

Structural timber
Strength classes

La norma stabilisce un sistema di classi di resistenza per uso generale nei codici strutturali. Essa fornisce inoltre valori caratteristici delle proprietà di resistenza, di rigidità e della massa volumica per ciascuna classe, e le regole per l'assegnazione dei tipi di legno (cioè le combinazioni di specie, provenienza e categoria) alle classi. La norma si applica a tutti i legnami di conifere e di latifoglie per uso strutturale.

TESTO INGLESE

La presente norma è la versione ufficiale in lingua inglese della norma europea EN 338 (edizione ottobre 2009).

La presente norma è la revisione della UNI EN 338:2004.

ICS 79.040

PREMESSA NAZIONALE

La presente norma costituisce il recepimento, in lingua inglese, della norma europea EN 338 (edizione ottobre 2009), che assume così lo status di norma nazionale italiana.

La presente norma è stata elaborata sotto la competenza della Commissione Tecnica UNI

Legno

La presente norma è stata ratificata dal Presidente dell'UNI ed è entrata a far parte del corpo normativo nazionale il 3 dicembre 2009.

Le norme UNI sono elaborate cercando di tenere conto dei punti di vista di tutte le parti interessate e di conciliare ogni aspetto conflittuale, per rappresentare il reale stato dell'arte della materia ed il necessario grado di consenso.

Chiunque ritenesse, a seguito dell'applicazione di questa norma, di poter fornire suggerimenti per un suo miglioramento o per un suo adeguamento ad uno stato dell'arte in evoluzione è pregato di inviare i propri contributi all'UNI, Ente Nazionale Italiano di Unificazione, che li terrà in considerazione per l'eventuale revisione della norma stessa.

Le norme UNI sono revisionate, quando necessario, con la pubblicazione di nuove edizioni o di aggiornamenti.

È importante pertanto che gli utilizzatori delle stesse si accertino di essere in possesso dell'ultima edizione e degli eventuali aggiornamenti.

Si invitano inoltre gli utilizzatori a verificare l'esistenza di norme UNI corrispondenti alle norme EN o ISO ove citate nei riferimenti normativi.

English Version

Structural timber - Strength classes

Bois de structure - Classes de résistance

Bauholz für tragende Zwecke - Festigkeitsklassen

This European Standard was approved by CEN on 29 September 2009.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 338:2009) has been prepared by Technical Committee CEN/TC 124 "Timber structures", the secretariat of which is held by SFS.

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 2010, and conflicting national standards shall be withdrawn at the latest by April 2010.

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 EN 338:2003.

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

Introduction

This European Standard has additional strength classes which are more suitable to the characteristic values of temperate hardwoods. It also has modified characteristic values for the softwood classes for shear strength and tension strength perpendicular to grain. The equations given for these two properties in Annex A have been modified accordingly.

Due to variations in the type and quality of timber available, the variety of end uses and the size of production output of the local timber industry, many different combinations of species and strength grade exist with different strength properties, which therefore complicate the design and specification of timber structures.

A strength class system groups together grades and species with similar strength properties thus making them interchangeable. This then permits an engineer to specify a chosen strength class and use the characteristic strength values of that class in design calculations.

Advantages of the strength class system are:

- a) Additional species/grades can be incorporated into the system at any time without affecting existing specifications for structural timber.
- b) At the time of carrying out design calculations, an engineer need not be aware of the costs and availability of alternative species and grades. He can simply design using the strength, stiffness and density values of a particular class and then specify that class; he can then use the tenders to select the most suitable and economic species/grade on offer. Note that, where a particular species is not acceptable (e.g. for reasons of durability) for a project, the specification needs to make this clear.
- c) Suppliers can offer their material to meet more specifications than would be possible if species and grades were specified.

1 Scope

This European Standard establishes a system of strength classes for general use in structural codes.

It gives characteristic strength and stiffness properties and density values for each class and the rules for the allocation of timber populations (i.e. combinations of species, source and grade) to the classes.

This standard is applicable to all softwood and hardwood timber for structural use.

2 Normative references

The following referenced documents are indispensable for the application 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 14081 (all parts), *Timber structures – Strength graded structural timber with rectangular cross section*

3 Terms and definitions

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

3.1

timber population

timber for which the characteristic values are relevant

NOTE The timber population is defined by parameters such as species or species grouping (combination of species), source and strength grade.

4 Symbols and abbreviations

$E_{0,mean}$ mean characteristic value of modulus of elasticity parallel to grain (in kN/mm^2)

$E_{0,05}$ 5-percentile characteristic value of modulus of elasticity parallel to grain (in kN/mm^2)

$E_{90,mean}$ mean characteristic value of modulus of elasticity perpendicular to grain (in kN/mm^2)

$f_{c,0,k}$ characteristic value of compressive strength parallel to grain (in N/mm^2)

$f_{c,90,k}$ characteristic value of compressive strength perpendicular to grain (in N/mm^2)

$f_{m,k}$ characteristic value of bending strength (in N/mm^2)

$f_{t,0,k}$ characteristic value of tensile strength parallel to grain (in N/mm^2)

$f_{t,90,k}$ characteristic value of tensile strength perpendicular to grain (in N/mm^2)

$f_{v,k}$ characteristic value of shear strength (in N/mm^2)

G_{mean} mean characteristic value of shear modulus (in kN/mm^2)

ρ_k characteristic value of density (in kg/m^3)

ρ_{mean} mean value of density (in kg/m^3)

5 Classification of structural timber

This standard provides for a number of strength classes, each designated by a number indicating the value of bending strength in N/mm².

The characteristic values of strength, stiffness and density for the strength classes are given in Table 1.

