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Eurokod 5: Dimensionering av träkonstruktioner – Del 1-1: Allmänt – Gemensamma regler och regler för byggnader

Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings

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SS-EN 1995-1-1:2004, utgåva 1 och SS-ENV 1995-1-1, utgåva 1, gäller parallellt längst till 2010-03-15.

The European Standard EN 1995-1-1:2004 has the status of a Swedish Standard. This document contains the official English version of EN 1995-1-1:2004.

SS-EN 1995-1-1:2004, edition 1 and SS-ENV 1995-1-1, edition 1, are valid for and run parallel longest to 2010-03-15.

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 1995-1-1

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English version

Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings

Eurocode 5: Conception et calcul des structures en bois - Partie 1-1 : Généralités - Règles communes et règles pour les bâtiments

Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-1: Allgemeines - Allgemeine Regeln und Regeln für den Hochbau

This European Standard was approved by CEN on 16 April 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This European Standard EN 1995-1-1 has been prepared by Technical Committee CEN/TC250 “Structural Eurocodes”, the Secretariat of which is held by BSI.

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 2005, and conflicting national standards shall be withdrawn at the latest by March 2010.

This European Standard supersedes ENV 1995-1-1:1993.

CEN/TC250 is responsible for all Structural Eurocodes.

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

Background of the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980s.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement[1] between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links de facto the Eurocodes with the provisions of all the Council’s Directives and/or Commission’s Decisions dealing with European standards (e.g. the Council Directive 89/106/EEC on construction products – CPD – and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990:2002	Eurocode: Basis of Structural Design
EN 1991	Eurocode 1: Actions on structures
EN 1992	Eurocode 2: Design of concrete structures
EN 1993	Eurocode 3: Design of steel structures
EN 1994	Eurocode 4: Design of composite steel and concrete structures
EN 1995	Eurocode 5: Design of timber structures
EN 1996	Eurocode 6: Design of masonry structures
EN 1997	Eurocode 7: Geotechnical design

[1] Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

EN 1998	Eurocode 8: Design of structures for earthquake resistance
EN 1999	Eurocode 9: Design of aluminium structures

Eurocode standards recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognise that Eurocodes serve as reference documents for the following purposes:

– as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 – Mechanical resistance and stability – and Essential Requirement N°2 – Safety in case of fire ;

– as a basis for specifying contracts for construction works and related engineering services ;

– as a framework for drawing up harmonised technical specifications for construction products (ENs and ETAs)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents[2] referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards[3] . Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical Committees and/or EOTA Working Groups working on product standards with a view to achieving full compatibility of these technical specifications with the Eurocodes.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

National Standards implementing Eurocodes

The National Standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a National title page and National foreword, and may be followed by a National annex.

The National annex may only contain information on those parameters which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, i.e.:

– values and/or classes where alternatives are given in the Eurocode;

– values to be used where a symbol only is given in the Eurocode;

– country specific data (geographical, climatic, etc.), e.g. snow map;

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[2] According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonised ENs and ETAGs/ETAs.

[3] According to Art. 12 of the CPD the interpretative documents shall:
give concrete form to the essential requirements by harmonising the terminology and the technical bases and indicating classes or levels for each requirement where necessary ;
indicate methods of correlating these classes or levels of requirement with the technical specifications, *e.g.* methods of calculation and of proof, technical rules for project design, etc. ;
serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals.
The Eurocodes, *de facto*, play a similar role in the field of the ER 1 and a part of ER 2.

– the procedure to be used where alternative procedures are given in the Eurocode;
– decisions on the application of informative annexes;
– references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and harmonised technical specifications (ENs and ETAs) for products

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works[4] . Furthermore, all the information accompanying the CE Marking of the construction products which refer to Eurocodes shall clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific to EN 1995-1-1

EN 1995 describes the Principles and requirements for safety, serviceability and durability of timber structures. It is based on the limit state concept used in conjunction with a partial factor method.

For the design of new structures, EN 1995 is intended to be used, for direct application, together with EN 1990:2002 and relevant Parts of EN 1991.

Numerical values for partial factors and other reliability parameters are recommended as basic values that provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management applies. When EN 1995-1-1 is used as a base document by other CEN/TCs the same values need to be taken.

National annex for EN 1995-1-1

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1995-1-1 should have a National annex containing all Nationally Determined Parameters to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

National choice is allowed in EN 1995-1-1 through clauses:

2.3.1.2(2)P	Assignment of loads to load-duration classes;
2.3.1.3(1)P	Assignment of structures to service classes;
2.4.1(1)P	Partial factors for material properties;
6.4.3(8)	Double tapered, curved and pitched cambered beams;
7.2(2)	Limiting values for deflections;
7.3.3(2)	Limiting values for vibrations;
8.3.1.2(4)	Nailed timber-to-timber connections: Rules for nails in end grain;
8.3.1.2(7)	Nailed timber-to-timber connections: Species sensitive to splitting;
9.2.4.1(7)	Design method for wall diaphragms;
9.2.5.3(1)	Bracing modification factors for beam or truss systems;
10.9.2(3)	Erection of trusses with punched metal plate fasteners: Maximum bow;
10.9.2(4)	Erection of trusses with punched metal plate fasteners: Maximum deviation.

