INTERNATIONAL STANDARD 3131

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Wood — Determination of density for physical and mechanical tests

Bois — Détermination de la masse volumique en vue des essais physiques et mécaniques

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3131 was drawn up by Technical Committee ISO/TC 55, *Sawn timber and sawlogs*, and circulated to the Member Bodies in June 1973.

It has been approved by the Member Bodies of the following countries :

Australia	Germany	Poland
Austria	Hungary	Romania
Belgium	India	South Africa, Rep. of
Bulgaria	Ireland	Sweden
Canada	Italy	Thailand
Chile	Japan	Turkey
Czechoslovakia	Mexico	U.S.S.R.
Egypt, Arab Rep. of	Netherlands	Yugoslavia
France	Norway	

The Member Body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

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Wood — Determination of density for physical and mechanical tests

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the density (ratio of mass to volume) of wood for physical and mechanical tests both at the moisture content at the time of test and in the absolutely dry condition, as well as the conventional density (ratio of mass in the absolutely dry condition to volume of the test piece with moisture content greater than or equal to the fibre saturation point).

2 REFERENCES

ISO 3129, *Wood — Sampling methods and general requirements for physical and mechanical tests.*

ISO 3130, *Wood — Determination of moisture content for physical and mechanical tests.*

ISO . . ., *Wood — Determination of shrinkage and swelling.*[1)]

3 PRINCIPLE

Determination of the mass of the test piece by weighing and of its volume by measurement of its dimensions or by another method. Calculation of the mass of a unit volume of the wood.

4 APPARATUS

4.1 Measuring instrument capable of determining the dimensions of the test pieces to an accuracy of 0,1 mm.

4.2 Balance capable of weighing to an accuracy of 0,01 g.

4.3 Equipment for the determination of moisture content in accordance with ISO 3130.

5 PREPARATION OF TEST PIECES

5.1 Test pieces shall be prepared in the form of right prisms having a square cross-section of side 20 mm and length along the grain of 25 ± 5 mm. 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 conventional density, it is permitted to prepare the test piece of any geometrical shape the volume of which may be easily measured.

To determine the relation between ultimate strength and density, it is recommended that the density be determined on test pieces made for particular tests or on test pieces for the determination of density cut from them in the form of right prisms with the dimensions stated above.

5.2 The preparation, moisture content and number of test pieces shall be in accordance with ISO 3129.

6 PROCEDURE

6.1 Determination of density at the moisture content at the time of test

Determine the mass of the test pieces to an accuracy of 0,01 g. 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. The volume of the test pieces may be determined by another method to an accuracy of 0,01 cm^3. Determine the moisture content of the test pieces according to ISO 3130. Take the whole test piece as the sample for the determination of moisture content.

6.2 Determination of density in the absolutely dry condition

Dry the test pieces gradually to constant mass to minimize their deformation and splitting. Carry out the weighing and measuring operations immediately after drying, in accordance with 6.1.

6.3 Determination of conventional density

The moisture content of test pieces shall be greater than or equal to the fibre saturation point. The test pieces may be soaked in distilled water at room temperature until no changes in dimensions occur. Measure the dimensions or volume of the test pieces according to 6.1, dry the test pieces according to 6.2 and weigh them according to 6.1.

1) In preparation.

7 CALCULATION AND EXPRESSION OF RESULTS

7.1 The density ρ_W of each test piece at the moisture content W at the time of the test is given, in kilograms per cubic metre (or grams per cubic centimetre), by the formula :

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

where

m_W is the mass, in kilograms (or grams), of the test piece at moisture content W;

a_W, b_W and l_W are the dimensions, in metres (or centimetres), of the test piece at moisture content W;

V_W is the volume, in cubic metres (or cubic centimetres), of the test piece at moisture content W.

Express the result to the nearest 5 kg/m³ (or 0,005 g/cm³).

When required, the density ρ_W shall be adjusted to a 12 % moisture content by the formula valid for moisture content from 7 to 17 % :

$$\rho_{12} = \rho_W \left[1 - \frac{(1 - K)\,(W - 12)}{100} \right]$$

where K is the coefficient of volumetric shrinkage for a change in moisture content of 1 %. The value of K shall be that specified in national standards or shall be determined according to ISO . . .. For approximate calculations, the value of K can be taken as equal to $0{,}85 \times 10^{-3}\ \rho_W$ when the density is expressed in kilograms per cubic metre and $0{,}85\ \rho_W$ when the density is expressed in grams per cubic centimetre.

7.2 The density ρ_0 of each test piece in the absolutely dry condition is given, in kilograms per cubic metre (or grams per cubic centimetre), by the formula :

$$\rho_0 = \frac{m_0}{a_0 \times b_0 \times l_0} = \frac{m_0}{V_0}$$

where

m_0 is the mass, in kilograms (or grams), of the test piece in the absolutely dry condition;

a_0, b_0 and l_0 are the dimensions, in metres (or centimetres), of the test piece in the absolutely dry condition;

V_0 is the volume, in cubic metres (or cubic centimetres), of the test piece in the absolutely dry condition.

Express the result to the nearest 5 kg/m³ (or 0,005 g/cm³).

7.3 The conventional density, ρ_y, of each test piece is given, in kilograms per cubic metre (or grams per cubic centimetre), by the formula :

$$\rho_y = \frac{m_0}{a_{max} \times b_{max} \times l_{max}} = \frac{m_0}{V_{max}}$$

where

a_{max}, b_{max} and l_{max} are the dimensions, in metres (or centimetres), of the test piece at a moisture content greater than or equal to the fibre saturation point;

V_{max} is the volume, in cubic metres (or cubic centimetres), at a moisture content greater than or equal to the fibre saturation point.

Express the result to the nearest 5 kg/m³ (or 0,005 g/cm³).

7.4 Calculate, to an accuracy of 10 kg/m³ (or 0,01 g/cm³), the arithmetic mean of the results obtained for the individual test pieces and report this as the average value for the density of the test pieces.

8 TEST REPORT

The test report shall include the following particulars :

a) reference to this International Standard;

b) details concerning sampling of the test pieces;

c) details in accordance with clause 7 of ISO 3129,

d) the test results calculated as specified in clause 7, and their statistical values;

e) the value of coefficient K used for the adjustment of the test results to a 12 % moisture content.