INTERNATIONAL STANDARD

ISO 12122-3

First edition
2016-07-01

Timber structures — Determination of characteristic values —

Part 3: Glued laminated timber

Structures en bois — Détermination des valeurs caractéristiques —

Partie 3: Exigences pour les bois lamellé-collé

Reference number
ISO 12122-3:2016(E)

© ISO 2016

COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

 © ISO 2016 – All rights reserved

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Symbols and abbreviated terms **1**
5 Reference population **1**
6 Sampling **2**
6.1 Sampling method 2
6.2 Sample size 2
7 Sample conditioning **2**
8 Test data **2**
8.1 Test method 2
8.2 Test data compatible with product description 3
8.3 Failure modes 3
9 Evaluation of characteristic values for structural properties **3**
9.1 Structural properties 3
9.2 Characteristic modulus of elasticity or stiffness 3
9.3 Characteristic values of strength or capacity 3
9.3.1 Characteristic bearing strength 3
9.3.2 Other characteristic values for strength or capacity based on the 5th percentile test value 3
10 Report **3**
Annex A (informative) **Commentary** **4**
Annex B (informative) **Analytical models for determining characteristic properties of glued laminated timber** **8**
Bibliography **9**

© ISO 2016 – All rights reserved

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 165, *Timber structures*.

ISO 12122 consists of the following parts, under the general title *Timber structures — Determination of characteristic values*:

— *Part 1: Basic requirements*

— *Part 2: Sawn timber*

— *Part 3: Glued laminated timber*

— *Part 4: Engineered wood products*[1)]

— *Part 6: Large components and assemblies*[1)]

The following parts are under preparation:

— *Part 5: Mechanical connections*

1) To be published.

© ISO 2016 – All rights reserved

Introduction

This part of ISO 12122 sets out a framework for establishing characteristic values from test results on a sample drawn from a clearly defined reference population of glued laminated timber. The characteristic value is an estimate of the property of the reference population with a consistent level of confidence prescribed in this part of ISO 12122.

This part of ISO 12122 is to be used in conjunction with ISO 12122-1.

This part of ISO 12122 permits the evaluation of characteristic values on testing on commercial sized specimens of glued laminated timber. Where the characteristic values are derived using calculations based on laminate structural properties, this part of ISO 12122 does not apply, but Annex B references other methods for estimating characteristic values.

In some cases, characteristic values determined in accordance with this part of ISO 12122 may be modified to become a design value.

This part of ISO 12122 has the following annexes:

— Annex A presents a commentary on this part of ISO 12122;

— Annex B presents information on analytical models for determining characteristic values of glued laminated timber.

© ISO 2016 – All rights reserved

Timber structures — Determination of characteristic values —

Part 3: Glued laminated timber

1 Scope

This part of ISO 12122 gives methods for the determination of characteristic values for a defined population of glued laminated timber products, calculated from test values.

It presents methods for the determination of

a) characteristic value of mean-based properties, and

b) characteristic value of 5th percentile-based properties.

NOTE Annex B gives information on the methods that have been successfully used to estimate the characteristic values of glued laminated timber products from properties of the laminates.

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

ISO 12122-1, *Timber structures — Determination of characteristic values — Part 1: Basic requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12122-1 and ISO 12578 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Symbols and abbreviated terms

Symbols defined in the relevant ISO product or test standard shall be used. Other symbols are defined in ISO 12122-1.

5 Reference population

In addition to the requirements for definition of the reference population in ISO 12122-1, the following attributes of glued laminated timber may be included:

a) sources of raw material;

© ISO 2016 – All rights reserved

b) seasoning method (if seasoned);

c) grading or production method for laminates including presence and frequency of finger joints;

d) layup of the glued laminated product;

e) specification of adhesives, method of application and method of curing adhesives;

f) quality control measures;

g) variations in the laminates (if any).

6 Sampling

6.1 Sampling method

The sampling method shall comply with the performance objective of sampling defined in ISO 12122-1.

Representation of each of the variants in the sample shall approximate the representation of the same variants in the reference population.

The sampling method shall be documented in the report as detailed in Clause 10 and this documentation shall indicate a response to each of the identified attributes of the reference population listed in compliance with Clause 5 and in ISO 12122-1 or otherwise important to the description of the reference population.

