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

Part 2:
Determination of density for physical and mechanical tests

Propriétés physiques et mécaniques du bois — Méthodes d'essais sur échantillons de bois sans défauts —

Partie 2: Détermination de la masse volumique en vue des essais physiques et mécaniques

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Foreword

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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. www.iso.org/directives

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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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 218, *Timber*.

This first edition of ISO 13061-2 cancels and replaces ISO 3131:1975, which has been technically revised with regards to the sizes of test pieces, precision of measurements and adjustment for moisture content.

ISO 13061 consists of the following parts, under the general title *Physical and mechanical properties of wood — Test methods for small clear wood specimens*:

— Part 1: *Determination of moisture content for physical and mechanical tests*

— Part 2: *Determination of density for physical and mechanical tests*

— Part 3: *Determination of ultimate strength in static bending*

— Part 4: *Determination of modulus of elasticity in static bending*

— Part 6: *Determination of ultimate tensile stress parallel to grain*

— Part 7: *Determination of ultimate tensile stress perpendicular to grain*

The following parts are under preparation:

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

— Part 10: *Determination of impact bending strength*

— Part 11: *Determination of resistance to impact*

— Part 12: *Determination of static hardness*

— Part 13: *Determination of radial and tangential shrinkage*

— Part 14: *Determination of volumetric shrinkage*

— Part 15: *Determination of radial and tangential swelling*

— Part 16: *Determination of volumetric swelling*

— Part 17: *Determination of ultimate stress in compression parallel to grain*

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Introduction

The main purpose of ISO 13061 is to establish test 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 2:
Determination of density for physical and mechanical tests

1   Scope

This part of ISO 13061 specifies a method for determining the density of wood for physical and mechanical tests on small clear wood specimens. It may also be used to determine density of test specimens for other physical or mechanical test and/or to determine the relationship between density and other properties of wood.

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 3129, *Wood — Sampling methods and general requirements for physical and mechanical testing of small clear wood specimens*

ISO 13061-1, *Physical and mechanical properties of wood - Test methods for small clear specimen — Part 1: Determination of moisture content 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 and the following apply.

3.1
wood density
mass of a unit volume of wood at specified moisture content

3.2
density in the absolutely dry condition (oven-dry density)
density based on oven-dry mass and oven-dry volume of a test piece

3.3
density at specified moisture content
density based on mass of a test piece including moisture and its volume at the same moisture content

3.4
basic (conventional) density
density based on oven-dry mass of a test piece and its green volume

3.5
green volume
volume of a test piece at moisture content greater than or equal to the fibre saturation point before any shrinkage occurs due to drying

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4   Principle

The density of wood is a ratio of mass to its volume (the mass of a test piece divided by its volume) at a certain level of moisture content. As the density varies with moisture content of wood, the conditions under which density is determined shall be specified. Wood density may be determined at oven-dry, partially dry, or green condition. For partially dry (or air-dry) wood, 12 % moisture content is frequently used as a reference. The term "Basic (conventional) density" is used when the mass of the test piece is determined at absolutely dry condition, i.e. oven-dry condition, but its volume is at moisture content greater than or equal to the fibre saturation point. The mass of the test piece is determined by weighing, and its volume by measurement of its dimensions, or by other method.

NOTE   The volume of irregularly shaped specimens can be determined by immersion in water or other liquid where the mass of displaced volume equals the volume of the test piece.

5   Apparatus

5.1   Measuring instrument, capable of measuring the dimensions (thickness, length and width) of the test pieces to the nearest 0,1 mm or to a precision of ± 0,3 %, whichever is greater.

5.2   Balance, capable of weighing to a precision of ± 0,2 % or less.

5.3   Equipment for the determination of moisture content, in accordance with ISO 13061-1.

6   Preparation of test pieces

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

6.2   Test pieces shall have a cross-section of at least 20 mm by 20 mm and minimum length along the grain of 20 mm and be made preferably in the form of rectangular prism. If the growth rings are more than 4 mm wide, the dimensions of the cross-section of the test piece shall be increased to include not less than five growth rings. For determination of the basic (conventional) density, test piece of any geometrical shape is permitted as long as the green volume may be easily measured. The minimum number of test pieces shall be in accordance with ISO 3129.

6.3   To determine the density of test pieces made for other physical or mechanical tests, and/or to determine the relationship between density and other properties of wood, the test pieces made for other tests or samples cut from them shall be used. The form, dimensions and method of taking samples depend on the form and dimensions of test pieces. At least one sample per test piece shall be taken near the point of interest (e.g. in the vicinity of the failure zone in destructive tests).

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

7   Procedure

7.1   Determination of density at the moisture content at the time of test.

7.1.1   Weigh each test piece to a precision of ± 0,2 % or less.

7.1.2   Measurement of dimensions

Measure the sides of the cross-section and the length of the test pieces along the axes of symmetry to the nearest 0,1 mm or to a precision of ± 0,3 %, whichever is greater. It is permitted to measure the volume

of the test pieces by another method to the nearest 0,01 cm^3 or to a precision of 0,3 %, whichever is greater.

7.1.3 Determination of moisture content

Determine the moisture content of the test pieces in accordance with ISO 13061-1. Take the whole test piece as a sample for the determination of moisture content.

7.2 Determination of density in the absolutely dry condition

Dry the test pieces in an oven gradually to a constant mass to minimize their distortion and splitting. After cooling down in a desiccator, perform the weighing and measuring operations as soon as possible, in accordance with 7.1.

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

7.3 Determination of basic density

The moisture content of test pieces shall be greater than or equal to the fibre saturation point so that no shrinkage occurs due to drying. If necessary, it is permitted to soak the test pieces in distilled water at room temperature until no changes in dimension occur. Measure the dimensions or volume of the test pieces according to 7.1.2, dry the test pieces according to 7.2 and weigh them according to 7.1.1.

8 Calculation and expression of results

8.1 The density, ρ_W, of each test piece at the moisture content W at the time of the test shall be calculated, in kg/m^3 (or g/cm^3), using the following formula:

$$\rho_W = \frac{m_W}{a_W \times b_W \times l_W} = \frac{m_W}{V_W} \tag{1}$$

where

m_W	is the mass, in kg (or g), of the test piece at moisture content W;
a_W, b_W and l_W	are the dimensions, in m (or cm), of the test piece at moisture content W;
V_W	is the volume, in m^3 (or cm^3), of the test piece at moisture content W.

The results shall be expressed to the nearest 5 kg/m^3 (or 0,005 g/cm^3).

When required, the density, ρ_W, shall be adjusted to a 12 % moisture content using nationally or internationally recognized method.

NOTE   The following formula can be used for adjustments of density if moisture content W is below the fibre saturation point:

$$\rho_{12} = \rho_W \frac{1 + 0,01(12 - W)}{1 + 0,01(12 - W)\dfrac{\rho_W}{\rho_{H_2O}}} \tag{2}$$

where

W	is the moisture content at the time of test, in percent;
ρ_{H2O}	is the density of water, 1000 kg/m^3 (or 1,000 g/cm^3).