SLOVENSKI STANDARD
SIST EN 384:1996

01-avgust-1996

Konstrukcijski les - Ugotavljanje značilnih vrednosti mehanskih lastnosti in gostote

Structural timber - Determination of characteristic values of mechanical properties and density

Bauholz für tragende Zwecke - Bestimmung charakteristischer Festigkeits-, Steifigkeits- und Rohdichtewerte

Bois de structure - Détermination des valeurs caractéristiques des propriétés mécaniques et de la masse volumique

Ta slovenski standard je istoveten z: **EN 384:1995**

ICS:

79.040	Les, hlodovina in žagan les	Wood, sawlogs and sawn timber

SIST EN 384:1996 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 384

February 1995

ICS 79.040

Descriptors: Wood, structural timber, frame structures, determination, characteristics, density, mechanical properties, mechanical strength, modulus of elasticity, testing conditions

English version

Structural timber - Determination of characteristic values of mechanical properties and density

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CEN

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

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Contents

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 124 "Timber structures" of which the secretariat 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of an identical text or by endorsement, at the latest by August 1995, and conflicting national standards shall be withdrawn at the latest by August 1995.

In accordance with 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 and United Kingdom.

Introduction

Structural codes can only function effectively if a standard method of determining the mechanical properties exists.

Whilst total accuracy of characteristic values for any defined population is an aim it is recognised that this is not achievable. A major aim of the procedures given in this standard is to produce characteristic values that are comparable in terms of the populations they represent. It is also important that the standard permits the use of as much existing test data as possible from various sampling and testing techniques.

Where methods are given to permit characteristic values to be determined from a less than ideal amount of structural size test data or from small clear defect free specimen test data, reduction factors to reflect a lower degree of confidence are employed.

This standard covers the stages of population definition, sampling, testing and analysis of data in the determination of characteristic values.

1 Scope

This Standard gives a method for determining characteristic values of mechanical properties and density, for defined populations of timber of visual and/or mechanical strength grades.

A method is also given for checking the strength of a timber sample against its designated value.

The values determined in accordance with this standard for mechanical properties and density are suitable for assigning grades and species to the strength classes of EN 338.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications

are listed hereafter. For dated references, subsequent amendments to or revisions ofany of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 338	Structural timber - Strength classes
EN 408	Timber structures - Structural timber and glued laminated timber - Determination of some physical and mechanical properties
EN 518	Structural timber - Grading - Requirements for visual strength grading standards
EN 519	Structural timber - Grading - Requirements for machine strength graded timber and grading machines
ISO 3131:1975	Wood - Determination of density for physical and mechanical tests

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1 characteristic value: Generally a value that corresponds to a fractile of the statistical distribution of a timber property. For strength properties, modulus of elasticity and density the fractile is the 5-percentile. For modulus of elasticity the mean value is also a characteristic value.

3.2 p-percentile: Value for which the probability of getting lower values is p per cent.

3.3 population: Timber defined by parameters such as species or species grouping, source and manufacturing process. It also includes the strength grade, except where the information on the total range of strength is required to determine relations between the mechanical properties used in deriving settings for grading machines.

3.4 sample: A number of specimens of one cross section size and from one population.

3.5 small clear test: Test to determine mechanical properties of small defect-free specimens.

3.6 specimen: Piece of timber for testing.

3.7 thickness: Lesser dimension perpendicular to the longitudinal axis of a piece of timber.

3.8 width: Greater dimension perpendicular to the longitudinal axis of a piece of timber.

3.9 **depth**: Dimension perpendicular to the longitudinal axis of a timber beam, in the plane of the bending forces.

4 Symbols

a_f distance between the inner load points of the bending test, in millimetre;

$\bar{E}$ mean modulus of elasticity for one sample, in newtons per square millimetre;

$E_{0,mean}$ mean characteristic value of modulus of elasticity parallel to grain, in newtons per square millimetre;

$E_{0,05}$ 5-percentile characteristic value of modulus of elasticity parallel to grain, in newtons per square millimetre;

$E_{90,mean}$ mean characteristic value of modulus of elasticity perpendicular to grain, in newtons per square millimetre;

$f_{c,0,k}$ characteristic value of compression strength parallel to grain, in newtons per square millimetre;

