SLOVENSKI STANDARD
SIST EN 519:1996

01-avgust-1996

Konstrukcijski les - Razvrščanje - Zahteve za strojno razvrščanje lesa po trdnosti in za naprave za razvrščanje

Structural timber - Grading - Requirements for machine strength graded timber and grading machines

Bauholz für tragende Zwecke - Sortierung - Anforderungen an maschinell nach der Festigkeit sortiertes Bauholz und an Sortiermaschinen

Bois de structure - Classement - Spécifications pour le bois classé par machine pour sa résistance et les machines a classer

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79.040	Les, hlodovina in žagan les	Wood, sawlogs and sawn timber
91.080.20	Lesene konstrukcije	Timber structures

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English version

Structural timber - Grading - Requirements for machine strength graded timber and grading machines

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Bauholz für tragende Zwecke - Sortierung - Anforderungen an maschinell nach der Festigkeit sortiertes Bauholz und an Sortiermaschinen

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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of an identical text or by endorsement, at the latest by August 1995, and conflicting national standards shall be withdrawn at the latest by August 1995.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

There are basically two methods of strength grading; visual grading and machine grading. This standard deals with machine grading. Machine strength is in common use in a number of countries. Its greater predictive accuracy compared with visual grading enables higher yields of higher strength classes to be achieved. The countries use two basic systems, referred to as "**output controlled**" and "**machine controlled**". Both systems require a visual override inspection to cater for strength reducing characteristics that are not automatically sensed by the machine.

The output controlled system is suitable for use where the grading machines are situated in sawmills grading particular sizes, species and grades in repeated production runs of around one working shift in duration. This enables the system to be controlled by testing timber specimens from the daily ouput. These tests together with the **cusum** statistical procedure are used to monitor and adjust the machine settings to maintain the required strength properties for each strength class. If the **cusum** procedure indicates that the process is in control then the machine settings may be modified to maximize yield. If the **cusum** procedure indicates that the process is out of control then, after further checks, the settings shall be modified to ensure the strength requirements are met and the timber may need to be re-graded. With this system it is permissible for machine approval requirements to be less
demanding and for machines of the same type to have non-identical performance.

The machine controlled system was developed in Europe around 1969. Because of the large number of sizes, species and grades used it was not possible to carry out quality control tests on timber specimens drawn from production. The system relies therefore on the machines being strictly assessed and controlled, and on considerable research effort to derive the machine settings, which remain constant for all machines of the same type.

The requirements in this standard are based on machines in current use and on future types of machines as far as these can be foreseen. It is recognized that additional clauses or standards may be required if unforeseen developments take place.

Because of the complexity of the subject, the standard is structured to facilitate use by the various interested parties as follows:

a) A specifier or user of machine strength graded timber, should refer to clauses 1 to 5 inclusive;

b) A company carrying out machine strength grading, should refer to clauses 1 to 6 inclusive and annexes A and C. If it is intended to operate the machine in an **"output controlled"** system then clause 9 and annex B should also be studied;

c) A company manufacturing grading machines, should be familiar with all clauses and annexes but most importantly clause 7;

d) A certification body, should refer to all clauses and annexes.

1 Scope

This standard specifies the requirements for assessing and operating machine strength grading systems, to strength grade structural timber, and laminates for glulam.

NOTE: Whilst it is permitted to use this standard to determine machine settings and to grade to any possible strength profile for a given species, this standard refers to the strength classes of EN 338 to provide suitable strength profiles and dictate the visual override requirements necessary to make machine grading to this standard possible.

In addition, guidance is given for the degree of quality control necessary to ensure the reliability of timber graded by strength grading machines. These requirements are given for both **"machine controlled"** and **"output controlled"** systems for grading timber.

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 of, any 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 336	Structural timber - Coniferous and poplar - Sizes, permissible deviations
EN 338	Structural timber - Strength classes
EN 384	Structural timber - Determination of characteristic values of mechanical properties and density
EN 408	Timber structures - Structural timber and glued laminated timber - Determination of some physical and mechanical properties

3 Definitions

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

3.1 batch: Timber of one species population and size graded in one working shift.

3.2 coefficient of determination: Square of the correlation coefficient.

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

3.4 indicating property: Measurement or combination of measurements closely related to strength, from which the machine determines the grade of each increment of length of a piece of timber.

3.5 machine derived modulus of elasticity: Value of modulus of elasticity calculated directly from an indicating property measurement and associated with the position of that measurement on the piece of timber.

