
**Timber structures — Glued laminated
timber — Component performance and
production requirements**

*Structures en bois — Bois lamellé-collé — Performance des
composants et exigences de production*

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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 12578 was prepared by Technical Committee ISO/TC 165, *Timber structures*.

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Introduction

Glued laminated timber is obtained by bonding together a number of laminations with their grain essentially parallel. In this way, a member with a rectangular solid cross-section can be produced. Other non-rectangular shapes can also be produced.

The purpose of the requirements in this International Standard is to provide minimum production requirements, which, when coupled with applicable structural performance requirements, assure the in-service performance of the glued, laminated timber. It can be necessary to supplement the requirements to take into consideration special conditions, materials or functional requirements.

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Timber structures — Glued laminated timber — Component performance and production requirements

1 Scope

This International Standard specifies requirements for the components of glued laminated timber members and minimum requirements for the production of such members for structural use.

This International Standard is applicable to products with a finished lamination thickness of not more than 50 mm.

Although most glued laminated timber is made from coniferous species, this International Standard also applies to broad-leaf species if the tests specified in this International Standard show that a satisfactory glue bond can be achieved.

The basic requirements apply to structural members of all service classes; however, special precautions are necessary for service class 3, for example, the use of weather-resistant adhesives (see 5.3).

This International Standard does not apply to the determination of strength and stiffness characteristics (see EN 1194).

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2 Normative references

ISO 12578:2008

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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 8375, *Timber structures — Glued laminated timber — Test methods for determination of physical and mechanical properties*

ISO 9709, *Structural timber — Visual strength grading — Basic principles*

ISO 10983:1999, *Timber structures — Solid timber finger-jointing — Production requirements*

ISO 12579:2007, *Timber structures — Glued laminated timber — Method of test for shear strength of glue lines*

ISO 12580:2007, *Timber structures — Glued laminated timber — Method of test for glue-line delamination*

ISO 13912, *Structural timber — Machine strength grading — Basic principals*

EN 301, *Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 301, ISO 12579, ISO 12580 and the following apply.

3.1 adhesive types
adhesive types I and II are adhesives according to the respective durability classes in accordance with EN 301

3.2 glued laminated timber glulam
structural member formed by bonding together timber laminations with their grain running essentially parallel to the beam's longitudinal axis

3.3 horizontal glulam
glued laminated timber with the wide faces of the laminations perpendicular to the direction of the larger cross-sectional dimension

See Figure 1 a).

3.4 vertical glulam
glued laminated timber with the wide faces of the laminations perpendicular to the direction of the smaller cross-sectional dimension

See Figure 1 b).

3.5 service class
group designation characterized by the moisture content of the members corresponding to the temperature and relative humidity of the surrounding air

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3.5.1 service class 1
group designation characterized by a moisture content in the materials corresponding to a temperature of 20 °C and the relative humidity of the surrounding air exceeding 65 % for a few weeks per year

NOTE In service class 1, the average equilibrium moisture content of most softwoods does not exceed 12 %.

3.5.2 service class 2
group designation characterized by a moisture content in the materials corresponding to a temperature of 20 °C and the relative humidity of the surrounding air exceeding 85 % for a few weeks per year

NOTE In service class 2, the average equilibrium moisture content of most softwoods exceeds 12 % but is less than 20 %.

3.5.3 service class 3
group designation characterized by climatic conditions leading to moisture contents higher than service class 2, such as when a member is fully exposed to the weather

NOTE In service class 3, the average equilibrium moisture content of most softwoods exceeds 20 %.

3.6 maximum delamination percentage
maximum delamination length of one glue line in the test piece, measured on both end-grain surfaces of the test specimen multiplied by 100 and divided by the total length of glue lines on the two end-grain surfaces of each test piece for a single glue line in a test piece

Modified from ISO 12580:2007, 8.3.

3.7**total delamination percentage**

delamination length of all glue lines on the two end-grain surfaces in the test piece multiplied by 100 and divided by two times the length of one glue line

Modified from ISO 12580:2007, 8.2.

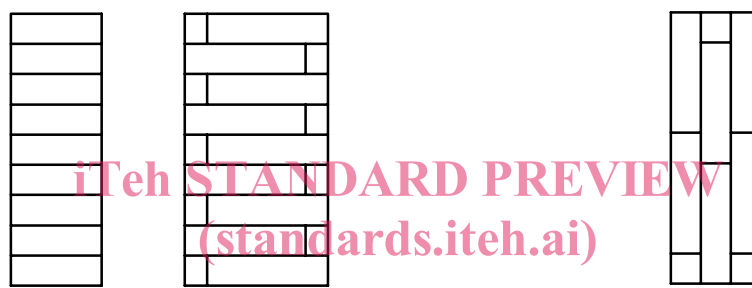
3.8**wood failure percentage**

percentage of the wood-failure area in relation to the total sheared area

ISO 12579:2007, 3.6

3.9**lamination**

piece or pieces of timber not more than 50 mm thick with or without end joints that form(s) part of a glulam member



ISO 12578:2008
 a) Horizontal glulam b) Vertical glulam
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Figure 1 — Glue lines in cross-sections showing the normal position of the glue lines

