
Eurocode 3: Projektiranje jeklenih konstrukcij - Del 1-7: Splošna pravila - Dodatna pravila za ravninske pločevinaste konstrukcije (ortotropne plošče), obremenjene s prečno obtežbo (prevzet ENV 1993-1-7:1999 z metodo platnice)

Eurocode 3: Design of steel structures - Part 1-7: General rules - Supplementary rules for planar plated structural elements with out of plane loading

Eurocode 3: Calcul des structures en acier - Partie 1-7: Règles générales - Règles supplémentaires pour la résistance et la stabilité des structures en plaques raidies chargées hors de leur plan

[SIST ENV 1993-1-7:2001](#)

Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-7: Allgemeine Bemessungsregeln - Ergänzende Regeln für ebene Blechfelder mit Querbelastung

Deskriptorji: jeklene konstrukcije, konstrukcijska jekla, jeklene plošče, prečna obtežba, pravila za računanje, mehanska trdnost

ICS 91.010.30; 91.080.10

Referenčna številka
SIST ENV 1993-1-7:2001 ((sl),en)

Nadaljevanje na straneh od II do V in od 1 do 47

NACIONALNI UVOD

Predstandard SIST ENV 1993-1-7 ((sl),en), Eurocode 3: Projektiranje jeklenih konstrukcij - Del 1-7: Splošna pravila - Dodatna pravila za ravninske pločevinaste konstrukcije (ortotropne plošče) brez prečne obremenitve, prva izdaja, 2001, ima status slovenskega predstandarda in je z metodo platnice prevzet evropski predstandard ENV 1993-1-7 (en), Eurocode 3: Design of steel structures - Part 1-7: General rules - Supplementary rules for planar plated structural elements with out of plane loading, September 1999.

NACIONALNI PREDGOVOR

Evropski predstandard ENV 1993-1-7:1999 je pripravil tehnični odbor Evropskega komiteja za standardizacijo CEN/TC 250 Konstrukcijski evrokodi.

Pripravo tega predstandarda sta CEN poverila Evropska komisija in Evropsko združenje za prosto trgovino.

Odločitev za prevzem tega predstandarda po metodi platnice je sprejela delovna skupina USM/TC KON/WG 3 Jeklene konstrukcije, ki je pripravila tudi nacionalni dokument za uporabo v Sloveniji, potrdil pa tehnični odbor USM/TC KON Konstrukcije.

Ta slovenski predstandard se lahko uporablja samo v skladu z nacionalnim dokumentom, ki je sestavni del SIST ENV 1993-1-7:2001.

Ta slovenski predstandard je dne 2000-12-04 odobril direktor USM.

Rok veljavnosti tega predstandarda je do izdaje evropskega standarda EN 1993-1-7.

ZVEZE S STANDARDI

S prevzemom tega evropskega predstandarda veljajo za omejeni namen referenčnih standardov vsi standardi, navedeni v izvorniku, razen tistih, ki so že sprejeti kot nacionalni standardi:

| | | |
|--------------------------------|-----------|---|
| SIST ENV 1991-1:1998 | ((sl),en) | Eurocode 1: Osnove projektiranja in vplivi na konstrukcije - 1. del: Osnove projektiranja |
| SIST ENV 1991-2-1:1998 | ((sl),en) | Eurocode 1: Osnove projektiranja in vplivi na konstrukcije - Del 2-1: Vplivi na konstrukcije - Gostote, lastna teža in koristne obtežbe |
| SIST ENV 1991-2-3:1998 | ((sl),en) | Eurocode 1: Osnove projektiranja in vplivi na konstrukcije - Del 2-3: Vplivi na konstrukcije - Obtežbe snega |
| SIST ENV 1991-2-4:1998 | ((sl),en) | Eurocode 1: Osnove projektiranja in vplivi na konstrukcije - Del 2-4: Vplivi na konstrukcije - Vplivi vetra |
| SIST ENV 1993-1-1:1996 | ((sl),en) | Eurocode 3: Projektiranje jeklenih konstrukcij - Del 1-1: Splošna pravila in pravila za stavbe |
| SIST ENV 1993-1-1:1996/A1:1996 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-1: Splošna pravila in pravila za stavbe - Dodatka D in K |
| SIST ENV 1993-1-1:1996/A2:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-1: Splošna pravila in pravila za stavbe - Dodatki G, H, J, N in Z |
| SIST ENV 1993-1-2:1999 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-2: Splošna pravila - Projektiranje požarnovarnih konstrukcij |
| SIST ENV 1993-1-3:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-3: Splošna pravila - |

