

Eurocode 9 - Design of aluminium structures - Part 1-4: Cold-formed structural sheeting

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EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1999-1-4:2007 sisaldab Euroopa standardi EN 1999-1-4: 2007 ingliskeelset teksti. Käesolev dokument on jõustatud 30.03.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 1999-1-4:2007 consists of the English text of the European standard EN 1999-1-4: 2007. This document is endorsed on 30.03.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.
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Käsitlusala: 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.	Scope: 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.
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ICS 91.010.30, 91.080.10

Võtmesõnad:

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Supersedes ENV 1999-1-1:1998, ENV 1999-1-2:1998,
ENV 1999-2:1998

English Version

Eurocode 9 - Design of aluminium structures - Part 1-4: Cold-formed structural sheeting

Eurocode 9 - Calcul des structures en aluminium - Partie 1-4: Les structures à plaques formées à froid

Eurocode 9 - Bemessung und Konstruktion von Aluminiumtragwerken - Teil 1-4: Kaltgeformte Profiltafeln

This European Standard was approved by CEN on 12 November 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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Contents

Page

Foreword	4
National Annex for EN 1999-1-4	6
1 General	7
1.1 Scope	7
1.1.1 Scope of EN 1999	7
1.1.2 Scope of EN 1999-1-4	7
1.2 Normative references	8
1.2.1 General references	8
1.2.2 References on structural design	8
1.2.3 Materials and materials testing	8
1.2.4 References on fasteners	8
1.2.5 Other references	8
1.3 Terms and definitions	9
1.4 Symbols	10
1.5 Geometry and conventions for dimensions	10
1.5.1 Form of sections	10
1.5.2 Form of stiffeners	10
1.5.3 Cross-section dimensions	11
1.5.4 Convention for member axis	11
2 Basis of design	12
3 Materials	13
3.1 General	13
3.2 Structural aluminium alloys	13
3.2.1 Material properties	13
3.2.2 Thickness and geometrical tolerances	14
3.3 Mechanical fasteners	15
4 Durability	15
5 Structural analysis	16
5.1 Influence of rounded corners	16
5.2 Geometrical proportions	17
5.3 Structural modelling for analysis	17
5.4 Flange curling	18
5.5 Local and distortional buckling	19
5.5.1 General	19
5.5.2 Plane cross-section parts without stiffeners	19
5.5.3 Plane cross-section parts with intermediate stiffeners	20
5.5.4 Trapezoidal sheeting profiles with intermediate stiffeners	24
6 Ultimate limit states	31
6.1 Resistance of cross-sections	31
6.1.1 General	31
6.1.2 Axial tension	31
6.1.3 Axial compression	31
6.1.4 Bending moment	32
6.1.5 Shear force	34
6.1.6 Torsion	35
6.1.7 Local transverse forces	35
6.1.8 Combined tension and bending	38
6.1.9 Combined compression and bending	39
6.1.10 Combined shear force, axial force and bending moment	39
6.1.11 Combined bending moment and local load or support reaction	40

6.2	Buckling resistance	40
6.2.1	General	40
6.2.2	Axial compression	41
6.2.3	Bending and axial compression.....	41
6.3	Stressed skin design	42
6.3.1	General	42
6.3.2	Diaphragm action.....	42
6.3.3	Necessary conditions	43
6.3.4	Profiled aluminium sheet diaphragms.....	44
6.4	Perforated sheeting with the holes arranged in the shape of equilateral triangles	45
7	Serviceability limit states	46
7.1	General.....	46
7.2	Plastic deformation.....	46
7.3	Deflections.....	46
8	Joints with mechanical fasteners	47
8.1	General.....	47
8.2	Blind rivets	48
8.2.1	General	48
8.2.2	Design resistances of riveted joints loaded in shear	48
8.2.3	Design resistances for riveted joints loaded in tension.....	48
8.3	Self-tapping / self-drilling screws	49
8.3.1	General	49
8.3.2	Design resistance of screwed joints loaded in shear.....	49
8.3.3	Design resistance of screwed joints loaded in tension	50
9	Design assisted by testing.....	52
Annex A [normative] – Testing procedures		53
A.1	General.....	53
A.2	Tests on profiled sheets	53
A.2.1	General	53
A.2.2	Single span test	54
A.2.3	Double span test.....	54
A.2.4	Internal support test	54
A.2.5	End support test	56
A.3	Evaluation of test results	57
A.3.1	General	57
A.3.2	Adjustment of test results	57
A.3.3	Characteristic values.....	58
A.3.4	Design values	59
A.3.5	Serviceability	59
Annex B [informative] – Durability of fasteners.....		60
Bibliography.....		62

Foreword

This European Standard (EN 1999-1-4:2007) 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, ENV 1999-1-2:1998 and ENV 1999-2:1998.

