



SLOVENSKI STANDARD SIST EN 1999-1-1:2007

01-maj-2007

BUXca Yý U
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

[SIST EN 1999-1-1:2007](https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-210b297cf/sist-en-1999-1-1-2007)

Ta slovenski standard je istoveten z: [EN 1999-1-1:2007](https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-210b297cf/sist-en-1999-1-1-2007)

ICS:

91.010.30	V^@ ã } áããã	Technical aspects
91.080.10	Kovinske konstrukcije	Metal structures

SIST EN 1999-1-1:2007

en;fr;de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 1999-1-1:2007

<https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-291f0bee97cf/sist-en-1999-1-1-2007>

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.

CEN members are the national standards bodies of 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 United Kingdom.

[SIST EN 1999-1-1:2007](https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-291f0bee97cf/sist-en-1999-1-1-2007)

<https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-291f0bee97cf/sist-en-1999-1-1-2007>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Content**Page**

Foreword	7
1 General	11
1.1 Scope	11
1.1.1 Scope of EN 1999.....	11
1.1.2 Scope of EN 1999-1-1	11
1.2 Normative references.....	12
1.2.1 General references	12
1.2.2 References on structural design	12
1.2.3 References on aluminium alloys.....	13
1.2.4 References on welding.....	15
1.2.5 Other references.....	15
1.3 Assumptions	16
1.4 Distinction between principles and application rules	16
1.5 Terms and definitions	16
1.6 Symbols	17
1.7 Conventions for member axes	27
1.8 Specification for execution of the work.....	27
2 Basis of design	29
2.1 Requirements	29
2.1.1 Basic requirements.....	29
2.1.2 Reliability management.....	29
2.1.3 Design working life, durability and robustness	29
2.2 Principles of limit state design.....	29
2.3 Basic variables.....	30
2.3.1 Actions and environmental influences.....	30
2.3.2 Material and product properties.....	30
2.4 Verification by the partial factor method.....	30
2.4.1 Design value of material properties.....	30
2.4.2 Design value of geometrical data.....	30
2.4.3 Design resistances.....	30
2.4.4 Verification of static equilibrium (EQU).....	31
2.5 Design assisted by testing	31
3 Materials.....	32
3.1 General.....	32
3.2 Structural aluminium	32
3.2.1 Range of materials	32
3.2.2 Material properties for wrought aluminium alloys	33
3.2.3 Material properties for cast aluminium alloys	36
3.2.4 Dimensions, mass and tolerances	37
3.2.5 Design values of material constants.....	37
3.3 Connecting devices.....	38
3.3.1 General.....	38
3.3.2 Bolts, nuts and washers.....	38
3.3.3 Rivets	39
3.3.4 Welding consumables.....	40
3.3.5 Adhesives.....	42
4 Durability	42
5 Structural analysis.....	43
5.1 Structural modelling for analysis.....	43
5.1.1 Structural modelling and basic assumptions.....	43
5.1.2 Joint modelling	43
5.1.3 Ground-structure interaction.....	43
5.2 Global analysis	43

5.2.1	Effects of deformed geometry of the structure	43
5.2.2	Structural stability of frames	44
5.3	Imperfections.....	45
5.3.1	Basis	45
5.3.2	Imperfections for global analysis of frames	45
5.3.3	Imperfection for analysis of bracing systems	49
5.3.4	Member imperfections	52
5.4	Methods of analysis.....	52
5.4.1	General	52
5.4.2	Elastic global analysis	52
5.4.3	Plastic global analysis	52
6	Ultimate limit states for members.....	53
6.1	Basis	53
6.1.1	General	53
6.1.2	Characteristic value of strength	53
6.1.3	Partial safety factors	53
6.1.4	Classification of cross-sections	53
6.1.5	Local buckling resistance	58
6.1.6	HAZ softening adjacent to welds	59
6.2	Resistance of cross-sections	61
6.2.1	General	61
6.2.2	Section properties	62
6.2.3	Tension	63
6.2.4	Compression.....	64
6.2.5	Bending moment	64
6.2.6	Shear.....	66
6.2.7	Torsion.....	67
6.2.8	Bending and shear	69
6.2.9	Bending and axial force	69
6.2.10	Bending, shear and axial force	70
6.2.11	Web bearing	71
6.3	Buckling resistance of members.....	71
6.3.1	Members in compression.....	71
6.3.2	Members in bending.....	75
6.3.3	Members in bending and axial compression	77
6.4	Uniformed built-up members	80
6.4.1	General	80
6.4.2	Laced compression members	82
6.4.3	Battened compression members	83
6.4.4	Closely spaced built-up members.....	85
6.5	Un-stiffened plates under in-plane loading	85
6.5.1	General	85
6.5.2	Resistance under uniform compression.....	86
6.5.3	Resistance under in-plane moment.....	87
6.5.4	Resistance under transverse or longitudinal stress gradient	88
6.5.5	Resistance under shear	88
6.5.6	Resistance under combined action	89
6.6	Stiffened plates under in-plane loading.....	89
6.6.1	General	89
6.6.2	Stiffened plates under uniform compression.....	90
6.6.3	Stiffened plates under in-plane moment.....	92
6.6.4	Longitudinal stress gradient on multi-stiffened plates	92
6.6.5	Multi-stiffened plating in shear	93
6.6.6	Buckling load for orthotropic plates.....	93
6.7	Plate girders.....	96
6.7.1	General	96
6.7.2	Resistance of girders under in-plane bending.....	96
6.7.3	Resistance of girders with longitudinal web stiffeners.....	97

