SLOVENSKI STANDARD
SIST EN 14081-2:2011+A1:2013

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Lesene konstrukcije - Razvrščanje konstrukcijskega lesa pravokotnega prečnega prereza po trdnosti - 2. del: Strojno razvrščanje - Dodatne zahteve za začetni preskus proizvodnje

Timber structures - Strength graded structural timber with rectangular cross section - Part 2: Machine grading; additional requirements for initial type testing

Holzbauwerke - Nach Festigkeit sortiertes Bauholz für tragende Zwecke mit rechteckigem Querschnitt - Teil 2: Maschinelle Sortierung; zusätzliche Anforderungen an die Erstprüfung

Structures en bois - Bois de structure de section rectangulaire classé selon la résistance - Partie 2: Classement mécanique - Exigences supplémentaires concernant les essais de type initiaux

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ICS:

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

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This European Standard was approved by CEN on 5 May 2010 and includes Amendment 1 approved by CEN on 8 October 2012.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 14081-2:2010+A1:2012) has been prepared by Technical Committee CEN/TC 124 “Timber structures”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes [A1] EN 14081-2:2010. [/A1]

This document includes Amendment 1 approved by CEN on 8 October 2012.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [/A1].

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

Other parts of the EN 14081 series are:

— EN 14081-1, *Timber structures — Strength graded structural timber with rectangular cross section — Part 1: General requirements*;

— EN 14081-3, *Timber structures — Strength graded structural timber with rectangular cross section — Part 3: Machine grading; additional requirements for factory production control*

— EN 14081-4, *Timber structures — Strength graded structural timber with rectangular cross section — Part 4: Machine grading — Grading machine settings for machine controlled systems*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Machine grading is in common use in a number of countries. 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 limited sizes, species and grades in repeated production runs of around one working shift or more. This enables the system to be controlled by testing timber specimens from the daily output. These tests together with statistical procedures are used to monitor and adjust the machine settings to maintain the required strength properties for each strength class. 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. 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 machines settings, which remain constant for all machines of the same type.

The acceptability of grading machines and the derivation of settings rely on statistical procedures and the results will therefore depend on the method used. For this reason this document gives appropriate statistical procedures.

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

1 Scope

This European Standard specifies requirements, additional to those in EN 14081-1, for initial type testing of machine graded structural timber with rectangular cross sections shaped by sawing, planing or other methods, and having deviations from the target sizes corresponding to EN 336. This includes requirements for strength grading machines and test equipment for proof loading graded material.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 338, *Structural timber — Strength classes*

EN 384, *Structural timber — Determination of characteristic values of mechanical properties and density*

EN 408:2003, *Timber structures — Structural timber and glued laminated timber — Determination of some physical and mechanical properties*

〉A1〈 EN 14081-1, *Timber structures — Strength graded structural timber with rectangular cross section — Part 1: General requirements* 〉A1〈

EN 14081-3, *Timber structures — Strength graded structural timber with rectangular cross section — Part 3: Machine grading; additional requirements for factory production control*

EN 14081-4, *Timber structures — Strength graded structural timber with rectangular cross section — Part 4: Machine grading — Grading machine settings for machine controlled systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given 〉A1〈 in EN 14081-1 and the following apply. 〉A1〈

3.1
characteristic strength
population 5-percentile value obtained from the results of tests with a duration of (300 ± 120) s using test pieces at an equilibrium moisture content resulting from a temperature of 20 °C and a relative humidity of 65 %

3.2
characteristic stiffness
population mean value obtained under the same test conditions as defined in 3.1

3.3
critical feed speed
speed within the intended usable range at which the grading machine is least accurate in measuring its indicating property

3.4
depth
dimension perpendicular to the longitudinal axis of a timber beam, in the plane of the bending forces

3.5
grade determining property
mechanical or physical property for which a particular value of that property should be achieved for the material to be assigned to that grade, e.g. bending strength, mean modulus of elasticity and density for the strength classes of EN 338

3.6
indicating property
IP
measurement or combination of measurements made by the grading machine, which are closely related to one or more of the grade determining properties

NOTE For grading machines which compute and predict values of the grade determining properties directly from numerous measuring devices, the indicating property may be a predicted value of a grade determining property.

