SLOVENSKI STANDARD
SIST EN 408:1996

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Lesene konstrukcije - Konstrukcijski les in lepljen lameliran les - Ugotavljanje nekaterih fizikalnih in mehanskih lastnosti

Timber structures - Structural timber and glued laminated timber - Determination of some physical and mechanical properties

Holzbauwerke - Bauholz für tragende Zwecke und Brettschichtholz - Bestimmung einiger physikalischer und mechanischer Eigenschaften

Structures en bois - Bois massif et bois lamellé collé - Détermination de certaines propriétés physiques et mécaniques

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91.080.20	Lesene konstrukcije	Timber structures

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English version

Timber structures - Structural timber and glued laminated timber - Determination of some physical and mechanical properties

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 124 "Timber structures", the secretariat of which is held by DS.

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by July 1995 and conflicting national standards shall be withdrawn at the latest by July 1995.

This standard is one of a series of standards for test methods for building materials and components. It was prepared by a working group under the convenorship of the National Standards Authority of Ireland (NSAI).

> NOTE: It is considered desirable to maintain the same clause numbers consistently throughout this series of standards. Consequently some clauses are void in this edition of this standard, but it is envisaged that future editions may need to include text in the clauses concerned.

No existing European Standard is superseded.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Introduction

The values obtained in any determination of the properties of timber depend upon the test methods used. It is therefore desirable that these methods be standardized so that results from different test centres can be correlated. Moreover, with the adoption of limit state design and with the development of both visual and machine stress grading, attention will be increasingly centred on the determination and monitoring of the strength properties and variability of timber in structural sizes. Again, this can be more effectively undertaken if the basic data are defined and obtained under the same conditions.

This European Standard, which is based on ISO 8375, specifies laboratory methods for the determination of some physical and mechanical properties of timber in structural sizes. The methods are not intended for the grading of timber or for quality control.

For the determination of shear modulus, alternative methods have been specified. The choice of which to use will depend upon the objective of the investigation and, to some extent, on the equipment available. It is recognized that the methods may not give the same results.

Following testing to this standard it is intended that the determination of characteristic values will normally be obtained according to procedures specified in other European Standards.

Attention is drawn to the advantages that may be gained, often with little extra effort, in extending the usefulness of test results by recording additional information on the growth characteristics of the piece that are tested, particularly at the fracture sections. Generally, such additional information should include grade-determining features such as knots, slope of grain, rate of growth, wane, etc., on which visual grading rules are based, and strength indicating parameters such as localized modulus of elasticity, on which machine stress grading is based.

1 Scope

This standard specifies test methods for determining the following properties of structural timber and glued laminated timber: modulus of elasticity in bending; shear modulus; bending strength; modulus of elasticity in tension parallel to the grain; tension strength parallel to the grain; modulus of elasticity in compression parallel to the grain; compression strength parallel to the grain.

In addition, the determination of dimensions, moisture content, and density are specified.

The methods apply to rectangular and circular shapes (of substantially constant cross-section) of solid unjointed timber or finger-jointed timber and glued laminated timber.

This standard is not intended for quality-control test purposes.

2 Normative references

None.

3 Symbols

A	cross-sectional area, in square millimetres
a	distance between a loading position and the nearest support in a bending test, in millimetres
$E_{c,0}$	modulus of elasticity in compression parallel to the grain, in newtons per square millimetre
E_m	modulus of elasticity in bending, in newtons per square millimetre
$E_{m,app}$	apparent modulus of elasticity in bending, in newtons per square millimetre
$E_{t,0}$	modulus of elasticity in tension parallel to the grain, in newtons per square millimetre
F	load, in newtons
F_{max}	maximum load, in newtons
$F_{max,est}$	estimated maximum load, in newtons
$f_{c,0}$	compressive strength parallel to the grain, in newtons per square millimetre
f_m	bending strength, in newtons per square millimetre
$f_{t,0}$	tensile strength parallel to the grain, in newtons per square millimetre

G shear modulus, in newtons per square millimetre

h depth of cross-section in a bending test, or the larger dimension of the cross-section, in millimetres

I second moment of area, in millimetres to the fourth power

K, k coefficients

k_G coefficient for shear modulus

l span in bending, or length of test piece between the testing machine grips in compression and tension, in millimetres

l_1 gauge length for the determination of modulus of elasticity, in millimetres

W section modulus, in millimetres to the third power

w deformation, in millimetres

Suffixes

1,2 refer to loads or deformations at particular points of a test and are referred to as necessary in the text

4 Determination of dimensions of test pieces

The dimensions of the test piece shall be measured to an accuracy of 1 %. All measurements shall be made when the test pieces are conditioned as specified in clause 7.

NOTE: If the width or thickness vary, these dimensions should be recorded as the average of three separate measurements taken at different positions on the length of each piece.

The measurements shall not be taken closer than 150 mm to the ends.

5 Determination of moisture content of test pieces

The moisture content of the test piece shall be determined on a section taken from the test piece. For structural timber the section shall be of full cross-section, free from knots and resin pockets.

In strength tests, the section shall be cut as close as possible to the fracture.

6 Determination of density of test pieces

The density of the whole cross-section of the test piece shall be determined on a section taken from the test piece. For structural timber the section shall be of full cross-section, free from knots and resin pockets.

In strength tests, the section shall be cut as close as possible to the fracture.

7 Conditioning of test pieces

The tests shall be carried out on pieces which are conditioned at the standard environment of (20 ± 2) °C and (65 ± 5) % relative humidity. A test piece is conditioned when it attains constant mass. Constant mass is considered to be attained when the results of two successive weighings, carried out at an interval of 6 h, do not differ by more than 0,1 % of the mass of the test piece.

