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Timber structures — Wood-based panels — Test methods for structural properties

Structures en bois — Panneaux à base de bois — Méthodes d'essai pour la détermination des propriétés structurelles

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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 16572 was prepared by Technical Committee ISO/TC 165, *Timber structures*.

Introduction

For each type and grade of panel product, as defined (for example in a wood-based panel standard), it is necessary to determine characteristic values of structural properties to enable it to be used for structural purposes. This International Standard details the necessary testing, which may only need to be carried out once for each type and grade of product unless there is a reason to suspect a significant change has occurred in its properties.

This International Standard is not intended for quality control testing.

Timber structures — Wood-based panels — Test methods for structural properties

1 Scope

This International Standard specifies test methods for determining the structural properties of commercial wood-based and lignocellulosic fibrous panel products for use in load-bearing timber structures. These properties are intended for the calculation of characteristic values.

NOTE Bamboo is an example of a lignocellulosic fibrous material.

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 9424, *Wood-based panels — Determination of dimensions of test pieces*

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

ISO 16979, *Wood-based panels — Determination of moisture content*

3 Terms and definitions

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

3.1
knife check
separation of the fibres which does not extend through the thickness of the veneer

3.2
length
⟨wood-based panels⟩ long dimension of the test piece in the plane of the panel

3.3
specimen
⟨wood-based panels⟩ piece of the panel from which a test piece will be fabricated

3.4
test area
⟨wood-based panels⟩ that portion of the test piece from which the structural property is being evaluated

3.5
test piece
⟨wood-based panels⟩ specimen or aggregate of parts from a sample fabricated to the size and shape required for testing

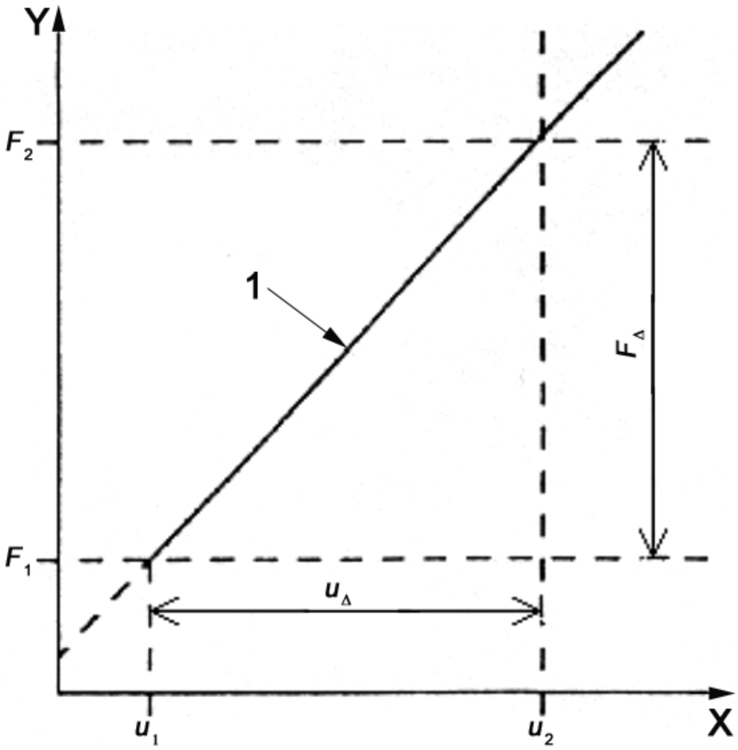
3.6
width
⟨wood-based panels⟩ short dimension of the test piece in the plane of the panel

4 Symbols and abbreviated terms

A	cross-sectional area of the test piece within the gauge length, equal to bt, in square millimetres
b	measured width of test piece, in millimetres
E	modulus of elasticity, in megapascals
F	load, in newtons
F_{max}	maximum load applied to the test piece, in newtons
F_{Δ}	increment of load on the linear portion of the load-deflection curve, in newtons (see Figure 1)
f	strength, in megapascals
G	modulus of rigidity, in megapascals
I_a	second moment of area, in millimetres to the fourth power
k	slope of the linear portion of the load versus deformation or deflection curve, in newtons per millimetre (see Figure 1)
l	length of test piece, in millimetres
l_1	gauge length, in millimetres
l_2	distance between an inner load point or line and the nearest support, in millimetres
M	moment, in newton millimetres
t	measured thickness of test piece, in millimetres
t_1	nominal thickness of the panel being tested, in millimetres
u	deflection or deformation, in millimetres
u_{Δ}	increment of deflection corresponding to F_{Δ}, in millimetres (see Figure 1)
W	section modulus, in millimetres to the third power

