SLOVENSKI STANDARD
oSIST prEN 1993-1-11:2024

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Nadomešča:
SIST EN 1993-1-11:2007

Evrokod 3 - Projektiranje jeklenih konstrukcij - 1-11. del: Natezne komponente

Eurocode 3 - Design of steel structures - Part 1-11: Tension components

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-11: Zugglieder

Eurocode 3 - Calcul des structures en acier - Partie 1-11 : Eléments tendus

Ta slovenski standard je istoveten z: **prEN 1993-1-11**

ICS:

91.010.30	Tehnični vidiki	Technical aspects
91.080.13	Jeklene konstrukcije	Steel structures
93.040	Gradnja mostov	Bridge construction

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EUROPEAN STANDARD

NORME EUROPÉENNE

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English Version

Eurocode 3 - Design of steel structures - Part 1-11: Tension components

Eurocode 3 - Calcul des structures en acier - Partie 1-11 : Eléments tendus

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-11: Zugglieder

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

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

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Contents

Page

European foreword

This document (prEN 1993-1-11:2024) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, 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 1993-1-11:2006 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.

0 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, software 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 the EN 1993 series

(1) The EN 1993 series 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 Eurocode — Basis of structural and geotechnical design.

(2) The EN 1993 series 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) The EN 1993 series 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: 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: 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 steel structures;*

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: Plate assemblies with elements under transverse loads*

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

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

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

EN 1993-1-11, *Design of Steel Structures — Part 1-11: Tension components;*

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 them.

0.3 Introduction to EN 1993-1-11

EN 1993-1-11 provides rules for structural design of tension components made of steel, in addition to other parts of EN 1993, for use in structures made of steel or other materials as e.g. concrete, steel-concrete composite and timber.

EN 1993-1-11 is intended for use by:

— committees drafting design related products, testing and execution standards,

— clients (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.

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 EN 1993-1-11

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 EN 1993-1-11 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 EN 1993-1-11 through notes to the following clauses:

4.3.6(1)	4.3.6(3)	4.4(3)	5.2.1(2)
5.3.1(2)	5.4.1(2)	8.2.2(1)	8.3(1)
8.4(1)	8.5.2.2(1)	8.5.3.2(1)	8.6.2(1)
10.3(1)	11(1)	C.3.1(1)	C.4.2(1)
C.4.3.2(1)	C.4.4.1 (1)		

National choice is allowed in EN 1993-1-11 on the application of the following informative annex:

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 EN 1993-1-11

(1) EN 1993-1-11 provides rules for structural design of tension components made of steel, in addition to other parts of EN 1993, for use in structures made of steel or other materials such as concrete, steel-concrete composite and timber.

(2) EN 1993-1-11 covers the resistance, serviceability and durability of steel tension elements.

(3) The following items/aspects are outside the scope of EN 1993-1-11:

— pre- or post-tensioned systems in accordance with EN 1992-1-1 and EN 1992-2;

— reinforcing steel as part of a concrete structure in accordance with EN 1992-1-1;

— tension components in piling;

— detailed design of terminations.

1.2 Assumptions

(1) Unless specifically stated, EN 1990, EN 1991 and the EN 1993-1 series apply.

(2) The design methods given in EN 1993-1-11 are applicable if:

— execution quality is according to EN 1090-2; and

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

(3) EN 1993-1-11 is used in conjunction with ENs, EADs and ETAs for tension components.

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. in 'should' clauses), permissions (i.e. through 'may' clauses), possibilities ('can' clauses), and in notes.

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

EN 1990:2023,[1] *Eurocode — Basis of structural and geotechnical design*

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

EN 1993 (all parts), *Eurocode 3 — Design of steel structures*

[1] As impacted by EN 1990:2023/prA1:2024

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1 Components and elements

3.1.1.1
tension component
tension element with terminations including accessories if applicable (e.g. corrosion protection, guiding, ...)