6.2 Sample size

The sample size shall comply with requirements of ISO 12122-1 and shall take into account the coefficient of variation (V) expected for the glued laminated timber in the reference population.

NOTE 1 See notes under the relevant clause in ISO 12122-1.

NOTE 2 ISO 12122-1 gives some guidance on selecting sample size.

7 Sample conditioning

The sample storage and testing environment shall reflect conditioning in accordance with the definition of the reference population as indicated in ISO 12122-1. Due to the large size of glued laminated timber, it is acceptable to test the sample at as-tested conditions provided that the results are adjusted in accordance with 8.2.

8 Test data

8.1 Test method

The test data shall be obtained from

a) ISO 8375, or

b) a standard test method appropriate for the glued laminated timber reference population provided equivalency factors with ISO 8375 can be established.

NOTE See notes under the relevant clause in ISO 12122-1.

Test methods involve many variables that will affect results including loading configuration and rates, specimen positioning and measurement methods. The level of precision of these variables should be appropriate to the objectives of the testing and the adjustments required in 8.2.

© ISO 2016 – All rights reserved

8.2 Test data compatible with product description

Where the characteristic value is applicable to a standard size or moisture content, adjustments to the raw test data may be required. Any adjustment shall be in accordance with ISO 12122-1 and shall be detailed in the report.

NOTE These adjustments include those required to pool data from different test programs as outlined in ISO 12122-1.

8.3 Failure modes

The failure modes obtained in the tests shall be recorded.

The data shall only be included in the analysis if it comes from a test in which the failure mode appropriate to the property was obtained.

NOTE The same test method may produce different failure modes on different products. The characteristic value may be underestimated by tests that produce failure modes that are different to ones that the test method was intended to produce.

9 Evaluation of characteristic values for structural properties

9.1 Structural properties

For glued laminated timber, determination of the characteristic values for structural properties shall be in accordance with ISO 12122-1 using data of material properties from glued laminated timber tests (see Annex A for more information).

NOTE Annex A gives guidance on the type of property that is appropriate for glued laminated timber.

9.2 Characteristic modulus of elasticity or stiffness

The characteristic modulus of elasticity or stiffness used for serviceability shall be the mean value taken as the average of the test values evaluated in accordance with ISO 12122-1, and in the case of its use in the ultimate limit state it shall be either the average or the 5th percentile value.

NOTE In some cases, where a reduction of modulus of elasticity or stiffness is not already factored into the behaviour equation used for design, a 5th percentile value of modulus of elasticity can be required to design for beam or column stability.

9.3 Characteristic values of strength or capacity

9.3.1 Characteristic bearing strength

The characteristic values for bearing strength, both parallel and perpendicular to grain, shall be the mean property obtained from results of tests.

9.3.2 Other characteristic values for strength or capacity based on the 5th percentile test value

The 75 % lower single-sided confidence limit of the test 5th percentile value shall be evaluated. Suitable methods for evaluating the 5th percentile value of the test data and estimating the 75 % lower single-sided confidence limit are presented in ISO 12122-1.

10 Report

The report shall comply with the requirements of ISO 12122-1.

© ISO 2016 – All rights reserved

Annex A
(informative)

Commentary

A.1 Commentary on scope

This part of ISO 12122 presents methods for determining characteristic values for glued laminated structural timber. It is to be used in conjunction with ISO 12122-1.

The part of ISO 12122 presents a uniform methodology for the evaluation of characteristic values that are consistent with the characteristic values found for other structural timber products.

The part of ISO 12122 does not establish methods for the determination of design values. These may be determined based on characteristic values from test data, but for glued laminated timber will also incorporate appropriate safety factors to account for any or all of the following factors.

— Expected changes in product or product properties over a long period. These changes could be due to variations in timber resource quality, production methods or adhesives.

— The complexity of the reference population. For example, where the reference population has a large number of producers who draw their resource over a large area, then the sampling may not effectively reflect all possible combinations of resource quality and production methods. In this way, the sample may not be truly representative and a safety factor may be applied to allow for that.

— Variations over time of the layup used for the glued laminated timber. These variations may include presence or frequency of finger joints.

