SLOVENSKI STANDARD
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Evrokod 3 - Projektiranje jeklenih konstrukcij - 1-3. del: Splošna pravila - Dodatna pravila za hladno oblikovane profile in pločevino

Eurocode 3 - Design of steel structures - Part 1-3: General rules - Supplementary rules for cold-formed members and sheeting

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-3: Allgemeine Regeln - Ergänzende Regeln für kaltgeformte Bauteile und Bleche

Eurocode 3 - Calcul des structures en acier - Partie 1-3: Règles générales - Règles supplémentaires pour les profilés et plaques formés à froid

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Eurocode 3 - Calcul des structures en acier - Partie 1-3: Règles générales - Règles supplémentaires pour les profilés et plaques formés à froid

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-3: Allgemeine Regeln - Ergänzende Regeln für kaltgeformte Bauteile und Bleche

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 250.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Contents

Page

European foreword 4

Introduction 5

1 Scope 8

2 Normative references 8

3 Terms, definitions and symbols 9
3.1 Terms and definitions 9
3.2 Symbols 14
3.3 Geometry and conventions 32

4 Basis of design 35
4.1 Basic requirements 35
4.2 Specific rules for cold-formed members and sheeting 35

5 Materials 37
5.1 General 37
5.2 Structural steel 39
5.3 Connecting devices 42

6 Durability 42

7 Structural analysis 43
7.1 Structural modelling for analysis 43
7.2 Global analysis 43
7.3 Structural modelling of cold-formed steel sections 47
7.4 Cross-sectional analysis — Geometric proportions and application range 51
7.5 Cross-sectional analysis — Flange curling 53
7.6 Cross-sectional analysis — Local and distortional buckling 54
7.7 Cross-sectional analysis — Local buckling between fasteners 80

8 Ultimate limit states 81
8.1 Resistance of cross-sections 81
8.2 Buckling resistance 103

9 Serviceability limit states 111
9.1 General 111
9.2 Plastic deformation 111
9.3 Deflections 111
9.4 Walkability of trapezoidal sheeting 112

10 Design of joints 113
10.1 General 113
10.2 Splices and end connections of members subject to compression 113
10.3 Connections with mechanical fasteners 113
10.4 Spot welds 121
10.5 Lap welds 123

11 Special considerations for members, liner trays and sheeting 128
11.1 Beams restrained by sheeting, liner trays or sandwich panels 128
11.2 Liner trays restrained by sheeting 142
11.3 Special considerations for sheeting 149

11.4 Lateral and torsional restraints of members provided by sheeting, liner trays or sandwich panels 160
11.5 Stressed skin design 170
12 Design assisted by testing 176
Annex A (normative) Testing procedures 178
A.1 General 178
A.2 Tests on materials 179
A.3 Tests on single beams and columns 179
A.4 Tests on structures and sub-assemblies 181
A.5 Tests on profiled sheeting and liner trays 184
A.6 Tests on torsionally restrained beams 193
A.7 Tests on fastenings 195
A.8 Tests on components of storage equipment 195
A.9 Evaluation of test results 196
Annex B (informative) Durability of fasteners 201
B.1 Use of this Informative Annex 201
B.2 Scope and field of application 201
Annex C (normative) Mixed effective width/effective thickness method for outstand elements 204
Bibliography 206

European foreword

This document (prEN 1993-1-3:2022) has been prepared by Technical Committee CEN/TC 250 “Structural Codes”, the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1993-1-3:2006 and its corrigenda.

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by the Eurocodes.

The Eurocodes recognize the responsibility of each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level through the use of National Annexes.

Introduction

0.1 Introduction to the Eurocodes

The Structural Eurocodes comprise the following standards generally consisting of a number of Parts:

— EN 1990, *Eurocode: Basis of structural and geotechnical 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*

— New parts are under development, e.g. Eurocode for design of structural glass

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, soft-ware developers, and committees drafting standards for related product, testing and execution standards.

NOTE Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

0.2 Introduction to EN 1993 (all parts)

(1) EN 1993 (all parts) applies to the design of buildings and civil engineering works in steel. 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 and geotechnical design.

(2) EN 1993 (all parts) is concerned only with requirements for resistance, serviceability, durability and fire resistance of steel structures. Other requirements, e.g. concerning thermal or sound insulation, are not covered.