NOTE: The calculation formula may assume the timber to be homogeneous within the machine's measuring span and may ignore the effects of shear deflection and minor end moments.

3.6 sample: Number of specimens of timber of one size and representative of one species population.

3.7 settings: Values associated with the variable controls of a grading machine which determine the acceptance to each strength class of timber graded by the machine.

3.8 strength reducing characteristic: Weakness in a piece of timber resulting from natural growth of the tree (e.g. knots, slope of grain) or changes in moisture content (e.g. fissures) or resulting from conversion of the log (e.g. the inclusion of wane) or caused by attack from fungi, insects or mechanical damage.

3.9 strength class: Classification of timber based on particular values of mechanical properties.

3.10 species population: Timber from an identifiable source and of a species or species combination that is, or is intended to be, strength graded and marketed as a commercially defined product.

3.11 timber size: Sawn or processed dimensions with respect to the permitted tolerances given in EN 336.

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

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

4 Symbols

A cusum control parameter;

B cusum control parameter;

B_a cusum parameter associated with acceptable quality level;

B_r cusum parameter associated with rejectable quality level;

b width of cross section, in millimetres ;

E theoretical modulus of elasticity, in newtons per square millimetre;

E_a actual modulus of elasticity measured in a proof load test, in newtons per square millimetre;

E_m modulus of elasticity in bending, in newtons per square millimetre;

E_{mac} machine derived modulus of elasticity, in newtons per square millimetre;

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

F applied force, in newtons;

F_p proof load, in newtons;

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

f_p proof stress, in newtons per square millimetre;

h depth of cross section, in millimetres;

K cusum control parameter;

k_h size factor;

L_a run length in acceptable region for cusum control;

L_r run length in rejectable region for cusum control;

N cusum control parameter;

t thickness, in millimetres;

w deflection or deformation, in millimetres;

Y cusum control parameter;

Z cusum control parameter.

5 Requirements for machine strength graded timber

5.1 The grading system shall operate in either a **machine controlled** or **output controlled** system.

5.2 The visual characteristics of each piece of timber shall meet the requirements of tables 1 and 2 when measured in accordance with annex C.

Where a machine does not fully grade to the ends of each piece of timber (as in bending type machines) these non-fully graded portions shall be visually examined. If the diameter of knots and slope of grain in the non-fully graded portions exceeds the size of such defects in the fully graded portion of the same piece of timber, and exceeds the limits given in table 2, then the piece shall be rejected.

5.3 The timber shall meet the requirements of EN 336 including one of the two tolerance classes.

5.4 Each piece of machine graded timber shall as a minimum give the following information clearly and indelibly indicated by marking or stamping on one face or edge:

a) grade and/or strength class;

b) species or species combination;

c) number of this standard;

d) information whereby the company and the machine responsible for the grading may be identified.

Table 1: Visual override requirement

Strength class according to EN 338		C18 and below	above C18
Max. permissible length of fissures[1)]	through the thickness	not greater than 600 mm in any 1 m length	twice width of piece
	not through the thickness	unlimited	half length of piece
Maximum distortion in mm over 2 m of length (see [2)] and figure 3)	bow	20 mm	10 mm
	spring	12 mm	8 mm
	twist	2 mm/25 mm width	1 mm/25 mm width
Wane (see figure 1)		wane must not reduce the full edge and face dimensions to less than 2/3 of the basic dimensions of the piece	
Resin pockets and Bark pockets	not through the thickness	unlimited if shorter than the width of the piece - otherwise the same limits as for fissures	
	through the thickness	unlimited if shorter than half the width of the piece - otherwise the same limits as for fissures	
Insect damage		no active infestation is permitted. Wood wasp holes are not permitted and worm and pin holes shall be assessed as abnormal defects	
Abnormal defects		where the reduction in strength caused by the abnormal defect is obiously less than caused by other defects permitted by this table, the piece may be accepted provided the defect is of a type that will not increase after conversion and drying	

[1)] Limitations on fissures may be disregarded if research confirms that they have no effect on strength.
[2)] Limits of distortion will be less if required by the method of operation of the grading machine.

NOTE: Sapstain is not a structural defect and is acceptable without limitation.