Table 1 — Strength classes - Characteristic values

	Softwood species										Hardwood species									
	C14	C16	C18	C20	C22	C24	C27	C30	C35	C40	C45	C50	D18	D24	D30	D35	D40	D50	D60	D70
Strength properties (in N/mm²)																				
Bending	14	16	18	20	22	24	27	30	35	40	45	50	18	24	30	35	40	50	60	70
Tension parallel	8	10	11	12	13	14	16	18	21	24	27	30	11	14	18	21	24	30	36	42
Tension perpendicular	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6
Compression parallel	16	17	18	19	20	21	22	23	25	26	27	29	18	21	23	25	26	29	32	34
Compression perpendicular	2,0	2,2	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9	3,1	3,2	7,5	7,8	8,0	8,1	8,3	9,3	10,5	13,5
Shear	3,0	3,2	3,4	3,6	3,8	4,0	4,0	4,0	4,0	4,0	4,0	4,0	3,4	4,0	4,0	4,0	4,0	4,0	4,5	5,0
Stiffness properties (in kN/mm²)																				
Mean modulus of elasticity parallel	7	8	9	9,5	10	11	11,5	12	13	14	15	16	9,5	10	11	12	13	14	17	20
5 % modulus of elasticity parallel	4,7	5,4	6,0	6,4	6,7	7,4	7,7	8,0	8,7	9,4	10,0	10,7	8	8,5	9,2	10,1	10,9	11,8	14,3	16,8
Mean modulus of elasticity perpendicular	0,23	0,27	0,30	0,32	0,33	0,37	0,38	0,40	0,43	0,47	0,50	0,53	0,63	0,67	0,73	0,80	0,86	0,93	1,13	1,33
Mean shear modulus	0,44	0,5	0,56	0,59	0,63	0,69	0,72	0,75	0,81	0,88	0,94	1,00	0,59	0,62	0,69	0,75	0,81	0,88	1,06	1,25
Density (in kg/m³)																				
Density	290	310	320	330	340	350	370	380	400	420	440	460	475	485	530	540	550	620	700	900
Mean density	350	370	380	390	410	420	450	460	480	500	520	550	570	580	640	650	660	750	840	1080
<p>NOTE 1 Values given above for tension strength, compression strength, shear strength, 5 % modulus of elasticity, mean modulus of elasticity perpendicular to grain and mean shear modulus, have been calculated using the equations given in Annex A.</p> <p>NOTE 2 The tabulated properties are compatible with timber at a moisture content consistent with a temperature of 20 °C and a relative humidity of 65 %.</p> <p>NOTE 3 Timber conforming to classes C45 and C50 may not be readily available.</p> <p>NOTE 4 Characteristic values for shear strength are given for timber without fissures, according to EN 408. The effect of fissures should be covered in design codes.</p>																				

6 Allocation of a timber population to a strength class

6.1 Grading

6.1.1 Visually graded timber

Visually graded timber shall be to a grading standard that meets the requirements of EN 14081-1.

NOTE EN 1912 lists a number of visual grades and species that are allocated to the strength classes of this standard.

6.1.2 Machine graded timber

Machine graded timber shall meet the requirements of EN 14081 (all parts).

6.2 Classification

6.2.1 Characteristic values

The characteristic values of bending strength, modulus of elasticity in bending (mean) and density for the timber population concerned shall be determined in accordance with EN 384.

NOTE Other strength and stiffness properties, as well as mean density values, are determined according to Annex A.

6.2.2 Allocation to a strength class

A timber population may be assigned to a strength class if its characteristic values of bending strength and density equal or exceed the values for that strength class given in Table 1, and its characteristic mean modulus of elasticity in bending equals or exceeds 95 % of the value for that strength class given in Table 1.

NOTE Provided the settings are available in EN 14081-4, a grading machine may be set to grade directly to the strength class strength, stiffness and density values. Timber graded in this way should be referred to by the strength class number and marked according to EN 14081-1, EN 14081-2 and EN 14081-3.

Annex A (informative)

Determination of values in addition to bending strength, stiffness and density

The following equations were used to determine the characteristic values in Table 1 for properties other than bending strength, mean modulus of elasticity in bending and density.

Tensile strength parallel to grain $f_{t,0,k} = 0,6 f_{m,k}$

Compression strength parallel to grain $f_{c,0,k} = 5(f_{m,k})^{0,45}$

Shear strength

$f_{v,k}$ shall be taken from Table 1

Tensile strength perpendicular to grain

$f_{t,90,k} = 0,4 \text{ N/mm}^2$ for softwoods

$f_{t,90,k} = 0,6 \text{ N/mm}^2$ for hardwoods

Compressive strength perpendicular to grain

$f_{c,90,k} = 0,007 \rho_k$ for softwoods

$f_{c,90,k} = 0,015 \rho_k$ for hardwoods

Modulus of elasticity parallel to grain

$E_{0,05} = 0,67 E_{0,mean}$ for softwoods

$E_{0,05} = 0,84 E_{0,mean}$ for hardwoods

Mean modulus of elasticity perpendicular to grain

$E_{90,mean} = E_{0,mean} / 30$ for softwoods

$E_{90,mean} = E_{0,mean} / 15$ for hardwoods

Mean shear modulus $G_{mean} = E_{0,mean} / 16$

Mean density $\rho_{mean} = 1,2 \cdot \rho_k$

Bibliography

- [1] EN 1912, *Structural timber - Strength classes - Assignment of visual grades and species*
- [2] EN 408, *Timber structures - Structural timber and glued laminated timber - Determination of some physical and mechanical properties*

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