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

Part 14:
**Determination of volumetric
shrinkage**

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

Partie 14: Détermination du retrait volumique



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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.

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 218, *Timber*.

This first edition of ISO 13061-14 cancels and replaces ISO 4858:1982, which has been technically revised with regards to the sizes, moisture content of test pieces and adjustment for moisture content.

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

Introduction

The main purpose of this document is to establish the common international point of member countries of the International Organization for Standardization (ISO), 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 14: Determination of volumetric shrinkage

1 Scope

This document specifies methods for the determination of volumetric shrinkage 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 testing of small clear wood specimens*

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:

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

4 Principle

This document specifies two methods, stereometric method and immersion method, for determining the volumetric shrinkage by measuring volume of a test piece before and after drying to a constant mass. The volume is calculated as a product of the linear dimensions of the test piece in stereometric method and measured as the volume of water displaced, or the mass of the water displaced in immersion method. The volumetric shrinkage is calculated as the change of the volume expressed as a percentage of the original volume. The initial measurements shall be taken on test pieces in green or fully saturated condition. The final measurements shall be taken on test pieces in absolutely dry (oven-dry) condition.

5 Stereometric method

5.1 Apparatus

5.1.1 Measuring instruments, capable of determining dimensions of the test piece to the nearest 0,02 mm, fitted with parallel flat ends, each of diameter 5 mm to 8 mm, and applying a clamping force which will not cause any deformation greater than the precision of the instrument.

5.1.2 A forced convection **oven** that can be maintained at a temperature of (103 ± 2) °C throughout the drying chamber for the time required to dry the specimen to the end point shall be used. The oven shall be vented to allow the evaporated moisture to escape.

5.1.3 Desiccator, a vapour-tight container with absorbent material (e.g. silica gel, calcium chloride, etc.) to maintain the air dry.

5.1.4 Vessel, containing distilled water.

5.1.5 Balance, accurate to 0,001 g.

5.2 Preparation of test pieces for stereometric method

5.2.1 General

The selection, preparation and the minimum number of test pieces shall be in accordance with ISO 3129.

5.2.2 Test pieces for determining volumetric shrinkage

Test pieces shall be cut from wood in green condition. Test pieces shall be made in the form of rectangular prisms, with the size of at least 20 mm in radial and tangential directions and at least 5 mm along the grain.

5.2.3 Inclination of annual rings of test pieces

The angle of inclination of annual rings to a pair of opposite radial faces of the test pieces shall not exceed 10°.

5.2.4 Marking of measurement points

Measurement points shall be marked at the middle of each surface of test piece. The centre points shall be marked on both faces of tangential and radial surfaces for determining the dimension in radial and tangential directions, respectively. Dimensions of the test pieces shall be measured between the marks at each stage of moisture conditions.

5.3 Procedure

5.3.1 Determination of the dimensions of test pieces in green or fully saturated condition

The moisture content of test pieces shall be considerably higher than the fibre saturation point (FSP). When the moisture content is below FSP, soak the test pieces in distilled water at a temperature of (20 ± 2) °C until no further change in dimensions occurs. Check the changes in dimensions every 3 d through repeated measurements at the same points until the difference between two successive measurements does not exceed 0,01 mm. In this case, it shall be reported that the results are obtained on test pieces which have been previously soaked. Measure the radial and tangential dimensions, l_{r1} and l_{t1} , of each test piece to an accuracy of 0,02 mm.

5.3.2 Determination of the dimensions of test pieces at absolutely dry (oven-dry) condition

After air-seasoning, the test pieces shall be open-piled and dried to constant weight at a temperature of (103 ± 2) °C in the oven, ensuring no checks distorting their dimensions and shape occur. Check the changes in weights of two or three control test pieces after 8 h of drying and repeat the measurements every 8 h or longer until the difference between two successive weighing does not exceed 0,2 % of the test pieces or when the difference between two successive measurements does not exceed 0,02 mm of the corresponding dimension of the test piece. Test pieces in which checks occurred during the test period shall be disregarded. Cool the test pieces to room temperature in the desiccator. Measure the radial and tangential dimensions, l_{r2} , and l_{t2} , of each test piece to an accuracy of 0,02 mm.