Table 2: Visual override requirements for non-fully machine graded portions (see 5.4)

These maximum limits are only applicable where the size of knots and slope of grain in the non-fully graded portion exceeds the size of similar characteristics in the fully graded portion of the same piece.		
Strength class according to EN 338	C18 and below	above C18
Knot diameter on face	1/2 × width of piece	1/4 × width of piece
Knot diameter on edge	3/4 × thickness of piece	1/2 × thickness of piece
Slope of grain	1 in 6	1 in 10
NOTE: The knot diameter is measured perpendicular to the longitudinal axis of the piece of timber. For arris knots the above limits apply to the portion of the knot visible on the particular face or edge being considered.		

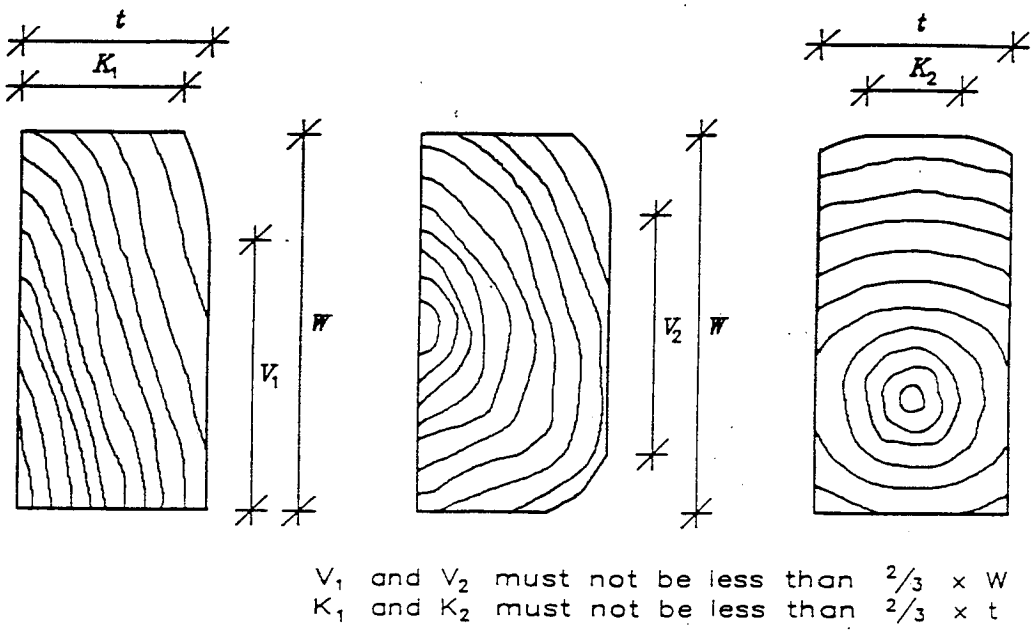

Figure 1: Amounts of wane

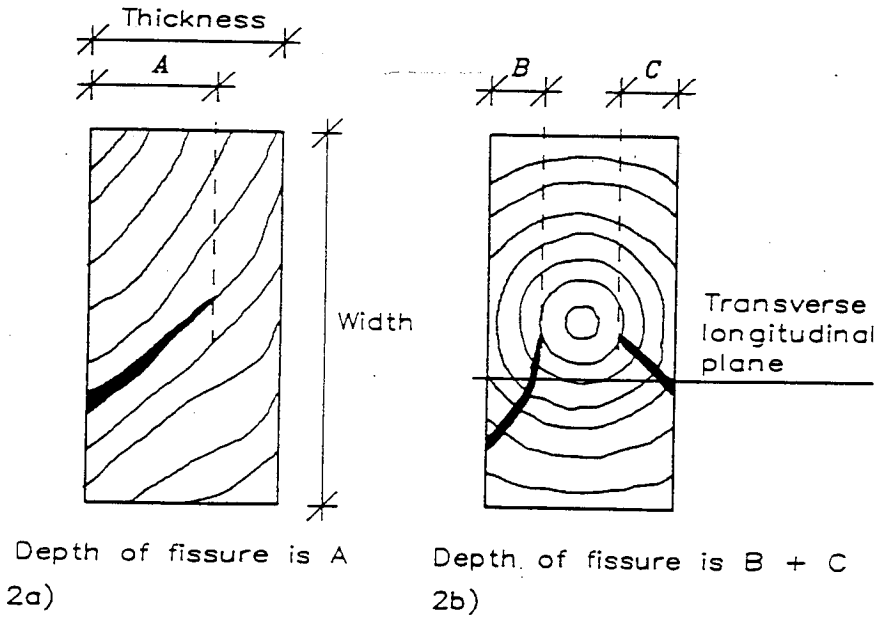

Figure 2: Fissures