[4] see Art.3.3 and Art.12 of the CPD, as well as clauses 4.2, 4.3.1, 4.3.2 and 5.2 of ID 1.

Section 1 General

1.1 Scope

1.1.1 Scope of EN 1995

(1)P EN 1995 applies to the design of buildings and civil engineering works in timber (solid timber, sawn, planed or in pole form, glued laminated timber or wood-based structural products, e.g. LVL) or wood-based panels jointed together with adhesives or mechanical fasteners. It complies with the principles and requirements for the safety and serviceability of structures and the basis of design and verification given in EN 1990:2002.

(2)P EN 1995 is only concerned with requirements for mechanical resistance, serviceability, durability and fire resistance of timber structures. Other requirements, e.g concerning thermal or sound insulation, are not considered.

(3) EN 1995 is intended to be used in conjunction with:
EN 1990:2002 Eurocode – Basis of design
EN 1991 “Actions on structures”
EN´s for construction products relevant to timber structures
EN 1998 “Design of structures for earthquake resistance”, when timber structures are built in seismic regions

(4) EN 1995 is subdivided into various parts:
EN 1995-1 General
EN 1995-2 Bridges

(5) EN 1995-1 “General” comprises:
EN 1995-1-1 General – Common rules and rules for buildings
EN 1995-1-2 General rules – Structural Fire Design

(6) EN 1995-2 refers to the common rules in EN 1995-1-1. The clauses in EN 1995-2 supplement the clauses in EN 1995-1.

1.1.2 Scope of EN 1995-1-1

(1) EN 1995-1-1 gives general design rules for timber structures together with specific design rules for buildings.

(2) The following subjects are dealt with in EN 1995-1-1:

Section 1: General

Section 2: Basis of design

Section 3: Material properties

Section 4: Durability

Section 5: Basis of structural analysis

Section 6: Ultimate limit states

Section 7: Serviceability limit states

Section 8: Connections with metal fasteners

Section 9: Components and assemblies

Section 10: Structural detailing and control.

(3)P EN 1995-1-1 does not cover the design of structures subject to prolonged exposure to temperatures over 60°C.

1.2 Normative references

(1) 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 (including amendments).

ISO standards:

ISO 2081:1986	Metallic coatings. Electroplated coatings of zinc on iron or steel
ISO 2631-2:1989	Evaluation of human exposure to whole-body vibration. Part 2: Continuous and shock-induced vibrations in buildings (1 to 80 Hz)

European Standards:

EN 300:1997	Oriented Strand Board (OSB) – Definition, classification and specifications
EN 301:1992	Adhesives, phenolic and aminoplastic for load-bearing timber structures; classification and performance requirements
EN 312-4:1996	Particleboards – Specifications. Part 4: Requirements for load-bearing boards for use in dry conditions
EN 312-5:1997	Particleboards – Specifications. Part 5: Requirements for load-bearing boards for use in humid conditions
EN 312-6:1996	Particleboards – Specifications. Part 6: Requirements for heavy duty load-bearing boards for use in dry conditions
EN 312-7:1997	Particleboards – Specifications. Part 7: Requirements for heavy duty load-bearing boards for use in humid conditions
EN 335-1:1992	Durability of wood and wood-based products – definition of hazard classes of biological attack. Part 1: General
EN 335-2:1992	Durability of wood and wood-based products – definition of hazard classes of biological attack. Part 2: Application to solid wood
EN 335-3:1995	Durability of wood and wood-based products – Definition of hazard classes of biological attack. Part 3: Application to wood-based panels
EN 350-2:1994	Durability of wood and wood-based products – Natural durability of solid wood. Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe
EN 351-1:1995	Durability of wood and wood-based products – Preservative treated solid wood. Part 1: Classification of preservative penetration and retention
EN 383:1993	Timber structures – Test methods. Determination of embedding strength and foundation values for dowel type fasteners
EN 385:2001	Finger jointed structural timber. Performance requirements and minimum production requirements
EN 387:2001	Glued laminated timber – Production requirements for large finger joints. Performance requirements and minimum production requirements
EN 409:1993	Timber structures – Test methods. Determination of the yield moment of dowel type fasteners – Nails

