INTERNATIONAL STANDARD ISO 3349

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Wood — Determination of modulus of elasticity in static bending

Bois — Détermination du module d'élasticité en flexion statique

First edition — 1975-12-15

UDC 674.03 : 539.32 : 531.224

Ref. No. ISO 3349-1975 (E)

Descriptors : wood, tests, bend tests, measurement, modulus of elasticity.

Price based on 3 pages

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 3349 was drawn up by Technical Committee ISO/TC 55, *Sawn timber and sawlogs*, and circulated to the Member Bodies in February 1974.

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

Belgium	Hungary	South Africa, Rep. of
Bulgaria	India	Spain
Canada	Ireland	Sweden
Czechoslovakia	New Zealand	Turkey
Egypt, Arab Rep. of	Norway	United Kingdom
Finland	Poland	U.S.S.R.
France	Romania	

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Germany
Netherlands

Printed in Switzerland

Wood — Determination of modulus of elasticity in static bending

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the modulus of elasticity of wood in static bending by measuring the deflection in the net bending area.

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.*

3 PRINCIPLE

Determination of the modulus of elasticity by measuring the deflection in the net bending area during the application to a test piece of a gradually increasing load within the region of proportionality of the load and deflection.

4 APPARATUS

4.1 Testing machine ensuring the rate of loading of the test piece or movement of the loading head according to 6.3 and allowing measurement of the load to an accuracy of 1 %.

4.2 Device for creation of a net bending area symmetrical in relation to the test piece length, consisting of two supports with two loading shoes between them. The distance between the supports shall be from 240 to 320 mm and that between the loading shoes shall be equal to 1/3 or 1/2 of the distance between the supports. The radius of curvature of the supports and shoes shall be 30 mm.

4.3 Instrument for measuring deflection of the test piece in the net bending area, consisting of

a) an arrangement for measuring linear movements to an accuracy of 0,001 mm;

b) a mechanism for fastening the arrangement on the neutral axis of the test piece and symmetrically in relation to the middle of its length, the distance between the points of fastening being equal to that between the loading shoes;

c) an arrangement fastened on the neutral axis of the test piece on the middle of its length to be used as the reference point from which the deflection of the test piece is read.

4.4 Measuring instrument for determining the cross-sectional dimensions of the test piece to an accuracy of 0,1 mm.

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

5 PREPARATION OF TEST PIECES

5.1 Test pieces shall be made in the form of right prisms with cross-section 20 mm × 20 mm and length along the grain from 300 to 380 mm.

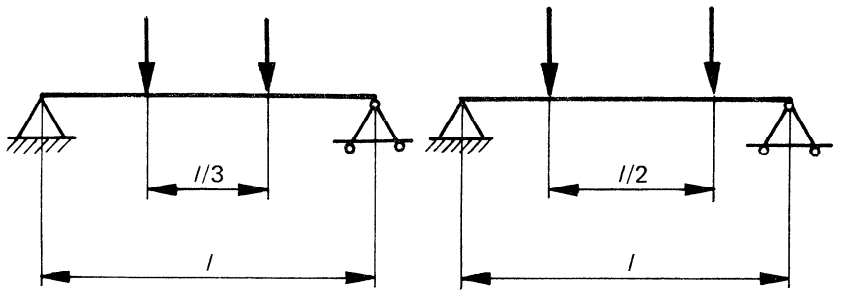
5.2 The preparation, moisture content and number of test pieces shall be in accordance with ISO 3129.

6 PROCEDURE

6.1 In the middle of the test piece length, measure the width in a radial direction and height in a tangential direction to an accuracy of 0,1 mm.

6.2 Place the test piece, with the instrument for measuring deflection (4.3) fastened on its neutral axis, into the device for cross-sectional bending (4.2). The bending force shall be directed perpendicular to the radial surface of the test piece (tangential bending) (see figure).

Dimensions in millimetres



a) b)

FIGURE — **Schematic arrangement of test piece and bending device (4.2)**

6.3 Carry out the test at a constant rate of loading or constant speed of movement of the testing machine loading head to ensure loading of the test piece until the load on its surface layer reaches 18 MPa in 30 s. When the load reaches 18 MPa, decrease the load on the test piece to 5 MPa, then increase the load again up to 18 MPa and decrease it to 5 MPa. During the next four loadings, measure the deflection within a period of not more than 10 s at the moments when the load reaches 7 and 18 MPa, to the nearest 0,001 mm.

If, within the load range between 7 and 18 MPa, the deflection is not proportional to the load, change the upper and lower limits of loading so that the values obtained for the deflection lie within the rectilinear portion of the load-deformation diagram. Determine the rectilinear portion of the diagram from the results of previous tests of similar test pieces. In the case where the limit of proportionality is exceeded during the test, the test piece shall be excluded from the calculations.

6.4 After completing the test, determine the moisture content of the test pieces according to ISO 3130.

Take as the sample for determination of moisture content a central portion of the test piece about 30 mm long. To determine the mean moisture content of a lot, it is permissible to use only some of the test pieces.

The minimum number of test pieces for moisture content determination shall be in accordance with ISO 3129.

7 CALCULATION AND EXPRESSION OF RESULTS

7.1 The modulus of elasticity E_W of each test piece at a moisture content W at the moment of test is given, in gigapascals, by the following formulae :

a) when the distance between the loading shoes is equal to 1/3 of the distance between the supports

$$E_W = \frac{P l^3}{36\, b h^3 f}$$

b) when the distance between the loading shoes is equal to 1/2 of the distance between the supports

$$E_W = \frac{3\, P l^3}{64\, b h^3 f}$$

where

P is the load equal to the difference between the arithmetic means of the upper and lower limits of loading, in newtons;

l is the distance between the supports, in centimetres;

b and h are the cross-sectional dimensions in the radial and tangential directions respectively of the test piece, in millimetres;

f is the deflection in the net bending area equal to the difference between the arithmetic means of the results obtained in measuring the deflection at the upper and lower limits of loading, in millimetres.

Express the result to an accuracy of 0,1 GPa.

7.2 When necessary, the modulus of elasticity E_W shall be adjusted to a 12 % moisture content to an accuracy of 0,1 GPa according to the following formula which is valid for a moisture content of 12 ± 3 % :

$$E_{12} = \frac{E_W}{1 - \alpha\,(W - 12)}$$

where α is the correction factor for moisture content, whose value shall be obtained from national standards.

7.3 The average modulus of elasticity in static bending of the test pieces cut out from one piece of the selected material shall be calculated to an accuracy of 0,1 GPa as the arithmetic mean of the test results obtained on the individual test pieces.

8 TEST REPORT

The test report shall include the following particulars :

a) reference to this International Standard;

b) details in accordance with 6.4 of ISO 3129;

c) method of loading (the rate of loading or the rate of movement of the loading head);

d) description and volume of the material submitted (the stand and the number of trees sampled, the lot of sawn timber and the number of boards sampled);

e) distance between the loading shoes;

f) direction of application of the load on the test piece;

g) number of test pieces tested;

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

i) if necessary, value of the coefficient α used in 7.2 for the adjustment of the test results to a 12 % moisture content;

j) date when the test was carried out;

k) name of the organization which carried out the test.

This page intentionally left blank

This page intentionally left blank

This page intentionally left blank