Where the timber to be tested is not readily conditionable to the above standard environment (e.g. for hardwoods with high densities), that fact shall be reported.

8 Determination of modulus of elasticity in bending

8.1 Test piece

The test piece shall have a minimum length of 19 times the depth of the section. Where this is not possible, the span of the beam shall be reported.

8.2 Procedure

The test piece shall be symmetrically loaded in bending at two points over a span of 18 times the depth as shown in figure 1. If the test piece and equipment does not permit these conditions to be achieved exactly, the distance between the load points and the supports may be changed by an amount not greater than 1,5 times the piece depth, and the span and test piece length may be changed by an amount not greater than three times the piece depth, while maintaining the symmetry of the test.

The test piece shall be simply supported.

> NOTE: Small steel plates of length not greater than one-half of the depth of the test piece may be inserted between the piece and the loading heads or supports to minimize local indentation.

Lateral restraint shall be provided as necessary to prevent buckling. This restraint shall permit the piece to deflect without significant frictional resistance.

Load shall be applied at a constant rate. The rate of movement of the loading-head shall be not greater than 0,003 h mm/s (see figure 1).

The maximum load applied shall not exceed the proportional limit load or cause damage to the piece.

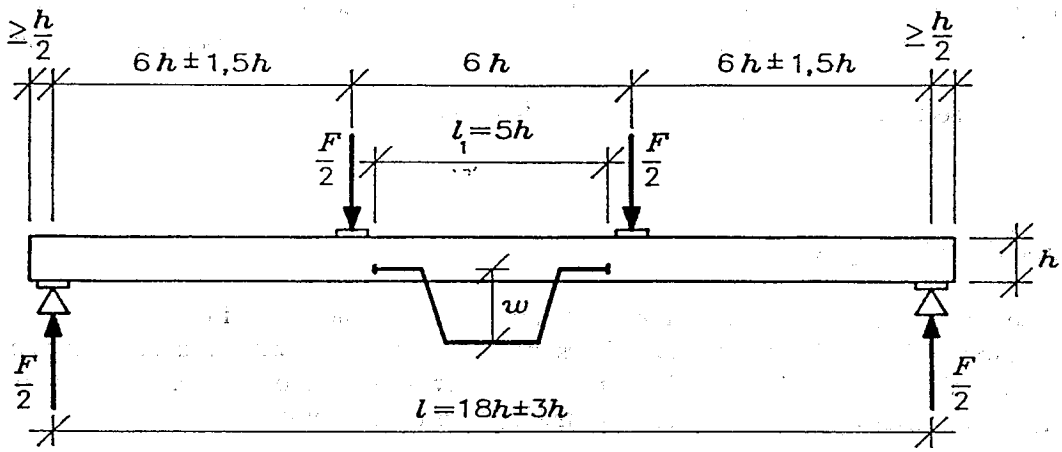

Figure 1: Test arrangement for measuring modulus of elasticity in bending.

The loading equipment used shall be capable of measuring the load to an accuracy of 1 % of the load applied to the test piece or, for loads less than 10 % of the applied maximum load, with an accuracy of 0,1 % of the maximum applied load.

Deformations shall be measured at the centre of a central gauge length of five times the depth of the section.

Deformations shall be determined with an accuracy of 1 % or, for deformations less than 2 mm, with an accuracy of 0,02 mm.

8.3 Expression of results

The modulus of elasticity in bending E_m is given by the equation

$$E_m = \frac{a\, l_1^2\, (F_2 - F_1)}{16\, I\, (w_2 - w_1)}$$

where

$F_2 - F_1$ is an increment of load on the straight line portion of the load deformation curve, in newtons, see figure 2.

$w_2 - w_1$ is the increment of deformation corresponding to $F_2 - F_1$, in millimetres, see figure 2.

The other symbols are as given in clause 3.

The modulus of elasticity shall be calculated to an accuracy of 1 %.

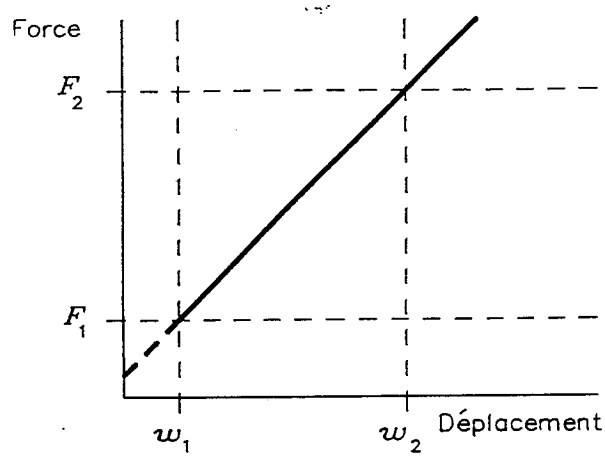

Figure 2: Load-deformation graph within the range of elastic deformation.

9 Determination of shear modulus - Single span method

NOTE: Measurement of the shear modulus of structural timber and glued laminated timber presents considerable difficulty but values suitable for use in design can be obtained by either one of the methods described in clauses 9 and 10.

9.1 General

This method involves the determination of the modulus of elasticity in bending E_m and the apparent modulus of elasticity $E_{m,app}$ for the same length of test piece.

9.2 Determination of modulus of elasticity in bending

The modulus of elasticity in bending shall be determined in accordance with clause 8.

9.3 Determination of apparent modulus of elasticity

9.3.1 Test piece

The test piece shall be that used for the determination of the modulus of elasticity in bending, see 9.2.