(3) EN 1993 is subdivided in various parts:

EN 1993-1, *Design of Steel Structures — Part 1: General rules and rules for buildings;*

EN 1993-2, *Design of Steel Structures — Part 2: Steel bridges;*

EN 1993-3, *Design of Steel Structures — Part 3: Towers, masts and chimneys;*

EN 1993-4, *Design of Steel Structures — Part 4: Silos and tanks;*

EN 1993-5, *Design of Steel Structures — Part 5: Piling;*

EN 1993-6, *Design of Steel Structures — Part 6: Crane supporting structures;*

EN 1993-7, *Design of steel structures — Part 7: Design of sandwich panels.*

(4) EN 1993-1 in itself does not exist as a physical document, but comprises the following 14 separate parts, the basic part being EN 1993-1-1:

EN 1993-1-1, *Design of Steel Structures — Part 1-1: General rules and rules for buildings;*

EN 1993-1-2, *Design of Steel Structures — Part 1-2: Structural fire design;*

EN 1993-1-3, *Design of Steel Structures — Part 1-3: Cold-formed members and sheeting;*

NOTE Cold formed hollow sections supplied according to EN 10219 are covered in EN 1993-1-1.

EN 1993-1-4, *Design of Steel Structures — Part 1-4: Stainless steels;*

EN 1993-1-5, *Design of Steel Structures — Part 1-5: Plated structural elements;*

EN 1993-1-6, *Design of Steel Structures — Part 1-6: Strength and stability of shell structures;*

EN 1993-1-7, *Design of Steel Structures — Part 1-7: Strength and stability of planar plated structures transversely loaded;*

EN 1993-1-8, *Design of Steel Structures — Part 1-8: Design of joints;*

EN 1993-1-9, *Design of Steel Structures — Part 1-9: Fatigue strength of steel structures;*

EN 1993-1-10, *Design of Steel Structures — Part 1-10: Selection of steel for fracture toughness and through-thickness properties;*

EN 1993-1-11, *Design of Steel Structures — Part 1-11: Design of structures with tension components made of steel;*

EN 1993-1-12, *Design of Steel Structures — Part 1-12: Additional rules for steel grades up to S960;*

EN 1993-1-13, *Design of Steel Structures — Part 1-13: Beams with large web openings;*

EN 1993-1-14, *Design of Steel Structures — Part 1-14: Design assisted by finite element analysis.*

(5) All subsequent parts EN 1993-1-2 to EN 1993-1-14 treat general topics that are independent from the structural type like structural fire design, cold-formed members and sheeting, stainless steels, plated structural elements, etc.

(6) All subsequent parts numbered EN 1993-2 to EN 1993-7 treat topics relevant for a specific structural type like steel bridges, towers, masts and chimneys, silos and tanks, piling, crane supporting structures, etc. EN 1993-2 to EN 1993-7 refer to the generic rules in EN 1993-1 and supplement, modify or supersede them.

0.3 Introduction to prEN 1993-1-3

prEN 1993-1-3 gives supplementary design rules for cold-formed steel members and sheeting. The focus in prEN 1993-1-3 is on design methods and design rules for individual cold-formed members (beams, columns and beam-columns), sheeting and liner trays regarding resistance, stability and serviceability.

0.4 Verbal forms used in the Eurocodes

The verb “shall” expresses a requirement strictly to be followed and from which no deviation is permitted in order to comply with the Eurocodes.

The verb “should” expresses a highly recommended choice or course of action. Subject to national regulation and/or any relevant contractual provisions, alternative approaches could be used/adopted where technically justified.

The verb “may” expresses a course of action permissible within the limits of the Eurocodes.

The verb “can” expresses possibility and capability; it is used for statements of fact and clarification of concepts.

0.5 National Annex for prEN 1993-1-3

National choice is allowed in this standard where explicitly stated within notes. National choice includes the selection of values for Nationally Determined Parameters (NDPs).

The national standard implementing prEN 1993-1-3 can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

When no national choice is given, the default choice given in this standard is to be used.

When no national choice is made and no default is given in this standard, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by appropriate parties.

National choice is allowed in prEN 1993-1-3 through notes to the following clauses:

4(3)	4(4)	4(5)	5.2.1(3)
7.1(2)	7.2.1(6)	8.2.5(2)	10.3(3)
10.3(3)	10.3(3)	10.3(3)	12(1)
A.1(1)	A.9.4(3)		

National choice is allowed in prEN 1993-1-3 on the application of the following informative annexes:

Annex B

The National Annex can contain, directly or by reference, non-contradictory complementary information for ease of implementation, provided it does not alter any provisions of the Eurocodes.

