SLOVENSKI STANDARD
SIST EN 1999-1-1:2007

01-maj-2007

Nadomeģļ a:
SIST ENV 1999-1-1:2002

Evrokod 9: Projektiranje konstrukcij iz aluminijevih zlitin - 1-1. del: Splošna pravila za konstrukcije

Eurocode 9 - Design of aluminium structures - Part 1-1: General structural rules

Eurocode 9 - Bemessung und Konstruktion von Aluminiumtragwerken - Teil 1-1: Allgemeine Bemessungsregeln

Eurocode 9 - Calcul des structures en aluminium - Partie 1-1: Regles générales

Ta slovenski standard je istoveten z: EN 1999-1-1:2007

ICS:

91.010.30	Tehniļ ni vidiki	Technical aspects
91.080.10	Kovinske konstrukcije	Metal structures

SIST EN 1999-1-1:2007 **en;fr;de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1999-1-1

February 2007

ICS 91.010.30; 91.080.10

Supersedes ENV 1999-1-1:1998

English Version

Eurocode 9 - Design of aluminium structures - Part 1-1: General structural rules

Eurocode 9 - Calcul des structures en aluminium - Partie 1-1: Règles générales

Eurocode 9 - Bemessung und Konstruktion von Aluminiumtragwerken - Teil 1-1: Allgemeine Bemessungsregeln

This European Standard was approved by CEN on 18 September 2006.

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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Ref. No. EN 1999-1-1:2007: E

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Foreword

This European Standard (EN 1999-1-1:2007) 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of an identical text or by endorsement, at the latest by August 2007, and conflicting national standards shall be withdrawn at the latest by March 2010.

This European Standard supersedes ENV 1999-1-1: 1998.

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, Luxemburg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the 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 the 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	Eurocode 0:	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
EN 1998	Eurocode 8:	Design of structures for earthquake resistance
EN 1999	Eurocode 9:	Design of aluminium structures

[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).

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 standard[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 a 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 (informative).

The National Annex (informative) 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 for partial factors and/or classes where alternatives are given in the Eurocode,
- values to be used where a symbol only is given in the Eurocode,
- geographical and climatic data specific to the Member State, e.g. snow map,
- the procedure to be used where alternative procedures are given in the Eurocode,
- references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and product harmonised technical specifications (ENs and ETAs)

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

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

[3] According to Art. 12 of the CPD the interpretative documents should :
a) 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 ;
b) 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. ;
c) 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.

[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.

construction products which refer to Eurocodes should clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific to EN 1999-1-1

EN 1999 is intended to be used with Eurocodes EN 1990 – Basis of Structural Design, EN 1991 – Actions on structures and EN 1992 to EN 1999, where aluminium structures or aluminium components are referred to.

EN 1999-1-1 is the first part of five parts of EN 1999. It gives generic design rules that are intended to be used with the other parts EN 1999-1-2 to EN 1999-1-5.

The four other parts EN 1999-1-2 to EN 1999-1-5 are each addressing specific aluminium components, limit states or type of structures.

EN 1999-1-1 may also be used for design cases not covered by the Eurocodes (other structures, other actions, other materials) serving as a reference document for other CEN TC´s concerning structural matters.

EN 1999-1-1 is intended for use by

- committees drafting design related product, testing and execution standards,
- owners of construction works (e.g. for the formulation of their specific requirements)
- designers and constructors
- relevant authorities

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 quality management applies.

National annex for EN 1999-1-1

This standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1999-1-1 should have a National Annex containing all Nationally Determined Parameters to be used for the design of aluminium structures to be constructed in the relevant country.

National choice is allowed in EN 1999-1-1 through clauses:

- 1.1.2(1)
- 2.1.2(3)
- 2.3.1(1)
- 3.2.1(1)
- 3.2.2(1)
- 3.2.2(2)
- 3.2.3.1(1)
- 3.3.2.1(3)
- 3.3.2.2(1)
- 5.2.1(3)
- 5.3.2(3)
- 5.3.4(3)
- 6.1.3(1)
- 6.2.1(5)
- 7.1(4)
- 7.2.1(1)
- 7.2.2(1)
- 7.2.3(1)
- 8.1.1(2)
- 8.9 (3)
- A(6) (Table A.1)
- C.3.4.1(2)
- C.3.4.1(3)
- C.3.4.1(4)
- K.1(1)
- K.3(1)

1 General

1.1 Scope

1.1.1 Scope of EN 1999

(1)P EN 1999 applies to the design of buildings and civil engineering and structural works in aluminium. It complies with the principles and requirements for the safety and serviceability of structures, the basis of their design and verification that are given in EN 1990 – Basis of structural design.

(2) EN 1999 is only concerned with requirements for resistance, serviceability, durability and fire resistance of aluminium structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

(3) EN 1999 is intended to be used in conjunction with:

- EN 1990 "Basis of structural design"
- EN 1991 "Actions on structures"
- European Standards for construction products relevant for aluminium structures
- prEN 1090-1: Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components[5]
- prEN 1090-3: Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures[5]

(4) EN 1999 is subdivided in five parts:

EN 1999-1-1 Design of Aluminium Structures: General structural rules.