3.1.1.2
tension element
component to transfer tensile forces from one termination to the other

3.1.1.3
termination
component to transfer tensile forces from the tension element into the structure or into axially connected tension elements

3.1.1.4
rod
circular solid rods made of structural steel, stainless steel, concrete reinforcement steel or prestressing steel

3.1.1.5
wire
product manufactured by cold working of wire rod that is in a suitable metallurgical condition for cold working

3.1.1.6
strand
product made of an assembly of wires of appropriate shape and dimensions laid helically in the same or opposite direction in one or more layers around a centre wire

3.1.1.7
7-wire strand
product consisting of six cold drawn wires laid helically in the same direction and with the same lay length around a centre wire

3.1.1.8
spiral rope
product made of a minimum of two layers of wires laid helically around a centre wire

3.1.1.9
spiral strand rope
product comprising only round wires

3.1.1.10
stranded rope
product made of several strands laid helically in one or more layers around a core (single layer rope) or centre (rotation-resistant or parallel-closed rope)

3.1.1.11
full-locked coil rope
product made of a core wire and of one or several layers of round wires stranded on top of this round wire core and one or several layers of shaped wires in alternating direction

3.1.1.12
parallel wire system
PWS
product made of a bundle of parallel prestressing wires with terminations

3.1.1.13
parallel strand system
PSS
product made of a bundle of parallel 7-wire strands with terminations

3.1.1.14
prefabricated parallel wire strands
PPWS
products made of a bundle of parallel high strength steel wires with terminations at both ends

Note 1 to entry: The parallel wires in each PPWS are usually assembled in a hexagonal shape by means of special bands. Several PPWSs are usually assembled and compacted to form a circular cable which is wrapped with a mild steel wire.

3.1.1.15
air spun bundles
tension elements made from arial spinning of parallel high strength wire

Note 1 to entry: Several bundles are usually compacted to a circular shape and wrapped by a mild steel wire.

3.1.1.16
saddle
support between a continuous tension element and the structure, transferring deviation forces

3.1.1.17
clamp
part that transfers the load from a secondary tension component to a continuous tension element

3.1.2 Material proprieties

3.1.2.1
modulus of deformation
equivalent material property resulting from the axial deformation property of tension elements that can be a combination of the wire modulus and geometric assembly of the wires if arranged in helixes

3.1.2.2
creep
time-dependant elongation (strain) of tension elements under permanent constant stress

3.1.2.3
relaxation
time-dependant reduction of stress in tension elements under fixed strain

3.1.3 Manufacturing and installation

3.1.3.1
pre-stretching
several load cycles that are applied to a spiral rope as part of the manufacturing process

Note 1 to entry: Pre-stretching removes initial permanent elongation and makes the rope perform linear elastic.

3.1.3.2
prestressing
process of initial tensioning of a tension component by applying a controlled deformation or a controlled force

3.2 Symbols

3.2.1 General

(1) For the purposes of this document, the following symbols apply.

3.2.2 Latin upper-case symbols

A_m nominal metallic cross-section of the tension element

E modulus of elasticity of steel used in the tension component

E_{d1} design value of the effect of the action with all tension components intact

E_{d2} design value of the effect of the action with the relevant tension components removed

E_d design value of the effect of the accidental loss of the tension component(s)

E_Q modulus of deformation of group B tension element

E_t effective modulus of elasticity of the tension component

$F_{c.min}$ calculated minimum breaking force of the tension element

F_{Ed} design value of the tension element axial force

$F_{Ed||}$ component of external design load parallel to the tension element

$F_{Ed\perp}$ component of the external design load perpendicular to the continuous tension element

F_{frict} friction force measured in a clamp slippage test

F_m characteristic value of maximal tensile strength for prestressing steel

$F_{p0,1}$ characteristic value of the strength for 0,1 % strain of prestressing steel

$F_{p,C}$ preloading force for a bolt

F_{Rd} design value of the tension element resistance

F_r clamping force

F_{ri} initial clamping force, and equal to the initial preloading force in the bolts, summed over all bolts

$F_{r||}$ slip resistant force measured in a slippage clamp test

F_{uk} characteristic value of the tension element breaking force