EN 460:1994	Durability of wood and wood-based products – Natural durability of solid wood – Guide of the durability requirements for wood to be used in hazard classes
EN 594:1995	Timber structures – Test methods – Racking strength and stiffness of timber frame wall panels
EN 622-2:1997	Fibreboards – Specifications. Part 2: Requirements for hardboards
EN 622-3:1997	Fibreboards – Specifications. Part 3: Requirements for medium boards
EN 622-4:1997	Fibreboards – Specifications. Part 4: Requirements for softboards
EN 622-5:1997	Fibreboards – Specifications. Part 5: Requirements for dry process boards (MDF)
EN 636-1:1996	Plywood – Specifications. Part 1: Requirements for plywood for use in dry conditions
EN 636-2:1996	Plywood – Specifications. Part 2: Requirements for plywood for use in humid conditions
EN 636-3:1996	Plywood – Specifications. Part 3: Requirements for plywood for use in exterior conditions
EN 912:1999	Timber fasteners – Specifications for connectors for timber
EN 1075:1999	Timber structures – Test methods. Testing of joints made with punched metal plate fasteners
EN 1380:1999	Timber structures – Test methods – Load bearing nailed joints
EN 1381:1999	Timber structures – Test methods – Load bearing stapled joints
EN 1382:1999	Timber structures – Test methods – Withdrawal capacity of timber fasteners
EN 1383:1999	Timber structures – Test methods – Pull through testing of timber fasteners
EN 1990:2002	Eurocode – Basis of structural design
EN 1991-1-1:2002	Eurocode 1: Actions on structures – Part 1-2: General actions – Densities, self-weight and imposed loads
EN 1991-1-3	Eurocode 1: Actions on structures – Part 1-3: General actions – Snow loads
EN 1991-1-4	Eurocode 1: Actions on structures – Part 1-4: General actions – Wind loads
EN 1991-1-5	Eurocode 1: Actions on structures – Part 1-5: General actions – Thermal actions
EN 1991-1-6	Eurocode 1: Actions on structures – Part 1-6: General actions – Actions during execution
EN 1991-1-7	Eurocode 1: Actions on structures – Part 1-7: General actions – Accidental actions due to impact and explosions
EN 10147:2000	Specification for continuously hot-dip zinc coated structural steel sheet and strip – Technical delivery conditions
EN 13271:2001	Timber fasteners – Characteristic load-carrying capacities and slip moduli for connector joints
EN 13986	Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking

EN 14080	Timber structures – Glued laminated timber – Requirements
EN 14081-1	Timber structures – Strength graded structural timber with rectangular cross-section – Part 1, General requirements
EN 14250	Timber structures. Production requirements for fabricated trusses using punched metal plate fasteners
EN 14279	Laminated veneer lumber (LVL) – Specifications, definitions, classification and requirements
EN 14358	Timber structures – Fasteners and wood-based products – Calculation of characteristic 5-percentile value and acceptance criteria for a sample
EN 14374	Timber structures – Structural laminated veneer lumber – Requirements
EN 14544	Strength graded structural timber with round cross-section – Requirements
EN 14545	Timber structures – Connectors – Requirements
EN 14592	Timber structures – Fasteners – Requirements
EN 26891:1991	Timber structures. Joints made with mechanical fasteners. General principles for the determination of strength and deformation characteristics
EN 28970:1991	Timber structures. Testing of joints made with mechanical fasteners; requirements for wood density (ISO 8970:1989)

NOTE: As long as EN 14250, EN 14081-1, EN 14080, EN 13986, EN 14374, EN 14358, EN 14544, EN 14545 and EN 14592 are not available as European standards, more information may be given in the National annex.

1.3 Assumptions

(1)P The general assumptions of EN 1990:2002 apply.

(2) Additional requirements for structural detailing and control are given in section 10.

1.4 Distinction between Principles and Application Rules

(1)P The rules in EN 1990:2002 clause 1.4 apply.

1.5 Terms and definitions

1.5.1 General

(1)P The terms and definitions of EN 1990:2002 clause 1.5 apply.

1.5.2 Additional terms and definitions used in this present standard

1.5.2.1
Characteristic value
Refer to EN 1990:2002 subclause 1.5.4.1.

1.5.2.2
Dowelled connection
Connection made with a circular cylindrical rod usually of steel, with or without a head, fitting tightly in prebored holes and used for transferring loads perpendicular to the dowel axis.

1.5.2.3
Equilibrium moisture content

The moisture content at which wood neither gains nor loses moisture to the surrounding air.

1.5.2.4
Fibre saturation point
Moisture content at which the wood cells are completely saturated.

1.5.2.5
LVL
Laminated veneer lumber, defined according to EN 14279 and EN 14374

1.5.2.6
Laminated timber deck
A plate made of abutting parallel and solid laminations connected together by nails or screws or prestressing or gluing.