3.7
optimum grade
highest grade, of those for which settings are required, to which a piece of timber can be assigned, such that the grade determining properties of the graded sample will meet the values required for the grade

3.8
settings
values of the parameters used to set the machine to grade timber, which are mathematically related to the indicating property

3.9
sub-sample
number of specimens of timber of one species or species combination, from one growth area or source of production

3.10
thickness
lesser dimension perpendicular to the longitudinal axis of a piece of timber

4 Symbols

b	width of cross section (in millimetres)
E	theoretical modulus of elasticity (in newtons per square millimetre)
E_p	actual modulus of elasticity measured in a proof load test (in newtons per square millimetre)
$E_{assigned}$	mean modulus of elasticity for assigned grade (in newtons per square millimetre)
$E_{optimum}$	mean modulus of elasticity for optimum grade (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_h size factor

ℓ span (in millimetres)

t thickness (in millimetres)

w deflection or deformation (in millimetres)

β_{ach} achieved safety index

β_{tar} target safety index

δ deflection (in millimetres)

μ mean value of bending strength for the optimum or assigned strength classes (in newtons per square millimetre)

5 Requirements for strength grading machines

5.1 The machine shall be of a type that meets the requirements given in Clauses 5 and 6 if it is part of a machine-controlled system, or Clauses 5 and 7 if it is part of an output controlled system. It shall be installed and set up according to the manufacturer's specification and to any additional requirements resulting from the tests given here. In addition, except when a grading machine operates by measuring the bending stiffness of timber, the installation and calibration shall be checked by the use of control planks, using the procedures given in EN 14081-3 under requirements for the use of control planks.

5.2 The following information shall be provided in the manufacturer's specification for the machine:

a) specification and description of the mechanical and electrical operation of the machine, and the software (this includes information on data processing such as smoothing of the output signals) used by the machine to grade timber;

b) range of environmental conditions under which the machine will operate;

c) installation, maintenance and operating instructions;

d) method, extent and frequency of calibration procedures, including the use of control planks if applicable;

e) species populations, sizes, tolerances, surface finish, moisture content, grades, environmental operating temperature range, throughput speed, and limits of warp of the timber to be graded;

f) manufacturing tolerances of the machine;

g) checking and adjustment procedures for all components that may affect the machine's grading accuracy.

5.3 Manufacturing tolerances and transducer accuracy tolerances shall ensure that production machines meet the requirements of this European Standard, and are compatible with grade settings derived for the machine type.

5.4 The grading machine shall not damage the timber during the grading operation to an extent that it affects the intended use of the timber.

NOTE For example, in bending type machines, damage should not be caused by large compression perpendicular to grain stresses and/or large bending stresses.

5.5 Grading machines whose indicating property does not take account of the material properties along the whole length of each piece of timber, but whose indicating property measurements are influenced by strength reducing characteristics away from the measuring position (as in bending type machines), shall measure the indicating property to within 800 mm of each end of the piece of timber. Where the indicating property is influenced only by strength reducing characteristics at the measuring position (as in radiation type machines), the measurements shall be made to within 150 mm of each end.

5.6 The grading machine shall be capable of comparing each indicating property measurement with pre-set boundary settings, which correspond to individual grades, and of marking each piece of timber according to the lowest grade sensed within the length of that piece.

5.7 The infeed and outfeed equipment shall provide the correct height and angle of entry/exit for the timber to/from the grading machine and shall not interfere significantly with the sensing of the indicating property, even when the timber is distorted within the limits given in item 5.2, e). If the infeed and outfeed equipment is not part of the grading machine then this requirement shall appear in the manual for the machine.

5.8 The grading machine shall be fitted with the means to enable the accuracy of each measuring device to be checked individually, to ensure correct operation of the machine.

6 Additional requirements for initial type testing for machine controlled systems

6.1 General

For machine controlled systems the acceptance of machine graded timber to meet the requirements of this European Standard predominantly depends on the grading machine and the settings used.

6.2 Requirements for the derivation and verification of machine settings

6.2.1 When a new species is required to be graded by a machine that has already been shown to meet the requirements of this European Standard, those requirements that are not likely to be affected by species differences may be disregarded for the new species.