CEN/TC 250 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, Bulgaria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italia, 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 agreement¹ 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 No.1 – Mechanical resistance and stability, and Essential Requirement No 2 – Safety in case of fire
- as a basis for specifying contracts for the execution of construction works and related engineering services
- as a framework for drawing up harmonised technical specifications for construction products (En's and ETA's)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents² referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards³. 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 [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 harmonised technical specifications (EN's and ETA's) for products

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works⁴. Furthermore, all the information accompanying the CE Marking of the

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 :

- 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 shall clearly mention which Nationally Determined Parameters have been taken into account.

National Annex for EN 1999-1-4

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 1999-1-4 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 1999-1-4 through clauses:

- 2(3)
- 2(4)
- 2(5)
- 3.1(3)
- 7.3(3)
- A.1(1)
- A.3.4(3)

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 construction products relevant for aluminium structures
- EN 1090-1: Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components⁵
- EN 1090-3: Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures⁵

(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 1999-1-4

(1)P EN 1999-1-4 gives design requirements for cold-formed trapezoidal aluminium sheeting. It applies to cold-formed aluminium products made from hot rolled or cold rolled sheet or strip that have been cold-formed by such processes as cold-rolled forming or press-breaking. The execution of aluminium structures made of cold-formed sheeting is covered in EN 1090-3.

NOTE The rules in this part complement the rules in other parts of EN 1999-1.

(2) Methods are also given for stressed-skin design using aluminium sheeting as a structural diaphragm.

(3) This part does not apply to cold-formed aluminium profiles like C-, Z- etc profiles nor cold-formed and welded circular or rectangular hollow sections.

(4) EN 1999-1-4 gives methods for design by calculation and for design assisted by testing. The methods for the design by calculation apply only within stated ranges of material properties and geometrical properties for which sufficient experience and test evidence is available. These limitations do not apply to design by testing.

(5) EN 1999-1-4 does not cover load arrangement for loads during execution and maintenance.

⁵ To be published

1.2 Normative references

(1) 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.

1.2.1 General references

- EN 1090-1: Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components⁶
- EN 1090-3: Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures⁶

1.2.2 References on structural design

- EN 1990 Eurocode 0 - Basis of structural design
- EN 1991 Eurocode 1 – Action on structures – All parts
- EN 1995-1-1 Eurocode 5: Design of timber structures - Part 1-1 General rules and rules for buildings
- EN 1999-1-1 Eurocode 9: Design of aluminium structures - Part 1-1 General structural rules

1.2.3 Materials and materials testing

- EN 485-2:1994 Aluminium and aluminium alloys - Sheet, strip and plate - Part 2: Mechanical properties
- EN 508-2:2000 Roofing products from metal sheet - Specification for self-supporting products of steel, aluminium or stainless steel sheet - Part 2: Aluminium
- EN 1396:1996 Aluminium and aluminium alloys - Coil coated sheet and strip for general applications - Specifications
- EN 10002-1 Metallic materials - Tensile testing - Part 1: Method of test at ambient temperature
- EN 10088 Stainless steels - Part 1: List of stainless steels

1.2.4 References on fasteners

- EN ISO 1479 Hexagon head tapping screws
- EN ISO 1481 Slotted pan head tapping screws
- EN ISO 15480 Hexagon washer head drilling screws with tapping screw thread
- EN ISO 15481 Cross recessed pan head drilling screws with tapping screw thread
- EN ISO 15973 Closed end blind rivets with break pull mandrel and protruding head
- EN ISO 15974 Closed end blind rivets with break pull mandrel and countersunk head
- EN ISO 15977 Open end blind rivets with break pull mandrel and protruding head
- EN ISO 15978 Open end blind rivets with break pull mandrel and countersunk head
- EN ISO 15981 Open end blind rivets with break pull mandrel and protruding head
- EN ISO 15982 Open end blind rivets with break pull mandrel and countersunk head
- ISO 7049:1994 Cross recessed pan head tapping screws

1.2.5 Other references

- EN ISO 12944-2 Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 2: Classification of environments

⁶ To be published