1 Scope

1.1 Scope of prEN 1993-1-3

(1) This document provides rules for structural design of cold-formed steel members and sheeting.

(2) This document applies to cold-formed steel products made from coated or uncoated hot- or cold-rolled sheet or strip, which have been cold-formed by processes such as roll-forming or press-braking. It also covers sheeting and members which are curved during fabrication by continuous bending or roll-forming. Sheeting which has the curvature created by crushing the inner flanges is not included. This document is also applicable to the design of profiled steel sheeting for composite steel and concrete slabs at the construction stage, see EN 1994. The execution of steel structures made of cold-formed steel members and sheeting is covered in EN 1090-4. Provisions for bolted connections are provided in EN 1090-2.

NOTE The rules in prEN 1993-1-3 complement the rules in other parts of EN 1993-1.

(3) Methods are also given for stressed-skin design, using steel sheeting as a structural diaphragm.

(4) This document does not apply to cold-formed circular and rectangular structural hollow sections supplied to EN 10219, for which reference is made to EN 1993-1-1 and EN 1993-1-8.

(5) This document provides methods for design by calculation and for design assisted by testing. The methods for design by calculation apply only within the stated ranges of material properties and geometric proportions, for which sufficient experience and test evidence is available. These limitations do not apply to design assisted by testing.

1.2 Assumptions

(1) Unless specifically stated, EN 1990, EN 1991 (all parts) and EN 1993-1-1 apply.

(2) The design methods given in prEN 1993-1-3 are applicable if:

— the execution quality is as specified in EN 1090-4, the execution quality of bolted connections is as specified in EN 1090-2, and

— the construction materials and products are as specified in the relevant parts of EN 1993 (all parts), or in the relevant material and product specifications.

(2) EN 1993 is intended to be used in conjunction with:

— the parts of EN 1992 to EN 1999 where steel structures or steel components are referred to within those documents;

— EN, EAD and ETA standards for construction products relevant to steel structures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE See the Bibliography for a list of other documents cited that are not normative references, including those referenced as recommendations (i.e. through 'should' clauses) and permissions (i.e. through 'may' clauses).

EN 1090-2, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*

EN 1090-4, *Execution of steel structures and aluminium structures — Part 4: Technical requirements for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications*

EN 1990, *Eurocode — Basis of structural and geotechnical design*

EN 1991 (all parts), *Eurocode 1 — Actions on structures*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1 Material

3.1.1.1
basic material
flat steel sheet material used for cold-forming sections and profiled sheeting

3.1.1.2
basic yield strength
tensile yield strength of the basic material

3.1.1.3
nominal thickness
target average thickness after cold-forming specified by the steel supplier, inclusive of zinc and other metallic coating layers, but not including organic coatings

3.1.1.4
steel core thickness
nominal thickness minus zinc and other metallic coating layers

3.1.1.5
coil
storage system where a continuous plate is wound onto a drum

3.1.1.6
cold-forming
procedure of metal-forming executed near room temperature without the addition of heat

3.1.1.7
press-braking
method of cold-forming using a brake press, where a metal sheet is bent between a punch and die

3.1.1.8

roll-forming

metal-forming process involving the continuous bending of a steel sheet into a cross-section by forcing it through successive sets of rolls

3.1.1.9

galvanizing

zinc coating for corrosion protection

3.1.1.10

harmonized product standard

European standard developed by a recognized European Standards Organization: CEN, CENELEC or ETSI, in response to a request from the European Commission to one of these organizations

3.1.2 Cold-formed steel members, sheeting and sandwich panels

3.1.2.1

member

structural element with cross-sectional dimensions much smaller than its length

3.1.2.2

sheeting

structural element with a depth much smaller than its width and length, typically used as cladding or decking

3.1.2.3

liner tray

profiled sheet with large lipped edge stiffeners, suitable for interlocking with adjacent liner trays to form a plane of ribbed sheeting that is capable of supporting a parallel plane of profiled sheeting spanning perpendicular to the span of the liner trays

3.1.2.4

sandwich panel

cladding or roofing system consisting of a typically low-density core bonded to two outer skin layers