| | | |
|------------------------|-----------|--|
| | | Dodatna pravila za hladnooblikovane tankostenske profile in pločevine |
| SIST ENV 1993-1-4:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-4: Splošna pravila - Dodatna pravila za nerjavna jekla |
| SIST ENV 1993-1-5:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-5: Splošna pravila - Dodatna pravila za ravninske pločevinaste konstrukcije (ortotropne plošče) brez prečne obremenitve |
| SIST ENV 1993-1-6:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 1-6: Splošna pravila - Dodatna pravila za lupinaste konstrukcije |
| SIST ENV 1993-2:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij – 2. del: Jekleni mostovi |
| SIST ENV 1993-3-1:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 3-1: Stolpi, jambori in dimniki - Stolpi in jambori |
| SIST ENV 1993-3-2:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 3-2: Stolpi, jambori in dimniki - Dimniki |
| SIST ENV 1993-4-1:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 4-1: Silosi, rezervoarji in cevovodi - Silosi |
| SIST ENV 1993-4-2:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 4-2: Silosi, rezervoarji in cevovodi - Rezervoarji |
| SIST ENV 1993-4-3:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij - Del 4-3: Silosi, rezervoarji in cevovodi - Cevovodi |
| SIST ENV 1993-5:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij – 5. del: Piloti in zagatne stene |
| SIST ENV 1993-6:2001 | ((sl),en) | Projektiranje jeklenih konstrukcij – 6. del: Žerjavne proge |

OPOMBI

- Povsod, kjer se v besedilu predstandarda uporablja izraz "evropski predstandard", v SIST ENV 1993-1-7:2001 to pomeni "slovenski predstandard".
- Nacionalni uvod in nacionalni predgovor nista sestavni del predstandarda.

| VSEBINA | Stran |
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Nacionalni dokument za uporabo v Sloveniji

Za vrednosti parametrov, podanih v okvirju (večinoma delni varnostni faktorji odpornosti ali zunanjih vplivov), se v SIST ENV 1993-1-7:2001 privzamejo priporočene vrednosti, podane v ENV 1993-1-7:1999.

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ICS 91.010.30; 91.080.10

English version

**Eurocode 3: Design of steel structures - Part 1-7: General rules -
Supplementary rules for planar plated structural elements with
out of plane loading**

Eurocode 3: Calcul des structures en acier - Partie 1-7:
Règles générales - Règles supplémentaires pour la
résistance et la stabilité des structures en plaques raidies
chargées hors de leur plan

Eurocode 3: Bemessung und Konstruktion von Stahlbauten
- Teil 1-7: Allgemeine Bemessungsregeln - Ergänzende
Regeln für ebene Blechfelder mit Querbelaugung

This European Prestandard (ENV) was approved by CEN on 25 December 1998 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

Objectives of the Eurocode

- (1) The “Structural Eurocodes” comprise a group of standards for the structural and geotechnical design of buildings and civil engineering works.
- (2) They cover execution and control only to the extent that is necessary to indicate the quality of the construction products, and the standard of the workmanship, needed to comply with the assumptions of the design rules.
- (3) Until the necessary set of harmonized technical specifications for products and for methods of testing their performance is available, some of the Structural Eurocodes cover some of these aspects in informative annexes.

Background to the Eurocode programme

- (4) The Commission of the European Communities (CEC) initiated the work of establishing a set of harmonized technical rules for the design of building and civil engineering works which would initially serve as an alternative to the different rules in force in the various member states and would ultimately replace them. These technical rules became known as the “Structural Eurocodes”.
- (5) In 1990, after consulting their respective member states, the CEC transferred the work of further development, issue and updating of the Structural Eurocodes to CEN and the EFTA Secretariat agreed to support the CEN work.

- (6) CEN Technical Committee CEN/TC 250 is responsible for all Structural Eurocodes.

Eurocode programme

- (7) Work is in hand on the following Structural Eurocodes, each generally consisting of a number of parts:

- EN 1991 Eurocode 1 Basis of design and 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 provisions for earthquake resistance of structures;
- EN 1999 Eurocode 9 Design of aluminium alloy structures.

- (8) Separate sub-committees have been formed by CEN/TC 250 for the various Eurocodes listed above.

- (9) This Part 1-7 of ENV 1993 is published by CEN as a European Prestandard (ENV) with an initial life of three years.