$f_{c,90,k}$ characteristic value of compression strength perpendicular to grain, in newtons per square millimetre;

f_k characteristic value of strength, in newtons per square millimetre;

$f_{m,k}$ characteristic value of bending strength, in newtons per square millimetre;

f_r 5-percentile ranked test value;

$f_{t,0,k}$ characteristic value of tensile strength parallel to grain, in newtons per square millimetre;

$f_{t,90,k}$ characteristic value of tensile strength perpendicular to grain, in newtons per square millimetre;

f_{05} 5-percentile value for each sample;

$\bar{f}_{05}$ the mean value of f_{05} for several samples;

$f_{v,k}$ characteristic value of shear strength, in newtons per square millimetre;

G_{mean} mean characteristic value of shear modulus, in newtons per square millimetre;

h depth of a bending specimen or width of a tension specimen, in millimetre;

k_g factor used for determining characteristic values of tension and compression parallel to grain and shear;

k_h factor for adjusting f_k when h is different from 150 mm;

k_l factor for adjusting length;

k_q factor for use when checking the quality of a graded sample;

k_s factor for adjusting number and size of samples;

k_v factor for adjusting machine grading;

l span, in millimetre;

l_{es} effective length for the standard test procedure in millimetre;

l_{et} effective length for the test in millimetre;

n number of specimens in a sample;

s standard deviation;

ρ density, in kilogrammes per cubic metre;

ρ_k characteristic density (5-percentile), in kilogrammes per cubic metre;

ρ_{05} 5-percentile density for a sample, in kilogrammes per cubic metre.

5 Mechanical properties determined from full size specimens

5.1 Sampling

Samples shall be selected from the population. The population shall be capable of being identified at all stages of production, supply and on the construction site.

The test material shall be a representative sample of the population.

NOTE 1: Any known or suspected difference in the mechanical properties of the population distribution due to growth regions, sawmills, tree size or method of conversion should be represented within the number of samples selected, by a similar proportion to their frequency in the population. This should be the major influence in determining the number and size of samples.

The number of specimens in each sample shall be not less than 40.

NOTE 2: Where samples are small and/or few in number the characteristic values will be penalised, see 5.4.

The cross section size of specimens shall be the same within a sample, but different for other samples.

5.2 Testing

Testing shall be carried out in accordance with EN 408. A critical section shall be selected in each piece of timber. This section is the position at which failure is expected to occur, based on a visual

examination and any other information such as measurements from a strength grading machine. The critical section shall be in a position that can be tested, e.g. not outside the inner load points in a bending test or in close proximity to the jaws in a tension test. For tests to determine modulus of elasticity the critical section shall be positioned at the centre of the gauge length. The grade of the piece of timber shall be determined by the grade of the critical section.

NOTE 1: Because the method used for determining the 5-percentile values of the strength properties is non-parametric (see 5.3.1), not all specimens in the test samples need to be tested to failure.

For a bending test the tension edge shall be selected at random.

NOTE 2: For the determination of settings for most of the grading machines currently in production in Europe a modulus of elasticity measured over a 900 mm span with a centre point load and the thickness as the depth (flatwise bending) is necessary.

NOTE 3: Existing data from different test methods or moisture conditions are acceptable provided sufficient information exists to adjust the results to the reference conditions given in 5.3.3. These differences might be in moisture content, test spans or orientation of test specimens. If these data are not available recommendations for some of these adjustments are given in 5.3.4.

5.3 Analysis of data

5.3.1 Determination of sample 5-percentile

For each sample a 5-percentile value f_{05} shall be determined from the equation

$$f_{05} = f_r$$

f_r is obtained by ranking all the test values for a sample in ascending order. The 5-percentile value is the test value for which 5 % of the values are lower. If this is not an actual test value (i.e. the number of test values is not divisible by 20) then interpolation between the two adjacent values is permitted.

5.3.2 Determination of the sample mean of modulus of elasticity

The sample mean value of modulus of elasticity $\bar{E}$ shall be calculated from the equation

$$\bar{E} = \frac{\sum E_i}{n}$$

where:

E_i is the i th value of modulus of elasticity in the range 1 to n, in newtons per square millimetre.

5.3.3 Reference conditions

5.3.3.1 Moisture content. The reference moisture content shall be consistent with 20 °C and 65 % relative humidity.

NOTE: For most softwood this corresponds to a moisture content of about 12 %.