5.4 Calculation and expression of results

Calculate the total volumetric shrinkage, β_V , as a percentage by [Formula \(1\)](#):

$$\beta_V = \frac{(l_{r1} \times l_{t1}) - (l_{r2} \times l_{t2})}{l_{r1} \times l_{t1}} \times 100 \quad (1)$$

where

l_{r1} and l_{t1} are the dimensions, in millimetres, of the green or fully saturated test piece, measured in the radial and tangential directions, respectively;

l_{r2} and l_{t2} are the dimensions, in millimetres, of the test piece at absolutely dry (oven-dry) condition, measured in the radial and tangential directions, respectively.

Express the result to the nearest 0,1 %.

The mean and the standard deviation of the results obtained for the individual test pieces in a sample shall be calculated to an accuracy of 0,1 %.

6 Immersion method

6.1 Apparatus

6.1.1 A forced convection **oven** that can be maintained at a temperature of (103 ± 2) °C throughout the drying chamber for the time required to dry the specimen to the end point shall be used. The oven shall be vented to allow the evaporated moisture to escape.

6.1.2 Desiccator, a vapour-tight container with absorbent material (e.g. silica gel, calcium chloride, etc.) to maintain the air dry.

6.1.3 Vessel, containing distilled water.

6.1.4 Balance, accurate to 0,001 g.

6.2 Preparation of test pieces for immersion method

6.2.1 The selection, preparation and the minimum number of test pieces shall be in accordance with ISO 3129.

6.2.2 Test pieces for determining volumetric shrinkage by immersion method may be made in any shapes and shall be at least 4 cm³ in volume.

6.3 Procedure

6.3.1 Determination of the volume of test pieces in green or fully saturated condition

The moisture content of test pieces shall be considerably higher than the fibre saturation point (FSP). When the moisture content is below FSP, soak the test pieces in distilled water at a temperature of (20 ± 2) °C until no further change in volume occurs. Check the changes in volume every 3 d through repeated measurements until the difference between two successive measurements does not exceed 0,01 cm³. In this case, it should be reported that the results are obtained on test pieces which have been previously soaked. Measure the volume of each test pieces, V_1 , to an accuracy of 0,01 cm³ by measuring the volume of water displaced or by measuring the mass of the water displaced. The mass in grams is numerically equal to the volume in cubic centimetres.

6.3.2 Determination of the volume of test pieces at absolutely dry (oven-dry) condition

After air-seasoning, the test pieces shall be open-piled and dried to constant mass at a temperature of (103 ± 2) °C in the oven, ensuring no checks distorting their dimensions and shape occur. Check the changes in mass of two or three control test pieces after 8 h of drying and repeat the measurements at intervals of every 8 h or longer until the difference between two successive weighing does not exceed 0,2 % of the test pieces. Test pieces in which checks occurred during the test period shall be disregarded. Cool the test pieces to room temperature in the desiccator. Measure the volume, V_2 , of each test piece to an accuracy of 0,01 cm³. Care shall be taken to prevent the influence of water absorption on the volume measurement at absolutely dry (oven-dry) condition.

6.4 Calculation and expression of results

Calculate the total volumetric shrinkage, β_V , as a percentage, by [Formula \(2\)](#):

$$\beta_V = \frac{V_1 - V_2}{V_1} \times 100 \quad (2)$$

where

V_1 is the volume, in cubic centimetres, of the green or fully saturated test piece;

V_2 is the volume, in cubic centimetres, of the test piece at absolutely dry (oven-dry) condition.

Express the result to the nearest 0,1 %.

The mean and the standard deviation of the results obtained for the individual test pieces in a sample shall be calculated to an accuracy of 0,1 %.

7 Test report

The test report shall include the following information:

- a) a reference to this document, i.e. ISO 13061-14;
- b) the sampling details in accordance with ISO 3129;
- c) the details pertaining to measurements of test pieces;
- d) the test results and their statistical values calculated as specified in [5.4](#) and [6.4](#);
- e) the date when the test was carried out;
- f) the name of the organization which carried out the test.

Bibliography

- [1] ISO 24294, *Timber — Round and sawn timber — Vocabulary*