- (10) This Prestandard is intended for experimental application and for the submission of comments.

(11) After approximately two years CEN members will be invited to submit formal comments to be taken into account in determining future actions.

(12) Meanwhile feedback and comments on this Prestandard should be sent to the secretariat of CEN/TC 250/SC 3 at the following address:

BSI Standards
British Standards House
389 Chiswick High road
London W 4 4AL
England

or to your national standards organization.

National Application Documents (NAD's)

(13) In view of the responsibilities of the authorities in member countries for safety, health and other matters covered by the essential requirements of the Construction Products Directive (CPD), certain safety elements in this ENV have been assigned indicative values which are identified by ("boxed values"). The authorities in each member country are expected to review the "boxed values" and may substitute alternative definitive values for these safety elements for use in national application.

(14) Some of the supporting European or International Standards might not be available by the time this Prestandard is issued. It is therefore anticipated that a National Application Document (NAD) giving any substitute definitive values for safety elements, referencing compatible supporting standards and providing guidance on the national application of this Prestandard, will be issued by each member country or its Standards Organization.

[SIST ENV 1993-1-7:2001](https://standards.jeh.ai/catalog/standards/sist/ebe07b9b-43e8-4c98-8b9a-3919edd45df4/sist-env-1993-1-7-2001)

(15) It is intended that this Prestandard is used in conjunction with the NAD valid in the country where the building or civil engineering works is located.

Matters specific to this Prestandard

(16) The Parts of ENV 1993 that are currently envisaged are:

| | |
|--------------|---|
| ENV 1993-1-1 | General rules: General rules and rules for buildings; |
| ENV 1993-1-2 | General rules: Structural fire design; |
| ENV 1993-1-3 | General rules: Supplementary rules for cold formed thin gauge members and sheetings; |
| ENV 1993-1-4 | General rules: Supplementary rules for stainless steels; |
| ENV 1993-1-5 | General rules: Supplementary rules for planar plated structures without transverse loading; |
| ENV 1993-1-6 | General rules: Supplementary rules for shell structures |
| ENV 1993-1-7 | General rules: Supplementary rules for planar plated structural elements with out of plane loading; |
| ENV 1993-2 | Steel bridges; |
| ENV 1993-3 | Towers, masts and chimneys; |
| ENV 1993-4 | Silos, tanks and pipelines; |
| ENV 1993-5 | Piling; |
| ENV 1993-6 | Crane supporting structures, |
| ENV 1993-7 | Marine and maritime structures; |

ENV 1993-8 Agricultural structures.

(17) This Part 1-7 of ENV 1993 complements Part 2, Part 4 and Part 7 of ENV 1993 by providing the rules for planar plated structures needed in the design of plate segments in bridges, silos, tanks and marine structures.

(18) Because these rules are not specific to bridges, silos and tanks they have been assembled as a separate document, in a form that is capable of future incorporation with other general rules in ENV 1993 -1-1.

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1 General

1.1 Scope

(1) Part 1-7 of ENV 1993 provides principles and application rules for the structural design of unstiffened and stiffened plates which are loaded by out of plane actions. It is to be used in conjunction with ENV 1993-1-1 and the relevant application standards.

(2) Any action consideration, such as:

- definition of an action
- combination of actions
- partial safety factors on actions

are to be taken from ENV 1991 as far as general rules are concerned, and the relevant parts of ENV 1993 as far as specific application rules are concerned.

(3) This document defines only the characteristic values of the resistance; the partial safety factor for resistance are to be taken from the relevant application standards.

(4) This Part 1-7 is concerned with the requirements of an appropriate design against the ultimate limit state taking account of the following failure modes:

- Plastic limit state
- cyclic plasticity
- buckling
- fatigue.

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(5) Overall equilibrium of the structure (sliding, uplifting, overturning) is not included in this Part 1-7, but is treated in ENV 1993-1-1. Special considerations for specific applications may be found in the relevant applications parts of ENV 1993-1-1.

(6) The rules in this Part 1-7 refer to plate segments in plated structures which may be stiffened or unstiffened. These plate segments may be individual plates or parts of a plated structure. They are loaded by out of plane actions in combination with in plane actions from overall structural behaviour.

(7) The verification of unstiffened and stiffened plated structures loaded only by in-plane effects shall be carried out with the design rules given in ENV 1993-1-5. In ENV 1993-1-7 rules for the interaction between the effects of in plane and out of plane loading are given.