— Anticipated variations in quality control across the reference population in the future.

Characteristic values presented in this part of ISO 12122 relate only to the determination of characteristic values from the results of tests on full-scale glued laminated timber products. The whole suite of ISO 12122 standards has this common basis. However, in many cases, the characteristic properties for glued laminated timber are estimated from calculation using models that relate the laminate properties to the properties of the composite beams. The scope of this part of ISO 12122 does not cover these methods, but Annex B contains information linking to some commonly accepted models for these calculations. This part of ISO 12122 can be used to verify such models using tests on full-scale glued laminated timber products.

A.2 Commentary on normative references

No commentary.

A.3 Commentary on terms and definitions

No commentary. (See ISO 12122-1).

A.4 Commentary on symbols

No commentary. (See ISO 12122-1).

© ISO 2016 – All rights reserved

A.5 Commentary on reference population

Characteristic values can be taken to represent the properties of the material from which the sample was taken. The reference population is the definition of the parent population to which the characteristic properties are said to apply. ISO 12122-1 presents some general requirements for definition of the reference population, but some other features are known to influence the structural properties of glued laminated timber.

— The properties of the wood that is the raw material for the glued laminated timber product may affect the properties of the final product. This means that the definition of the reference population should include all possible sources of wood for the product. This will also require sampling across the full range of raw material sources to ensure that the test sample is truly representative of the reference population.

— Temperature of seasoning may also have an influence on the structural properties of seasoned wood materials. Range of seasoning temperatures and the method of seasoning, which may relate to the speed of moisture removal, should be declared.

— Grading of raw material and production methods employed may also have a significant influence on the properties of the completed glued laminated timber products. In some cases, relatively small changes in grading (e.g. variation of laminate knot limits) may significantly affect some properties. Likewise, some manufacturing details may be critical to some product properties. These may include presence of finger-joints in outer laminations, sharpness of cutters for profiling finger joints or holding pressures and times for glued joints. Where a reference population may be drawn from plants that use a range of manufacturing processes, they should all be represented in the test sample.

— The behaviour of the adhesive under applied load is often crucial to product structural performance. Hence, any factor that may influence the strength of the adhesive shall be linked to the reference population. Where a range of adhesive specifications, handling and application methods or curing methods may be present in the reference population, these variations should be declared and care should be taken to ensure that they are all included in the representative sample.

— Quality control measures are often used to maintain various aspects of production that can affect structural properties. Specification of the quality control processes is an important consideration in defining the reference population. Ideally, all producers included in the reference population should have the same quality control measures, but where there are variations, these should all be included in the specification of the reference population.

— Where the product specification uses laminates of different grades used in different parts of the glued laminated beam, this should be declared as a characteristic of the reference population. All producers in the reference population should be using the same layup specification as it usually has a significant effect on the structural properties of the product.

Where the characteristic values are to be material properties (e.g. bending strength, f_m), it is possible that the reference population can include a range of sizes as the capacity of the different sized products can be evaluated using the different geometric parameters for each size. If this is the case, the size range in the reference population should be declared.

ISO 12122-1 refers to the period over which the product was manufactured. In some climates, the time of year can affect the properties of the raw materials or manufacturing processes in use.

The lists in ISO 12122-1 and in this part of ISO 12122 are examples, but the intent of the clause is that anything in the manufacture of the product that may affect the structural properties shall be included in the description.

© ISO 2016 – All rights reserved

A.6 Commentary on sampling

Where the reference population of the glued laminated timber products includes a number of different manufacturers or processes, care should be taken to ensure that all variations in raw material and production methods are included in the representative sample. Although glued laminated timber products may have lower coefficients of variation (V) within a product specification compared with other timber products, variations in raw materials or production methods may contribute to higher V for a whole reference population compared with product from a single manufacturer.

The list of features to be described in the reference population (from ISO 12122-1:2014; Clause 5 and A.5) can be used to derive a sampling program that will include all of the variations in the reference population.

Tests on glued laminated timber products with lower coefficients of variation than sawn timber can use smaller sample sizes. Guidance on sample size can be found in ISO 12122-1.

A.7 Commentary on sample conditioning

Most glued laminated timber products are seasoned. Samples shall be stored so that the moisture content remains within the requirements for the seasoned product.

