SLOVENSKI STANDARD
SIST EN 14081-2:2018

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Nadomešča:
SIST EN 14081-2:2011+A1:2013

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

Timber structures - Strength graded structural timber with rectangular cross section - Part 2: Machine grading; additional requirements for 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 à section rectangulaire classé pour sa résistance - Partie 2 : Classement mécanique par machine; exigences supplémentaires concernant les essais de type

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EUROPEAN STANDARD

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English Version

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 14081-2:2018) 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of an identical text or by endorsement, at the latest by April 2019, and conflicting national standards shall be withdrawn at the latest by April 2019.

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

This document will supersede EN 14081-2:2010+A1:2012.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Compared to EN 14081-2:2010+A1:2012, the following main modifications have been made:

— new definitions added in Clause 3;

— new requirements for sampling, settings areas and minimum cross-section area;

— introduction of standardized areas;

— method for deriving settings is no longer normative, since several methods may be used; an example of a method is given in Annex B;

— new method for verification of settings;

— cost matrix requirements are changed, to better allow settings that aim for reduced reject rather than yield in the highest grade;

— new method for output control systems;

— introduction of adaptive settings;

— introduction of fixed settings.

This standard is part of a series of standards on *Timber structures — Strength graded structural timber with rectangular cross section* ("EN 14081") that includes:

— *Part 1: General requirements;*

— *Part 2: Machine grading; additional requirements for type testing;*

— *Part 3: Machine grading; additional requirements for factory production control.*

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Machine grading is in common use in a number of countries. There are two basic systems, referred to as “output control” and “machine control”. Both systems require a visual override inspection to cater for performance reducing characteristics that are not automatically sensed by the machine.

The output control 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 control 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, under basic machine control operation, remain constant for all machines of the same type.

Additional factory production control requirements are given in EN 14081-3.

This standard provides a new approach, applicable to both machine control and output control systems, which permits fine adjustment of settings on a grading machine based on continuous monitoring of Indicating Property (IP) data during grading. This approach is called “adaptive settings”.

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.

Grading assignments to strength classes are based on grading reports. When these grading reports are evaluated and approved by CEN/TC 124 /WG 2 /TG 1, they become Approved Grading Reports (AGR).

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 recognized that additional clauses or standards may be required if unforeseen developments take place.

Since the previous version of this European Standard (EN 14081-2:2010+A1:2012), grading settings work, and research data, have provided more information about the variation in wood properties. Several new rules were created by CEN/TC 124 /WG 2 to update the procedures and ensure safety of grading – particularly of settings covering many countries, and are referenced in the guidance paper (see Annex A). This new version of the standard updates the procedures according to the guidance paper.

1 Scope

This document specifies requirements, additional to those of EN 14081-1, for type testing of machine graded structural timber with rectangular cross-sections shaped by sawing, planning or other methods, and having deviations from the target sizes corresponding to EN 336. This includes requirements for strength grading machines.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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*

EN 14358, *Timber structures — Calculation and verification of characteristic values*

EN 13556, *Round and sawn timber — Nomenclature of timbers used in Europe*

EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
assigned grade
grade to which a piece of timber is assigned when using the appropriate setting for that specific grade

3.2
characteristic value
representative value of a material property used for design, which is based either on 5-percentile values (e.g. strength properties and density) or on a mean value (e.g. modulus of elasticity)

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
in the case of bending, the cross sectional dimension parallel to the direction of loading, and in the case of tension, the width

3.5
grade combination
set of one or more grades plus reject graded together

3.6
grade determining property (GDP)
mechanical or physical property, for which a particular value of that property is required for the material to be assigned to that grade

Note 1 to entry: E.g. bending strength, mean MOE and density for the C and D strength classes of EN 338.

3.7
growth area
source from which timber is intended to be strength graded

3.8
indicating property (IP)
measurement or combination of measurements made by the grading machine, used in estimating one or more of the grade determining properties, and upon which the settings are based

3.9
optimum grade
grade to which a piece of timber is assigned, such that the highest possible yield is obtained in the highest grade when using the GDPs as the indicating properties

3.10
p-percentile
value for which the probability of getting lower values is p %

3.11
sample
number of ungraded specimens of one timber species or species combination, one timber source, with sizes and quality representative of the timber population (of the species/species combination from the timber source)

3.12
setting (S)
value of the parameters used to set the machine to grade timber, which are mathematically related to the indicating property

3.13
setting area
combination of countries and / or standardized areas for which the same settings are valid

Note 1 to entry: a setting area is usually part of a test area.

3.14
standardized area
countries that can be combined to one setting area without further justification

3.15
test area
combination of countries and / or standardized areas from which timber is to be tested to obtain a setting area

Note 1 to entry: test area is part of a growth area.

