
**Physical and mechanical properties of
wood — Test methods for small clear
wood specimens —**

Part 5:
**Determination of strength in
compression perpendicular to grain**

*Propriétés physiques et mécaniques du bois — Méthodes d'essais sur
petites éprouvettes de bois sans défauts —*

*Partie 5: Détermination de la résistance en compression
perpendiculaire au fil*





COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents		Page
Foreword		iv
Introduction		v
1 Scope		1
2 Normative references		1
3 Terms and definitions		1
4 Principle		1
5 Apparatus		1
6 Preparation of test pieces		2
6.1 General		2
6.2 Dimensions of test pieces		2
6.3 Moisture content of test pieces		2
7 Procedure		2
8 Calculation and expression of results		3
9 Test report		5

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 of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 218, *Timber*.

This first edition of ISO 13061-5 cancels and replaces ISO 3132:1975, which has been technically revised. The main changes are as follows:

- sizes, moisture content of test pieces and adjustment for moisture content have been technically revised;
- some sentences were reconstructed for clarity.

A list of all parts in the ISO 13061 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The main purpose of this document is to establish the common standard concerning testing methods for small clear wood specimens and general requirements for determining physical and mechanical properties of wood.

Physical and mechanical properties of wood — Test methods for small clear wood specimens —

Part 5: Determination of strength in compression perpendicular to grain

1 Scope

This document specifies a method for determining the strength in compression perpendicular to grain of wood.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3129, *Wood — Sampling methods and general requirements for physical and mechanical tests*

ISO 13061-1, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 1: Determination of moisture content for physical and mechanical tests*

ISO 13061-2, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 2: Determination of density for physical and mechanical tests*

ISO 24294, *Timber — Round and sawn timber — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24294 apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Principle

The strength in compression perpendicular to grain is determined by the application of a gradually increasing load to the whole surface of the test piece in the radial or tangential direction or at an angle of 45° with the direction of the growth rings and estimating the stress at the proportional limit from the load-deformation diagram.

5 Apparatus

5.1 Testing machine, capable of ensuring a constant rate of loading of the test piece or of movement of the loading head and allowing the measurement of the load to a precision of 1 %.

5.2 Uniform-loading device, consisting of at least one self-aligning plate of hardened steel, whose spherical surface is in contact to provide a uniform distribution of load over the surface of the test piece.

5.3 Displacement measuring device, capable of measuring the deformation of the test piece during loading to the nearest 0,01 mm.

5.4 Measuring instrument, capable of measuring the dimensions of the test piece to the nearest 0,1 mm.

5.5 Equipment for the determination of moisture content and density, which shall be in accordance with ISO 13061-1 and ISO 13061-2, respectively.

6 Preparation of test pieces

6.1 General

The sampling and preparation of test pieces shall be in accordance with ISO 3129.

6.2 Dimensions of test pieces

Test pieces shall be prepared in the form of rectangular prisms with a square or rectangular cross-section having the dimensions of breadth, b × height, h × length, l , where the height, h , is from 20 mm to 50 mm in the direction of the applied load perpendicular to grain, the length, l , along the grain is 1,5 to 3 times the height, h , and the breadth, b , is not less than one half of the height, h . When testing wood with growth rings more than 4 mm wide or any tropical wood, the cross-sectional dimensions shall be increased so that the test piece contains at least five growth rings, or has a square or rectangular cross-section perpendicular to the grain with the smallest side not less than 50 mm.

6.3 Moisture content of test pieces

6.3.1 Test pieces can be tested in green or in air-dry condition.

6.3.2 The moisture content of test pieces tested in green condition shall be equal to or exceed the fibre saturation point (FSP).

6.3.3 Test pieces tested in air-dry condition shall be conditioned to a constant mass in an atmosphere with a relative humidity of (65 ± 5) % and a temperature of (20 ± 2) °C.

NOTE Constant mass is considered to be reached when the results of two successive weighing operations, carried out at an interval of 8 h, do not differ by more than 0,2 % of the mass of the test piece.

6.2.4 After preparation, the test pieces shall be stored under conditions, which ensure that their moisture content remains unchanged before testing.

7 Procedure

7.1 Measure the breadth, height and length of the test piece to the nearest 0,1 mm.

7.2 Determine the density of the test piece in accordance with ISO 13061-2 using dimensions measured prior to the loading as the volume of the test piece changes after the test.

7.3 Load the test piece using the testing machine with loading platens covering the whole surface of the test piece placed in the centre. The load direction can be radial or tangential or at an angle of $\sim 45^\circ$ with the direction of the growth rings of the test piece.

7.4 The load shall be applied continuously at a constant rate of loading or a constant rate of movement of the loading head such that the proportional limit is reached in not less than 1,0 min and not more than 5 min after the start of loading.

7.5 When using a testing machine without an accurate recording device, a displacement measuring device shall be used to determine the deformation of the height, h , of the test piece along the compression load direction to the nearest 0,01 mm at equal intervals of load increase. The interval shall be at least 10 times smaller than the load corresponding to the proportional limit.

NOTE Load intervals of 200 N for wood of lower density and 400 N for wood of higher density can be used for test pieces of the smallest dimensions.