Otherwise the requirements of ISO 12122-1 apply.

A.8 Commentary on testing

A.8.1 Commentary on test method

ISO 8375 presents test methods for most structural properties for glued laminated timber. Other properties can be tested in accordance with other recognized timber test international and national standards.

A.8.2 Commentary on test data compatible with product description

Adjustment of the test data to a reference size, moisture content or temperature may be required. Where this is performed, it shall comply with the requirements of ISO 12122-1.

For glued laminated timber, the characteristic properties often relate to a reference size, and hence where pooling of data on different sizes takes place, the data shall be corrected to the standard size. In order to do this, the guidelines on pooling in ISO 12122-1 should be carefully followed.

A.8.3 Commentary on failure modes

Where tests are aimed at a particular structural property, but a different failure mode has occurred, then the intended property may be underestimated by the test data.

An example is the test for flexural strength, f_m, may be performed, but shear failures or longitudinal glue line failures may be produced. In this case, the calculated flexural strength from the test is a lower bound on the true bending strength of the product.

Where the failure mode obtained in the test involved glue failures, this may indicate that the glue lines are not stronger than the timber, and as a result, calculation methods for the determination of characteristic values may not be valid and the product may not comply with the relevant product standard.

© ISO 2016 – All rights reserved

A.9 Commentary on evaluation of characteristic values for structural properties

A.9.1 Commentary on structural properties

Structural properties of glued laminated timber are generally presented as modulus of elasticity and strengths that shall be multiplied by a relevant geometric property for design.

— Strengths are presented in the same units as stress and multiplied by an area to give a force or a section modulus to give a moment as the section capacity.

— Modulus of elasticity (in the same units as stress) is used in the calculation of deformation under load.

Table A.1 — Classification of characteristic values for glued laminated timber

Characteristic value Characteristic properties	Basis	Typical units
Bending strength, f_m	5th percentile	MPa
Tension strength, $f_{t,0}$, parallel to grain	5th percentile	MPa
Compression strength, $f_{c,0}$, parallel to grain	5th percentile	MPa
Shear strength, f_s	5th percentile	MPa
Compression strength, $f_{c,90}$, perpendicular to grain	Mean (5th percentile)[a]	MPa
Tension strength, $f_{t,90}$, perpendicular to grain	5th percentile	MPa
Modulus of elasticity, E	Mean (5th percentile)[a]	MPa or GPa
Shear modulus, G	Mean (5th percentile)[a]	MPa

[a] Indicates that for some products, a 5th percentile value may be required in addition to the normal mean-based value.

A.9.2 Commentary on characteristic modulus of elasticity

No commentary. (See ISO 12122-1).

A.9.3 Commentary on characteristic values of strength

No commentary. (See ISO 12122-1).

A.10 Commentary on report

No commentary. (See ISO 12122-1).

© ISO 2016 – All rights reserved

Annex B
(informative)

Analytical models for determining characteristic properties of glued laminated timber

B.1 General

In some cases, the characteristic values of glued laminated timber can be calculated from the characteristic properties of the laminations. These models are statistically based and rely on the sharing of strength between the laminations that gives the completed section a higher characteristic strength than that of its laminations. These models are generally founded on the following principles.

— The glue joint may be required to be as strong as the timber in the lamination through the in-plant process control. Otherwise, the model should consider the strength of the glue joint in addition to the strength of the timber component.

— The properties of glued laminated timber are enhanced by the placement of laminating lumber in different location or orientation based on the principle of engineering mechanics.

— There are a large enough number of laminations to allow reinforcement of potential weaknesses in individual laminations by adjacent laminations on both the tension and compression side of the neutral axis.

B.2 Models

Several analytical models that have been successfully used in modelling selected mechanical properties of glued laminated timber are available from different countries or regions. While some models are stochastic and the others are deterministic in nature, most models are capable of predicting the characteristic property values of glued laminated timber in compliance with this part of ISO 12122.

© ISO 2016 – All rights reserved

Bibliography

ISO 12578, *Timber structures — Glued laminated timber — Component performance requirements*

© ISO 2016 – All rights reserved

ICS 91.080.20

Price based on 9 pages

© ISO 2016 – All rights reserved