EN 1999-1-2 Design of Aluminium Structures: Structural fire design.

EN 1999-1-3 Design of Aluminium Structures: Structures susceptible to fatigue.

EN 1999-1-4 Design of Aluminium Structures: Cold-formed structural sheeting.

EN 1999-1-5 Design of Aluminium Structures: Shell structures.

1.1.2 Scope of EN 1999-1-1

(1) EN 1999-1-1 gives basic design rules for structures made of wrought aluminium alloys and limited guidance for cast alloys (see section 3).

NOTE Minimum material thickness may be defined in the National Annex. The following limits are recommended – if not otherwise explicitly stated in this standard:

- components with material thickness not less than 0,6 mm;
- welded components with material thickness not less than 1,5 mm;
- connections with:
  - steel bolts and pins with diameter not less than 5 mm;
  - aluminium bolts and pins with diameter not less than 8 mm;
  - rivets and thread forming screws with diameter not less than 4,2 mm

(2) The following subjects are dealt with in EN 1999 1-1:

Section 1: General

Section 2: Basis of design

Section 3: Materials

5 To be published

Section 4: Durability
Section 5: Structural analysis
Section 6: Ultimate limit states for members
Section 7: Serviceability limit states
Section 8: Design of joints

Annex A Execution classes
Annex B Equivalent T-stub in tension
Annex C Materials selection
Annex D Corrosion and surface protection
Annex E Analytical models for stress strain relationship
Annex F Behaviour of cross section beyond elastic limit
Annex G Rotation capacity
Annex H Plastic hinge method for continuous beams
Annex I Lateral torsional buckling of beams and torsional or flexural-torsional buckling of compression members
Annex J Properties of cross sections
Annex K Shear lag effects in member design
Annex L Classification of connections
Annex M Adhesive bonded connections

(3) Sections 1 to 2 provide additional clauses to those given in EN 1990 "Basis of structural design".

(4) Section 3 deals with material properties of products made of structural aluminium alloys.

(5) Section 4 gives general rules for durability.

(6) Section 5 refers to the structural analysis of structures, in which the members can be modelled with sufficient accuracy as line elements for global analysis.

(7) Section 6 gives detailed rules for the design of cross sections and members.

(8) Section 7 gives rules for serviceability.

(9) Section 8 gives detail rules for connections subject to static loading: bolted, riveted, welded and adhesive bonded connections.

1.2 Normative references

(1) This European Standard incorporates by dated or undated reference, provisions from other publiccations. 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 if incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

1.2.1 General references

prEN 1090-1: Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components[6]

prEN 1090-3: Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures[6]

1.2.2 References on structural design

EN 1990 Basis of structural design

6 To be published

EN 1991 Actions on structures – All parts

EN 1993-1-1 Design of steel structures - Part 1-1: General rules and rules for buildings

EN 1999-1-2 Design of aluminium structures - Part 1-2: Structural fire design

EN 1999-1-3 Design of aluminium structures - Part 1-3: Structures susceptible to fatigue

EN 1999-1-4 Design of aluminium structures - Part 1-4: Cold-formed structural sheeting

EN 1999-1-5 Design of aluminium structures - Part 1-5: Shell structures

1.2.3 References on aluminium alloys

1.2.3.1 Chemical composition, form and temper definition of wrought products

EN 573-1:1994 Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 1: Numerical designation system.

EN 573-2:1994 Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 2: Chemical symbol based designation system

EN 573-3:2003 Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical compositions

EN 573-4:1994 Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 4: Forms of products

EN 515:1993 Aluminium and aluminium alloys - Wrought products - Temper designations

1.2.3.2 Technical delivery conditions

EN 485-1:1993 Aluminium and aluminium alloys - Sheet, strip and plate - Part 1: Technical conditions for inspection and delivery

EN 586-1:1997 Aluminium and aluminium alloys - Forgings - Part 1: Technical conditions for inspection and delivery

EN 754-1:1997 Aluminium and aluminium alloys - Cold drawn rod/bar and tube - Part 1: Technical conditions for inspection and delivery

EN 755-1:1997 Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 1: Technical conditions for inspection and delivery

EN 1592-1:1997 Aluminium and aluminium alloys - HF seam welded tubes - Part 1: Technical conditions for inspection and delivery

EN 12020-1:2001 Aluminium and aluminium alloys - Extruded precision profiles in alloys EN AW-6060 and EN AW-6063- Part 1: Technical conditions for inspection and delivery

EN 28839 Fasteners - Mechanical properties of fasteners - Bolts, screws, studs and nuts made from non-ferrous metals

EN ISO 898-1 Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs

EN ISO 3506-1 Mechanical properties of corrosion-resistant stainless-steel fasteners - Part 1: Bolts, screws and studs

1.2.3.3 Dimensions and mechanical properties

EN 485-2:1994 Aluminium and aluminium alloys - Sheet, strip and plate - Part 2: Mechanical properties

EN 485-3:2003 Aluminium and aluminium alloys - Sheet, strip and plate - Part 3: Tolerances on shape and dimensions for hot-rolled products

EN 485-4:1993 Aluminium and aluminium alloys - Sheet, strip and plate - Part 4: Tolerances on shape and dimensions for cold-rolled products