4 Symbols

| | |
|--------------|---|
| A | area, expressed in square millimetres |
| f_x | strength of a single end joint, expressed in megapascals |
| $f_{x,k}$ | characteristic strength of the end joints (5th percentile at 75 % confidence), expressed in megapascals |
| $f_{x,dc,k}$ | required characteristic strength of the end joints, expressed in megapascals |
| $f_{x,15,k}$ | characteristic strength of 15 tested end joints, expressed in megapascals |
| f_v | shear strength, expressed in megapascals |
| r | radius of curvature, expressed in millimetres |
| t_{fin} | finished thickness, expressed in millimetres |
| t_{lam} | lamination thickness, expressed in millimetres |
| x | subscript indicating bending or tension |

5 Component requirements

5.1 General

The grading of the timber shall result in reliable strength and stiffness properties in the laminations. The bonding operations shall result in reliable and durable bonds in end joints and between laminations.

5.2 Timber

The timber shall be graded in accordance with either ISO 9709 or ISO 13912. The strength and stiffness properties of the glued laminated timber shall be established in accordance with ISO 8375.

5.3 Adhesives

The adhesive shall enable joints of such strength and durability to be produced such that the integrity of the bond is maintained throughout the intended lifetime of the structure.

The adhesive shall be chosen considering the conditions in service, including climate, moisture conditions, exposure to elevated temperatures, the timber species, the preservative used (if any) and the production methods.

Adhesives of type I, as classified in accordance with EN 301, may be employed for structural members used in all service classes.

For structures in service classes 1 or 2, an adhesive of type II, as classified in accordance with EN 301, may be used, provided the temperature of the member in the structure is always below 50 °C.

Special precautions shall be taken for service class 3, for which weather-resistant adhesives shall be used. For structures in service class 3, the required strength and durability can be achieved by a phenolic- or aminoplastic-type poly-condensation adhesive classified as type 1 in accordance with EN 301.

For adhesives of types other than those covered by EN 301, a bond with an equivalent durability and strength shall be achieved. Structural-wood-adhesive standards, such as ASTM D2559 and CSA 0112.9, have provisions defining these strength and durability requirements.

5.4 End joints in laminations

The characteristic strength, $f_{x,k}$, (5th percentile at the 75 % confidence level) obtained from flat-wise bending or tension tests of the end joints shall meet the requirement of Equation (1):

$$f_{x,k} \geq f_{x,dc,k} \quad (1)$$

where $f_{x,dc,k}$ is the required characteristic strength of the end joint in flat-wise bending or tension to achieve the end-use beam performance, which shall be determined in accordance with a documented process in accordance with the applicable standard.

The tests shall be carried out as follows.

- a) Bending tests shall be carried out in accordance with ISO 10983:1999, 7.1.4.2.
- b) Tension tests shall be carried out in accordance with ISO 10983:1999, 7.1.4.3.

If the distribution is not known, the characteristic strength, $f_{x,k}$, shall be determined from the log-normal probability distribution function in accordance with ISO 10983.

5.5 Glue-line integrity and strength

5.5.1 The glue-line integrity shall be based on testing the glue line in a full cross-sectional specimen cut from the manufactured glulam member. The specimens shall be representative of the manufactured product and of any pre-gluing chemical treatment of the laminations. For all service classes, bond strength shall be determined using block-shear tests in accordance with ISO 12579. Delamination tests shall be performed based on the service class as specified in 5.5.2.

5.5.2 For structures of service class 3, delamination tests shall be made in accordance with methods A, B or D plus E of ISO 12580:2007.

For structures of service class 2, delamination tests shall be performed according to methods A, B, C or D plus E of ISO 12580:2007.

For structures of service class 1, delamination tests shall not be required.

For quality control, the test methods are specified in 7.3.2.

5.5.3 Depending on the method and number of cycles as required in ISO 12580, the total delamination percentage of each cross-sectional specimen shall be less than the values given in Table 1.

Table 1 — Maximum delamination

| Adhesive type | Delamination method | Delamination % | |
|---------------|---------------------|----------------|---------------|
| | | After cycle 1 | After cycle 2 |
| Type I | A | 5 | 10 |
| | B | 5 | 10 |
| | D | — | 5 |
| | E ^c | — | 5 |
| Type II | A ^d | 5 | 10 |
| | B ^d | 5 | 10 |
| | C | 5 | — |
| | D | 5 | — |
| | E ^c | 5 | — |

^a In accordance with EN 301.
^b In accordance with ISO 12580.
^c It is necessary that methods D and E be used together.
^d Methods A and B are not required for type II adhesives; but if they are used, the same delamination requirements apply as for type I adhesives.

For all delamination methods, the maximum delamination percentage of any single glue line shall be ≤ 20 %.

5.5.4 Each test result from the block-shear tests of each cross-sectional specimen performed in accordance with ISO 12579 shall comply with the following requirements with regard to the shear strength and wood-failure percentage (WFP).

The average glue-line shear strength shall be no less than 90 % of the shear strength of the unbonded wood of the same species. The average shear strength of all glue lines in a cross-section shall be at least 6 mPa. For coniferous wood, poplar and broad leaf species with a specific gravity of 0,5 or less, a shear strength of 4 mPa for all glue lines in a cross-section shall be regarded as acceptable if the wood-failure percentage is 100.