NOTE Annex B gives background information and guidance on the procedure required here to derive grading machine settings.

6.2.2 The requirements for selecting the total test sample are given below. Note that the numbers of sub-samples and specimens given are minimums and the reason for the number actually used shall be given in the report (see 6.2.6). The overriding requirement which determines the number of sub-samples and the number of specimens to be tested is that the test sample shall be representative of the timber source from which the production timber is taken.

To derive settings for a new machine type and/or a new species (or species combination) or growth area, the total test sample shall be selected as a minimum number of four sub-samples (see 3.9), to represent the range of timber for which the settings are applicable (see EN 14081-1 under the requirements for machine grading). The minimum number of pieces in a sub-sample shall be 100. The minimum number of pieces in the total test sample shall be 900 for the derivation of settings for the full range of grades and sizes of a grading machine. To derive settings for new species for a machine that has previously met the requirements of this European Standard with different species, a minimum of 450 pieces shall be required.

To test whether existing settings in EN 14081-4 are acceptable for use with a new growth area of the same species, the new growth area shall supply a minimum of two sub-samples (see first paragraph of this clause) each containing a minimum of 100 pieces. Each piece shall be graded by the machine using the existing settings and then tested to determine the grade determining properties as given in EN 384 using the k_v (bending strength only) factor on strength and the 0,95 factor on $E_{0,mean}$, but in addition, the use of k_s also for $E_{0,mean}$. The grade determining properties shall equal or exceed those required for the grade.

The number of pieces in the total sample shall ensure that there are a minimum number of 20 pieces in each assigned grade for which settings are required.

If more than two grades are to be graded in one pass then it may be necessary to increase the number of pieces up to 40 pieces per grade.

The timber shall represent the timber source (see EN 14081-1 under the requirements for machine grading), range of sizes, and quality to be graded in production (with the exception of 6.2.3, c) below), with the most demanding surface finish, and grading shall be carried out at the critical feed speed. The range of permitted sizes for which settings shall be used in production shall not be extrapolated more than 10 % from the maximum and minimum sizes tested.

It is acceptable for machines not to measure density, but if density is a grade determining property it shall be checked in accordance with 6.2.4. If density is not a grade determining property the characteristic value for the assigned grade (see 6.2.4.6) shall be determined in accordance with EN 384 and given in the report (see 6.2.6).

NOTE The grade determining properties for meeting the requirements of EN 338 are bending strength, MOE and density. For other grades the grade determining properties may be different.

If a grading machine does not detect certain strength reducing characteristics in timber, and those characteristics are not detected by visual override inspection or other procedures, care shall be taken to ensure that those characteristics are present in the test sample in the same proportions as will exist in production. Mention of such characteristics shall also be made in the report on the approval tests to ensure that they are taken into account when settings are required for other species.

6.2.3 In addition to the requirements given in 6.2.2 the number of pieces shall be influenced by the following:

NOTE 1 Justification for the number of sub-samples tested should be made in the report (see 6.2.6).

a) number of grades and sizes to be graded. At least three sizes shall be tested;

b) level of the grades;

NOTE 2 Grades with very high critical properties, e.g. above strength class C30, should require more test data because errors in the model are more significant.

c) strength and/or stiffness requirement for the strength class to be graded compared to the grade determining property range within the sample. Where the characteristic properties of almost all the timber sample meet the requirements for the grade being tested, the grades assigned by the grading machine have little chance of being in error. Where possible, a greater quantity of weaker material of the same species shall be included in the sample to ensure that the grading machine is making valid decisions when assigning timber to grades (see 6.2.4);

d) number of sensing devices used by the machine and the complexity of the model;

NOTE 3 A simple regression model based on one independent variable is likely to require less data than a complex neural network model involving a number of sensing devices.

e) similarity of the species being considered to other species already graded by that type of grading machine.

6.2.4

6.2.4.1 For each species, the effect of the variables given in 6.2.2 (where relevant) on the indicating property shall be established (interpolation is permitted), and used to develop the mathematical model relating the machine's indicating property to the grade determining properties. For this purpose sub-samples may be taken from the sample required for 6.2.2. The effect of variables which are not dependent on the particular