(8) Design rules for cold formed thin gauge members and sheeting are given in ENV 1993-1-3.

(9) The temperature range within which the rules of this Part 1-7 are allowed to be applied are defined in the relevant application parts of ENV 1993.

(10) The rules in this Part 1-7 refer to structural design under actions which may be treated as quasi-static in nature.

(11) The rules in this Part 1-7 refer to structures constructed in compliance with the execution specification of ENV 1993-1-1.

(12) Wind loading and bulk solids flow may, in general, be treated as quasi-static actions. For fatigue, the dynamic effects must be taken into account according to the relevant application parts of ENV 1993. The stress resultants arising from the dynamic behaviour are then treated in this part as quasi-static.

1.2 Distinction between principles and application rules

(1)P Depending on the character of the individual paragraphs, a distinction is made in this Part between principles and application rules.

(2)P The principles comprise:

- general or definitive statements for which there is no alternative;
- requirements and analytical models for which no alternative is permitted unless specifically stated.

(3) The principles are identified by the letter P following the paragraph number.

(4)P The application rules are generally recognized rules that follow the principles and satisfy their requirements. Alternative design rules different from the application rules given in the Eurocode may be used, provided that it is shown that the alternative rule accords with the relevant principles and has at least the same reliability.

(5) In this Part the application rules are identified by a number in brackets, as in this paragraph.

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1.3 Normative references

This European Prestandard 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 Prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- ENV 1993 *Eurocode 3: Design of steel structures:*
- Part 1.1: *General rules: General rules and rules for buildings;*
 - Part 1.3: *Supplementary rules for cold formed thin gauge members and sheeting;*
 - Part 1.5: *General rules: Supplementary rules for planar plated structures without transverse loading;*
 - Part 1.6: *General rules: Supplementary rules for shell structures;*
 - Part 2: *Steel bridges;*
 - Part 4.1: *Silos;*
 - Part 4.2: *Tanks;*
 - Part 4.3: *Pipelines;*

1.4 Definitions

1.4.1 Stress components

1.4.1.1 Membrane stresses in rectangular plate

σ_{mx} is the membrane stress in the x-direction due to membrane forces n_x .

σ_{my} is the membrane stress in the y-direction due to membrane forces n_y .

τ_{mxy} is the membrane shear stress due to membrane forces n_{xy} .

NOTE : The stresses are positive when they occur tension in the plate.

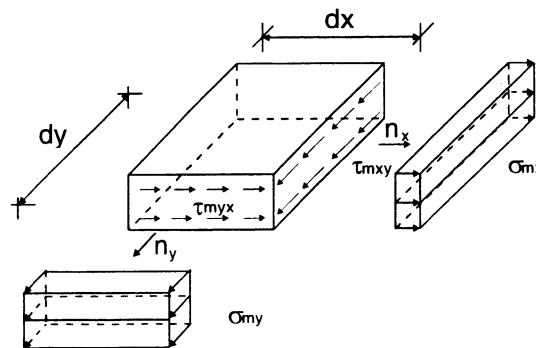


Figure 1.1: Definition of membrane stresses
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1.4.1.2 Bending and shear stresses in rectangular plates due to bending

σ_{bx} is the stress in the x-direction due to bending moment m_x .

σ_{by} is the stress in the y-direction due to bending moment m_y .

τ_{hxy} is the shear stress due to the twisting moment m_{xy} .

τ_{bxz} is the shear stress due to transverse shear forces q_x .

τ_{byz} is the shear stress due to transverse shear forces q_y .

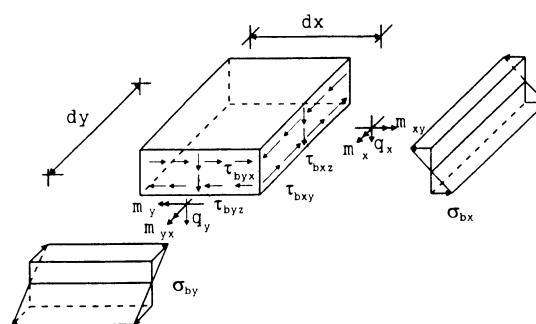


Figure 1.2: Definition of bending and shear stresses due to bending

NOTE : In general, there are eight stress resultants in a plate at any point. The shear stresses τ_{bxz} and τ_{byz} due to q_x and q_y are in most practical cases insignificant compared to the other components of stress, and therefore they may normally be disregarded for the design.