Subscripts applied to loads, capacities, strengths, stiffnesses, and moduli of elasticity:

app	apparent
c	compression
edge	edgewise
m	bending
s	planar shear
t	tension
true	true bending
v	panel shear



Key

X deflection or deformation

Y load

1 slope = k

NOTE Experience has demonstrated that suitable values of F_1 and F_2 are approximately 10 % and 40 % of F_{max}, respectively.

Figure 1 — Load-deflection or deformation graph within the linear range

5 Sampling

5.1 Sampling of panels

All panels in a sample shall be of the same type, grade, thickness range and composition and/or lay-up as defined in a standard or product specification. The sample shall be representative of the product as defined.

5.2 Sampling of specimens

The position of the specimens within the panels shall be selected to ensure the sampling of specimens is unbiased. The specimens for each type of test in each direction shall be from a different position in different panels of the same sample.

NOTE An example of a cutting schedule based on a sample of four panels, each with a minimum area of 1 200 mm × 2 400 mm, is given in Annex B.

6 Preparation of test pieces

6.1 Conditioning

6.1.1 Standard conditioning

With the exception of 6.1.2, all test pieces shall be conditioned to constant mass in an atmosphere of relative humidity (65 ± 5) % and temperature (20 ± 2) °C. Constant mass is deemed to be attained when the results of at least three successive weighings indicate the moisture content has stabilized to within ± 0,5 % for at least a 48 h period.

If the conditions of the testing room are not the same as those in the conditioning chamber, test pieces shall remain in the conditioning chamber until testing.

6.1.2 Alternative conditionings

Test pieces may be differently conditioned and/or unconditioned.

Unless otherwise noted in the test report, results from Clauses 7 to 11 shall be corrected to reflect conditioning as specified in 6.1.1. The procedure for correcting structural properties shall be technically sound, using moisture content results from 6.3, and shall be recorded in the test report.

6.2 Dimensions of test pieces

6.2.1 Method of measurement

The dimensions shall be determined in accordance with ISO 9424.

6.2.2 Measurements to be taken

The thickness of the test pieces shall be measured at the four corners of the test area and averaged. With the exception of panel shear, methods A and B, the width of the test pieces shall be measured at two points along each edge of the test area and averaged. The length of the test pieces for panel shear, method A, and planar shear, method A, tests shall be measured at two points along each edge of the test area and averaged. The length of the test pieces for panel shear, method B, shall be measured along the centreline of the test area (including the radius section), as shown in Figure 9.

If the thicknesses of individual plies or layers in plywood or composite panels are required, then each shall be measured to the nearest 0,1 mm at the four edges of the test piece and averaged.

6.3 Moisture content

6.3.1 Method of measurement

The moisture content shall be determined in accordance with the procedures of ISO 16979.

6.3.2 Measurements to be taken

The moisture content shall be determined from at least one test piece per panel and measured at the time of testing.

6.4 Density

6.4.1 Method of measurement

The density shall be determined in accordance with the procedures of ISO 9427.

6.4.2 Measurements to be taken

The density shall be determined from at least one test piece per panel and measured at the time of testing.

7 Bending properties

7.1 True bending properties flatwise

7.1.1 Test piece

The test piece shall be rectangular in cross-section. The depth of the test piece shall be equal to the thickness of the panel, and the width shall be not less than 300 mm. The total length of the test piece shall be the span between the supports plus an overhang sufficiently long to prevent the test piece from slipping off the supports during testing.

7.1.2 Loading equipment

The loading equipment shall be capable of measuring the load to an accuracy of 1 % of the maximum load.