3.1.2.5

bend

rounded transition zone between flat plate elements

3.1.2.6

unstiffened elements

internal or outstand compression elements without stiffeners

3.1.2.7

stiffened elements

compression elements with intermediate or edge stiffeners

3.1.2.8

stiffener

within the context of EN 1993-1-3 the term 'stiffener' without further specification refers to a longitudinal stiffener, i.e. a single fold or succession of folds in the cross-section aimed at increasing the resistance against local buckling/distortional buckling

3.1.2.9

edge stiffener

longitudinal stiffener obtained by folding over the edge of a plate element with the aim of increasing the resistance against cross-sectional instability

3.1.2.10

intermediate stiffener

longitudinal stiffener consisting of multiple bends within a plate element with the aim of increasing the resistance against cross-sectional instability

3.1.3 Stability modes

3.1.3.1

cross-sectional instability

instability where the cross-section as a whole does not undergo any translation or rotation; cross-sectional instabilities are usually categorized into local buckling and distortional buckling modes

3.1.3.2

local (plate) buckling

cross-sectional instability in which the constituent plates only undergo out-of-plane plate bending deformations and the corners of the cross-section remain in their original positions, defined as plate buckling according to EN 1993-1-5

3.1.3.3

distortional buckling

cross-sectional instability where some constituent plates undergo in-plane displacements in addition to out-of-plane displacements resulting from plate bending; in the particular case of lipped C- or Z-sections, distortional buckling may be interpreted as torsional-flexural buckling of the flange-lip assembly about the web-flange junction

3.1.3.4

global buckling

instability characterized by a translation and/or rotation of the cross-section with minimal change in its shape (i.e. excluding cross-sectional instability); global buckling modes include flexural, torsional, torsional-flexural and lateral-torsional modes.

3.1.4 Cross-sectional analysis

3.1.4.1

design thickness

steel thickness used in design by calculation, according to 3.3.3(6) and 5.2.4

3.1.4.2

developed length

length measured along the midline of plate element(s) or a cross-section, including the lengths of any bends or stiffeners

3.1.4.3

gross cross-section

full cross-section without any deductions to account for local/distortional buckling or the presence of holes

3.1.4.4

effective cross-section

idealized cross-section accounting for the modified stress distribution in the local/distortional post-buckling range; the effective cross-section consists of portions of the plate elements adjacent to longitudinally supported edges which are assumed to carry stress, while the remainder of the cross-section is assumed to carry no stress

3.1.4.5

effective thickness

reduced thickness of a plate-stiffener assembly to account for the effects of distortional buckling

3.1.4.6

effective width

width or combined widths of a plate element, assumed to carry stress in the post-local buckling range, while the remainder of the plate element is assumed to carry no stress (see also: effective cross-section)

3.1.4.7

relative slenderness

normalized non-dimensional slenderness ratio

3.1.5 Cold-formed steel structures

3.1.5.1

support

location at which a member is able to transfer forces or moments to a foundation, or to another member or structural component

3.1.5.2

restraint

full restriction of the lateral, rotational or warping deformation of a member or element, which increases its buckling resistance

3.1.5.3

partial restraint

restriction of the lateral, rotational or warping deformation of a member or element, which increases its buckling resistance in a similar way to a spring support

3.1.5.4

residual bending moment resistance

bending moment resistance remaining in the cross-section after reaching the maximum cross-sectional design bending moment resistance (i.e. on the descending branch of the moment-rotation curve)

3.1.5.5

diaphragm action

structural behaviour primarily involving in-plane shear in sheeting

3.1.5.6

stressed-skin design

design method that allows for the contribution made by diaphragm action to the stiffness and strength of a structure

3.1.5.7

anti-sag bar

member providing lateral restraint to the free flange of a purlin

3.1.6 Joints

3.1.6.1

joint

zone where two or more members are interconnected

3.1.6.2

connection

set of basic components used to transfer forces and moments between two or more members or sheets at the location where they meet

3.1.6.3

basic component of a joint

part of a joint that makes a contribution to one or more of its structural properties

3.1.6.4

connected element

any member or sheeting that is joined to another member or sheeting

3.1.6.5

fastener

connection element: rivets, cartridge-fired pins, self-tapping/self-drilling screws, bolts or welds

3.1.6.6

fastening

local interaction of a fastener (rivets, cartridge-fired pins or self-tapping/self-drilling screws) with the surrounding material of the connected elements