus of elasticity in bending — major axis | ISO 16978 | MPa | 4 800 | 4 800 | 4 800 | 4 800 | 4 800 |
| Modulus of elasticity in bending — minor axis | ISO 16978 | MPa | 1 900 | 1 900 | 1 900 | 1 900 | 1 900 |
| Internal bond | ISO 16984 | MPa | 0,50 | 0,45 | 0,40 | 0,35 | 0,30 |
| Swelling in thickness — 24 h | ISO 16983 | % | 12 | 12 | 12 | 12 | 12 |
| If it is known by the purchaser that the OSB is intended for specific use in flooring, walls or roofing, additional applicable performance reference standards in Annex C should be consulted as these requirements can apply. | | | | | | | |

## 10.3 Moisture resistance

For the requirements for moisture resistance, two options are given in Table 7 corresponding to the two principal recognized methods of evaluation. It is necessary for the manufacturer to show compliance with only one of these two options.

a) The Option 1 requirements apply to OSB subjected to an accelerated aging test, the cyclic test, in accordance with ISO 16987.

b) The Option 2 requirements apply to OSB subjected to the boil test in accordance with ISO 16998.

The glues or adhesive systems suitable for the application of either Option 1 or 2 are unrestricted.

For Option 1, there are two alternative sets of requirements, either through measuring the internal bond after the cyclic test (alternative A) or through measuring the bending strength after the cyclic test (alternative B). The manufacturer shall show compliance with only one of these two alternatives.

**Table 7 — Heavy duty load-bearing OSB for use in humid conditions — Requirements for moisture resistance**

| Board type OSB HLB-MR | Test method | Unit | Requirement | | | | |
|---|---|---|---|---|---|---|---|
| | | | Board thickness range nominal mm | | | | |
| Property | | | 6 to 10 | > 10 and < 18 | 18 to 25 | > 25 to 32 | > 32 to 40 |
| Option 1 — Alternative A, internal bond after cyclic test | ISO 16987 | MPa | 0,21 | 0,17 | 0,15 | 0,10 | 0,08 |
| Option 1 — Alternative B, bending strength after cyclic test in major axis | ISO 16987 and ISO 16978 | MPa | 15 | 14 | 13 | 6 | 6 |
| Option 2, internal bond after boil test | ISO 16998 | MPa | 0,17 | 0,15 | 0,13 | 0,06 | 0,05 |

## 11 Marking

In the case of all load-bearing types, each panel shall be clearly marked by the manufacturer using indelible direct printing and in the case of all non-load-bearing board types each panel or package shall be clearly marked by the manufacturer, either using indelible direct printing or 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 16894:2009;

c) the type of OSB, e.g. OSB LB-REG;

d) the nominal thickness;

e) the direction of the major axis (if not, the length of the panel);

f) formaldehyde information, if required by the national standard;

g) the batch number, or the production week and year;

h) any additional attributes, such as resistance to fire, insects or decay.

# Annex A
(normative)

# Calculation of the 5th percentile and 95th percentile values

## A.1 General

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

## A.2 Symbols

The general notation symbols are the following.

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

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

$x_{5\%}$ = lower 5th 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 95th 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

For each group of test pieces, or measurements, the mean value of each individual panel (panel mean) shall be calculated using Equation (A.1):

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

### 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 using Equation (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

The grand mean of all test pieces (mean of panel means), or all of a group of test values, from the sample, shall be calculated using Equation (A.3):

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

### A.3.4 Standard deviation of panel means

The standard deviation between panel means shall be calculated using Equation (A.4):

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

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

The standard deviation between panel means shall be calculated using Equation (A.5):

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

### A.3.6 The 5th and 95th percentile of a normally distributed panel property

The 5th percentile of a normally distributed panel property shall be calculated using Equation (A.6):

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

$$x_{95\%} = \bar{\bar{x}} + t_n \, s_{\bar{x}} \quad \text{[A.6 b)]}$$

**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 |

# Annex B
(normative)

# Alternative moisture cycle for moisture resistance

## B.1 General

The following moisture cycle test is a quality control method to accelerate bond degradation. Following moisture cycling, a mechanical test is generally performed.

## B.2 Specimen preparation

Specimen size and configuration shall depend upon the test method to follow moisture cycling. Those dimensions shall be used for strength calculations after cycling. For example the size of the bending specimen in accordance with ISO 16978 is 50 mm wide with the length defined as [(20 × nominal thickness) + 50] mm.

## B.3 Treatment of the test pieces

The following shall apply.

a) Pretreatment is not required.

b) The specimens shall be separated to ensure free movement of water and air around the specimens.

c) The specimens shall be placed in a vacuum-pressure vessel, which is filled with water at 66 °C (150 °F).

d) A vacuum of 50,6 kPa (15 in. of mercury) shall be drawn on the vessel for 30 minutes.

e) The vacuum shall be released and the specimens shall be allowed to soak in the water at atmospheric pressure for 30 minutes.

f) The vessel shall be drained and the specimens dried for at least 15 hours at 82 °C (180 °F) in an oven with fan-forced air recirculation of 45 air changes to 50 air changes per minute. The specimens shall be tested dry according to the appropriate test method.

# Annex C
(normative)

# Supplementary properties

For certain applications, information on some supplementary properties may be required. On request, this information shall be supplied by the manufacturer. Supplementary properties, together with the appropriate methods, are given in Table C.1.

**Table C.1 — Requirements for supplementary properties**

| Physical properties | Test method |
|---|---|
| Dimensional changes | ISO 16985 |
| **Mechanical properties** | |
| Screw withdrawal | ISO 27528 |
| Lateral nail resistance | CSA 0437 |
| Duration of load/creep | EN 1156 |
| Tension | ISO 16572 |
| Compression | ISO 16572 |
| Shear | ISO 16572 |
| Bending | ISO 16572 |
| Impact resistance | EN 1128 |
| **Performance properties** | |
| Floor | EN 1195 |
| Wall | EN 594+EN 596 |
| Roofing | ISO 16985 |
| NOTE Characteristic values for some of these properties are given in regional, industry or national standards, such as EN 12369-1, CSA 086-09 or APA Panel Design Specification (PDS). | |

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