6.7.4	Resistance to shear.....	98
6.7.5	Resistance to transverse loads	102
6.7.6	Interaction.....	105
6.7.7	Flange induced buckling.....	106
6.7.8	Web stiffeners.....	106
6.8	Members with corrugated webs.....	108
6.8.1	Bending moment resistance.....	108
6.8.2	Shear force resistance	108
7	Serviceability Limit States	110
7.1	General.....	110
7.2	Serviceability limit states for buildings	110
7.2.1	Vertical deflections.....	110
7.2.2	Horizontal deflections.....	110
7.2.3	Dynamic effects.....	110
7.2.4	Calculation of elastic deflection	110
8	Design of joints.....	111
8.1	Basis of design.....	111
8.1.1	Introduction	111
8.1.2	Applied forces and moments	111
8.1.3	Resistance of joints.....	111
8.1.4	Design assumptions	112
8.1.5	Fabrication and execution.....	112
8.2	Intersections for bolted, riveted and welded joints	112
8.3	Joints loaded in shear subject to impact, vibration and/or load reversal	113
8.4	Classification of joints.....	113
8.5	Connections made with bolts, rivets and pins	113
8.5.1	Positioning of holes for bolts and rivets	113
8.5.2	Deductions for fastener holes	115
8.5.3	Categories of bolted connections.....	117
8.5.4	Distribution of forces between fasteners	119
8.5.5	Design resistances of bolts.....	120
8.5.6	Design resistance of rivets	122
8.5.7	Countersunk bolts and rivets	123
8.5.8	Hollow rivets and rivets with mandrel.....	123
8.5.9	High strength bolts in slip-resistant connections	123
8.5.10	Prying forces.....	125
8.5.11	Long joints.....	125
8.5.12	Single lap joints with fasteners in one row	126
8.5.13	Fasteners through packings.....	126
8.5.14	Pin connections.....	126
8.6	Welded connections.....	129
8.6.1	General.....	129
8.6.2	Heat-affected zone (HAZ).....	129
8.6.3	Design of welded connections	129
8.7	Hybrid connections.....	136
8.8	Adhesive bonded connections	136
8.9	Other joining methods	136
Annex A [normative] – Reliability differentiation.....		137
A.1	Introduction	137
A.2	Design provisions for reliability differentiation - Design supervision levels.....	137
A.3	Execution provisions for reliability differentiation – Execution classes	137
A.4	Governing factors for choice of execution class.....	137
A.5	Hazards connected with the execution and use of the structure	138
A.6	Determination of execution class.....	138
A.7	Utilization grades.....	139
Annex B [normative] - Equivalent T-stub in tension.....		140