3.16
thickness
lesser dimension perpendicular to the longitudinal axis of a piece of timber

3.17
timber source
identifiable geographical origin of a species or species combination from which timber is, or is intended to be, strength graded

3.18
width
larger dimension perpendicular to the longitudinal axis of a piece of timber

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

a_{DENS}	slope in the DENS formula
a_{MOE}	slope in the MOE formula
a_{MOR}	slope in the MOR formula
b	thickness for edgewise bending and width for flatwise bending
b_{DENS}	intercept in the DENS formula
b_{MOE}	intercept in the MOE formula
b_{MOR}	intercept in the MOR formula
c	load configuration constant
$DENS$	density
$DENS_{req}$	required density
E	modulus of elasticity parallel to grain
$E_{optimum}$	optimum modulus of elasticity
$E_{assigned}$	assigned modulus of elasticity
f_0	measured first-mode longitudinal resonant frequency
f	strength
$f_{k,assigned}$	assigned characteristic strength
$f_{assigned}$	assigned strength
$f_{k,optimum}$	optimum characteristic strength
$f_{optimum}$	optimum strength
F	force
h	depth

IP	indicating property
$IP_{mean,ref,grade}$	mean value of IP of the reference sample
$IP_{mean,prod,grade}$	running value of IP
l	span
MOE	modulus of elasticity parallel to the grain
MOE_{req}	required MOE
MOR	bending strength
MOR_{req}	required MOR
r	correlation coefficient between IP and grade determining property in the whole ungraded data set which is used for determination of initial settings
S_{adapt}	adaptive setting
$s_{\delta,DENS}$	standard error of density estimates
S_{DENS}	setting for DENS
S_{ini}	initial setting
S_{MOE}	setting for MOE
$s_{\delta,MOR}$	standard error of MOR estimates
s_{δ}	standard error of the estimate
S_{MOR}	setting for MOR
t	a factor from Student's t-distribution
u	timber moisture content
β_{ach}	achieved safety index
β_{tar}	target safety index
δ	generic deformation
μ	mean value
ρ	timber density

5 Requirements for strength grading machines

The machine shall be of a type that meets the requirements given in Clauses 6 and 7 if it is part of a machine control system, or Clause 8 if it is a part of an output control 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. 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 used by the machine to grade timber (this includes information on data processing such as smoothing of the output signals);

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

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

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

The grading machine shall not damage the timber during the grading operation to an extent that it affects the intended use of the timber. For example, in bending type machines, damage should not be caused by large compression perpendicular to grain stresses and/or large bending stresses.

NOTE When approving a new machine, consideration of already approved machines having the same technology can contribute to the approval procedure, including settings derivation.

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.

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 given in this clause that are not likely to be affected by species differences may be disregarded for the new species.

Machine settings that were derived in accordance with previous versions of this standard remain valid unless there is evidence that the required grade determining properties are not met. In that case, new settings shall be derived according to this version of the standard.

6 Derivation of settings for machine control systems

6.1 Requirements on sampling

Sampling shall be representative of the timber to be graded. The timber shall represent the timber source, species, range of sizes and quality to be graded in production with the most demanding surface finish for the performance of the grading machine.

NOTE 1 Annex A gives guidance on sampling.

For each species or species combination, the minimum number of specimens required for deriving or expanding settings shall be taken from Table 1:

Table 1 — Minimum number of specimens required for deriving or expanding settings

	Specimens	Total number of samples	Specimens per sample
Total settings area (see 6.4.2.2)	≥ 450	≥ 4	≥ 100
Expansion check: for each additional country or standardized area (see 6.4.2.3)	≥ 150	≥ 1	≥ 100

NOTE 2 Usually it is necessary to increase the total number of specimens to take into account the variability of the timber source, the performance of the machine, and the range of sizes and grades to be produced.

The minimum size of a setting area defined in this standard is normally a country or standardized area. Parts of countries or standardized areas may also be considered if they are clearly geographically defined.

Sampling for a setting area that includes more than one country shall contain at least one sample from each country, unless information exists which verifies that timber from one country can be safely graded using settings from another country without being included in the sampling.

The range of permitted thickness and width for which settings shall be used in production shall not be extrapolated more than 10 % from the maximum and minimum thickness and widths tested. This requirement should be considered when carrying out the sampling.

The minimum cross section area for which settings shall be used in production shall not be extrapolated more than 10 % from the minimum cross section area tested. This requirement should be considered when carrying out the sampling.

A minimum of 40 pieces shall be included in the sampling on all ends of the cross section thickness and width. This means that at least 40 pieces shall be in the range of 10 % of the upper tested timber thickness and width and at least 40 pieces shall be in the range of 10 % of the lower tested timber thickness and width.

A minimum of 40 pieces shall be included in the sampling for the smallest cross section area.

6.2 Requirements for grading process, destructive testing and calculation of grade determining properties

6.2.1 Grading process

Each piece shall be graded by the machine at the critical feed speed while documenting the moisture content, all variables necessary for calculating the IP, and any other variables that may affect the IP.

6.2.2 Destructive testing

Each piece shall be tested to determine the grade determining properties in accordance with EN 384 and EN 408. The characteristic values shall be calculated based on EN 384 and rounded to three significant digits.

In the case of a portable machine, the k_v factor (given in EN 384) shall be taken as 1.

6.2.3 Calculations of grade determining properties

One or more models (e.g. mathematical, statistical) relating the machine's measured parameters to one or more indicating properties to the grade determining properties shall be developed. Models may include variables such as size and moisture content, or may be determined from the data after adjusting the properties for such variables.

Where the machine measures the moisture content of each piece, moisture content may be used to adjust the settings model.