1.5.2.7
Moisture content
The mass of water in wood expressed as a proportion of its oven-dry mass.

1.5.2.8
Racking
Effect caused by horizontal actions in the plane of a wall.

1.5.2.9
Stiffness property
A property used in the calculation of the deformation of the structure, such as modulus of elasticity, shear modulus, slip modulus.

1.5.2.10
Slip modulus
A property used in the calculation of the deformation between two members of a structure.

1.6 Symbols used in EN 1995-1-1

For the purpose of EN 1995-1-1, the following symbols apply.

Latin upper case letters

A	Cross-sectional area
A_{ef}	Effective area of the total contact surface between a punched metal plate fastener and the timber
A_f	Cross-sectional area of flange
$A_{net,t}$	Net cross-sectional area perpendicular to the grain
$A_{net,v}$	Net shear area parallel to the grain
C	Spring stiffness
$E_{0,05}$	Fifth percentile value of modulus of elasticity;
E_d	Design value of modulus of elasticity;
E_{mean}	Mean value of modulus of elasticity;
$E_{mean,fin}$	Final mean value of modulus of elasticity;
F	Force
$F_{A,Ed}$	Design force acting on a punched metal plate fastener at the centroid of the effective area
$F_{A,min,d}$	Minimum design force acting on a punched metal plate fastener at the centroid of the effective area
$F_{ax,Ed}$	Design axial force on fastener;
$F_{ax,Rd}$	Design value of axial withdrawal capacity of the fastener;
$F_{ax,Rk}$	Characteristic axial withdrawal capacity of the fastener;
F_c	Compressive force

F_{d}	Design force
$F_{d,ser}$	Design force at the serviceability limit state
$F_{f,Rd}$	Design load-carrying capacity per fastener in wall diaphragm
$F_{i,c,Ed}$	Design compressive reaction force at end of shear wall
$F_{i,t,Ed}$	Design tensile reaction force at end of shear wall
$F_{i,vert,Ed}$	Vertical load on wall
$F_{i,v,Rd}$	Design racking resistance of panel i (in 9.2.4.2)or wall i (in 9.2.4.3)
F_{la}	Lateral load
$F_{M,Ed}$	Design force from a design moment
F_{t}	Tensile force
$F_{v,0,Rk}$	Characteristic load-carrying capacity of a connector along the grain;
$F_{v,Ed}$	Design shear force per shear plane of fastener; Horizontal design effect on wall diaphragm
$F_{v,Rd}$	Design load-carrying capacity per shear plane per fastener; Design racking load capacity
$F_{v,Rk}$	Characteristic load-carrying capacity per shear plane per fastener
$F_{v,w,Ed}$	Design shear force acting on web;
$F_{x,Ed}$	Design value of a force in x-direction
$F_{y,Ed}$	Design value of a force in y-direction
$F_{x,Rd}$	Design value of plate capacity in x-direction;
$F_{y,Rd}$	Design value of plate capacity in y-direction;
$F_{x,Rk}$	Characteristic plate capacity in x-direction;
$F_{y,Rk}$	Characteristic plate capacity in y-direction;
$G_{0,05}$	Fifth percentile value of shear modulus
G_{d}	Design value of shear modulus
G_{mean}	Mean value of shear modulus
H	Overall rise of a truss
I_{f}	Second moment of area of flange
I_{tor}	Torsional moment of inertia
I_{z}	Second moment of area about the weak axis
K_{ser}	Slip modulus
$K_{ser,fin}$	Final slip modulus
K_{u}	Instantaneous slip modulus for ultimate limit states
$L_{net,t}$	Net width of the cross-section perpendicular to the grain
$L_{net,v}$	Net length of the fracture area in shear
$M_{A,Ed}$	Design moment acting on a punched metal plate fastener
$M_{ap,d}$	Design moment at apex zone
M_{d}	Design moment
$M_{y,Rk}$	Characteristic yield moment of fastener
N	Axial force
$R_{90,d}$	Design splitting capacity
$R_{90,k}$	Characteristic splitting capacity
$R_{ax,d}$	Design load-carrying capacity of an axially loaded connection
$R_{ax,k}$	Characteristic load-carrying capacity of an axially loaded connection
$R_{ax,\alpha,k}$	Characteristic load-carrying capacity at an angle to grain
R_{d}	Design value of a load-carrying capacity
$R_{ef,k}$	Effective characteristic load-carrying capacity of a connection
$R_{iv,d}$	Design racking racking capacity of a wall
R_{k}	Characteristic load-carrying capacity
$R_{sp,k}$	Characteristic splitting capacity
$R_{to,k}$	Characteristic load-carrying capacity of a toothed plate connector
$R_{v,d}$	Design racking capacity of a wall diaphragm
V	Shear force; Volume
V_{u}, V_{l}	Shear forces in upper and lower part of beam with a hole
W_{y}	Section modulus about axis *y*
X_{d}	Design value of a strength property
X_{k}	Characteristic value of a strength property