7.1.3 Loading method

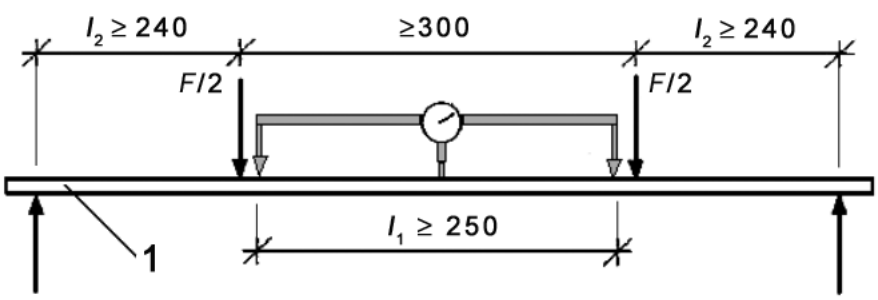
The application of the load shall be as shown in Figure 2, with minimum dimensions as noted. Contact points for loads and reaction forces shall be continuous across the width of the test piece and (30 ± 1) mm in diameter. The test hardware shall include appropriate mechanisms, such as rollers or pivots, to minimize the development of axial forces in the test piece and to allow the test piece to deflect freely under load. The application of the load shall create a zone of uniform bending moment between the load points, free of shear stresses.

The recommended distance for l_2 is $16t_1$ to preclude shear failures outside the zone of uniform bending moment.

NOTE 1 Large deflections may occur when test pieces with small bending stiffness are tested to failure, thus alternative test arrangements may be required. In general, the test configuration described in this subclause is suitable for a test piece with a thickness greater than 9 mm (corresponding to a bending stiffness per unit width of about 300 kN·mm^2/mm). Smaller thicknesses may be tested by using smaller-diameter supports and proportionally reducing the distances between them.

NOTE 2 Thick and/or wide test pieces may require larger-diameter supports.

Dimensions in millimetres



Key

1 test piece

Figure 2 — True bending modulus of elasticity and stiffness test configuration

7.1.4 Test procedure

7.1.4.1 Rate of application of load

The load, F, shall be applied at a constant rate so that the maximum load is reached within (300 ± 120) s.

7.1.4.2 Measurement of length and deformation

The lengths l_1 and l_2 shall be measured to the nearest 1 mm. The deflection of the test piece shall be measured between two parallel lines, perpendicular to the span, located in the zone of uniform moment, as shown in Figure 2. This distance (the gauge length) shall be not less than 250 mm. Deflection measurements may be referenced relative to the top or bottom of the test piece. Test pieces exhibiting excessive twist/warp may require two points of deflection measurement, in which case the average of the two readings shall be used in the calculations. The deflection over the gauge length shall be measured to the nearest 0,01 mm.

For t_1 less than 9 mm thick, the minimum 250 mm gauge length may be proportionally reduced, but should be as large as possible while maintaining adequate clearance between the gauges and the loading equipment.

7.1.5 Expression of results

7.1.5.1 True modulus of elasticity and bending stiffness

The true bending modulus of elasticity of the test piece shall be calculated from the linear portion of the load versus deflection graph, as given in Equation (1) or (2):

$$E_{\text{m,true}} = \frac{F_\Delta l_1^2 l_2}{16 u_\Delta I_\text{a}} \tag{1}$$

or

$$E_{\text{m,true}} = \frac{k l_1^2 l_2}{16 I_\text{a}} \tag{2}$$

The true bending stiffness, $E_{\text{m,true}} I_\text{a}$, of the test piece shall be calculated from the linear portion of the load versus deflection graph, as given in Equation (3) or (4):

$$E_{\text{m,true}} I_\text{a} = \frac{F_\Delta l_1^2 l_2}{16 u_\Delta} \tag{3}$$

or

$$E_{\text{m,true}} I_\text{a} = \frac{k l_1^2 l_2}{16} \tag{4}$$

7.1.5.2 Bending strength and moment capacity

The bending strength of the test piece shall be calculated as given in Equation (5):

$$f_{\text{m,true}} = \frac{F_{\text{max}} l_2}{2W} \tag{5}$$

The moment capacity of the test piece shall be calculated as given in Equation (6):

$$M_{\text{max,true}} = \frac{F_{\text{max}} l_2}{2} \tag{6}$$