B.1	General rules for evaluation of resistance.....	140
B.2	Individual bolt-row, bolt-groups and groups of bolt-rows.....	144
Annex C [informative] - Materials selection		146
C.1	General	146
C.2	Wrought products	146
C.2.1	Wrought heat treatable alloys.....	146
C.2.2	Wrought non-heat treatable alloys.....	149
C.3	Cast products	150
C.3.1	General	150
C.3.2	Heat treatable casting alloys EN AC-42100, EN AC-42200, EN AC-43000 and.....	150
C.3.3	EN AC-43300.....	150
C.3.4	Non-heat treatable casting alloys EN AC-44200 and EN AC-51300.....	150
C.3.5	Special design rules for castings.....	150
C.4	Connecting devices.....	152
C.4.1	Aluminium bolts.....	152
C.4.2	Aluminium rivets.....	152
Annex D [informative] – Corrosion and surface protection.....		153
D.1	Corrosion of aluminium under various exposure conditions.....	153
D.2	Durability ratings of aluminium alloys.....	153
D.3	Corrosion protection.....	154
D.3.1	General	154
D.3.2	Overall corrosion protection of structural aluminium	154
D.3.3	Aluminium in contact with aluminium and other metals	155
D.3.4	Aluminium surfaces in contact with non-metallic materials.....	155
Annex E [informative] - Analytical models for stress strain relationship.....		160
E.1	Scope	160
E.2	Analytical models.....	160
E.2.1	Piecewise linear models.....	160
E.2.2	Continuous models.....	162
E.3	Approximate evaluation of ϵ_u	165
Annex F [informative] - Behaviour of cross-sections beyond the elastic limit.....		166
F.1	General	166
F.2	Definition of cross-section limit states.....	166
F.3	Classification of cross-sections according to limit states	166
F.4	Evaluation of ultimate axial load.....	167
F.5	Evaluation of ultimate bending moment	168
Annex G [informative] - Rotation capacity		170
Annex H [informative] - Plastic hinge method for continuous beams.....		172
Annex I [informative] - Lateral torsional buckling of beams and torsional or torsional-flexural buckling of compressed members		174
I.1	Elastic critical moment and slenderness.....	174
I.1.1	Basis	174
I.1.2	General formula for beams with uniform cross-sections symmetrical about the minor or major axis	174
I.1.3	Beams with uniform cross-sections symmetrical about major axis, centrally symmetric and doubly symmetric cross-sections.....	179
I.1.4	Cantilevers with uniform cross-sections symmetrical about the minor axis	180
I.2	Slenderness for lateral torsional buckling	182
I.3	Elastic critical axial force for torsional and torsional-flexural buckling	184
I.4	Slenderness for torsional and torsional-flexural buckling.....	185
Annex J [informative] - Properties of cross sections.....		190
J.1	Torsion constant I_t	190

J.2	Position of shear centre S	190
J.3	Warping constant I_w	190
J.4	Cross section constants for open thin-walled cross sections	194
J.5	Cross section constants for open cross section with branches.....	196
J.6	Torsion constant and shear center of cross section with closed part	196
Annex K [informative] - Shear lag effects in member design.....		197
K.1	General.....	197
K.2	Effective width for elastic shear lag	197
K.2.1	Effective width factor for shear lag	197
K.2.2	Stress distribution for shear lag	198
K.2.3	In-plane load effects	199
K.3	Shear lag at ultimate limit states.....	200
Annex L [informative] - Classification of joints.....		201
L.1	General.....	201
L.2	Fully restoring connections.....	202
L.3	Partially restoring connections	202
L.4	Classification according to rigidity.....	202
L.5	Classification according to strength.....	203
L.6	Classification according to ductility	203
L.7	General design requirements for connections.....	203
L.8	Requirements for framing connections.....	203
L.8.1	General.....	203
L.8.2	Nominally pinned connections	204
L.8.3	Built-in connections.....	205
Annex M [informative] - Adhesive bonded connections.....		206
M.1	General	206
M.2	Adhesives	206
M.3	Design of adhesive bonded joints	207
M.3.1	General	207
M.3.2	Characteristic strength of adhesives.....	207
M.3.3	Design shear stress	208
M.4	Tests	208

iTech STANDARD PREVIEW

(standards.itech.ai)

SIST EN 1999-1-1:2007
<https://standards.itech.ai/catalog/standards/sist/13bf0081-1c9c-4710-a921-291106cc97cf/sist-en-1999-1-1-2007>

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 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 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 Documents² referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standard³. 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 works⁴. 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.

SIST EN 1999-1-1:2007

<https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-291f0bee97cf/sist-en-1999-1-1-2007>

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)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 1999-1-1:2007](https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-291f0bee97cf/sist-en-1999-1-1-2007)
<https://standards.iteh.ai/catalog/standards/sist/13bfd081-1c9c-47f0-a921-291f0bee97cf/sist-en-1999-1-1-2007>

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 components⁵
- prEN 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 1999-1-1

(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

EN 1999-1-1: 2007 (E)

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 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 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 components⁶

prEN 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 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