7.6 Continue the test until the total deformation in the load direction has exceeded 5 % of the height of the test piece.

7.7 As soon as the test has been completed, cut the central portion of the tested piece for the determination of the moisture content according to ISO 13061-1.

8 Calculation and expression of results

8.1 The load corresponding to the proportional limit shall be determined from the load-deformation diagram as follows.

The load corresponding to the proportional limit shall be determined as the ordinate of the point where the tangent of the angle formed by the load axis with the tangent to the load-deformation curve is 50 % greater than its value in the linear portion of the diagram (see [Figure 1](#)).

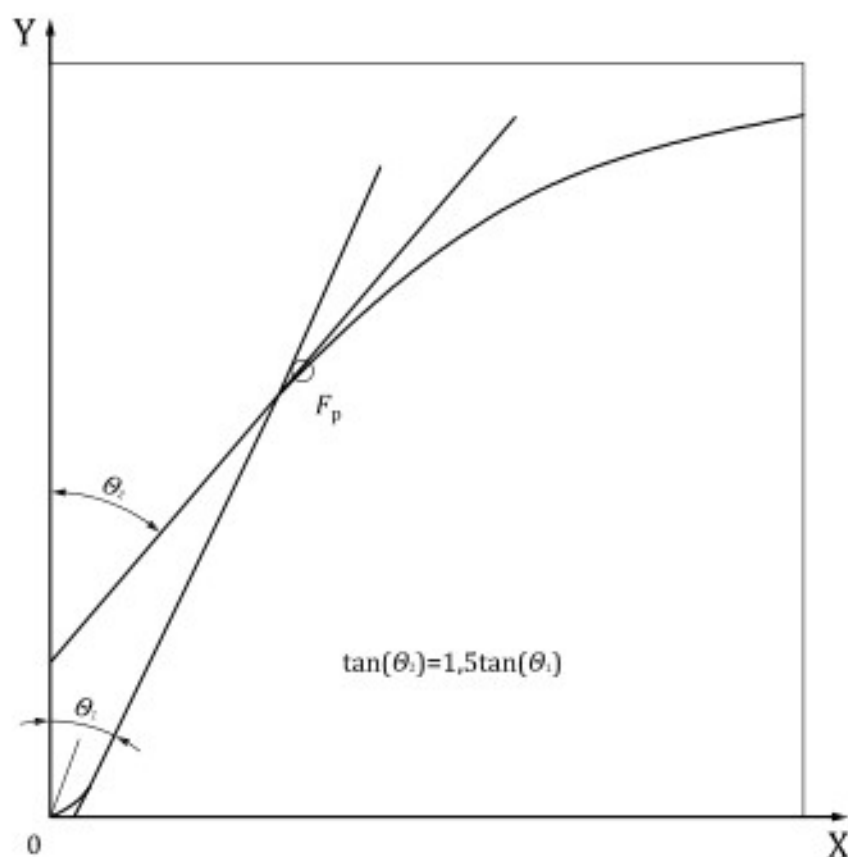
**Key**X deformation, θ , in degreesY load, F , in N

Figure 1 — Scheme for determining the load at the proportional limit from the load-deformation diagram

8.2 The proportional limit stress in compression perpendicular to the grain, $\sigma_{p,W}$, at the moisture content, W , at the time of test, shall be calculated, in N/mm^2 (MPa), using the following [Formula \(1\)](#):

$$\sigma_{p,W} = \frac{F_p}{A} \quad (1)$$

where

F_p is the load corresponding to the proportional limit, in N;

A is the bearing area, in mm^2 , $A = b \times l$ (b and l are, respectively, the breadth and length of the test piece, in mm).

The results shall be expressed to the nearest $0,1 \text{ N/mm}^2$ (MPa).

8.3 When required, the proportional limit stress, $\sigma_{p,W}$, shall be adjusted to a 12 % moisture content to the nearest $0,1 \text{ N/mm}^2$ using nationally or internationally recognized method.

NOTE An approximate adjustment of the proportional limit stress to a 12 % moisture content can be done using the following formula, which is valid for moisture contents of $(12 \pm 5) \%$:

$$\sigma_{12} = \sigma_W [1 + \alpha(W - 12)] \quad (2)$$

where

- α is the correction factor for the moisture content, whose value shall be obtained from national standards or an internationally recognized method;
- W is the moisture content of the wood, determined according to ISO 13061-1.

8.3 The mean and the standard deviation of the results obtained for the individual test pieces in a sample shall be calculated to a precision of 0,1 N/mm² (MPa).

9 Test report

The test report shall include the following information:

- a) a reference to this document, i.e. ISO 13061-5:2020;
- b) sampling details in accordance with ISO 3129;
- c) details concerning the sizes of the test pieces;
- d) time to reach the proportional limit;
- e) test results and their statistical values calculated as specified in [Clause 8](#);
- f) moisture content and density of wood of each test piece measured in accordance with ISO 13061-1 and ISO 13061-2, respectively;
- g) method used for the adjustment of the test results to a 12 % moisture content, if applicable;
- h) speed of testing;
- i) direction of application of load to growth ring orientation of the test piece;
- j) date when the test was carried out;
- k) name of the organization which carried out the test.

