SVENSK STANDARD
SS-EN 1993-1-7:2007

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Eurokod 3: Dimensionering av stålkonstruktioner – Del 1-7: Plana plåtkonstruktioner med transversallast

Eurocode 3: Design of steel structures – Part 1-7 : Strength and stability of planar plated structures subject to out of plane loading

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Standarden EN 1993-1-7:2007 gäller som svensk standard. Europastandarden fastställdes 2007-05-04 som SS-EN 1993-1-6:2007 medels publicering av ett ikraftsättningsdokument. Den utges nu i engelsk språkversion, som även inkluderar den nationella bilaga NA, och som ersätter det tidigare ikraftsättningsbladet.

Det finns för närvarande inga planer på att låta översätta denna Eurokod till svenska.

SS-EN 1993-1-7:2007, utgåva 1 och SS-ENV 1993-1-7, utgåva 1, gäller parallellt längst till 2010-03-30.

Nationellt förord

Eurokoderna innehåller metoder för att verifiera byggnadsverks och enskilda byggnadsverksdelars bärförmåga, stadga och beständighet samt deras funktionsduglighet då de utsätts för brand.

De innehåller ett antal parametrar där det enskilda landet får välja – s.k. nationellt valda parametrar (Nationally Determined Parameter), NDP. Det innebär att ländernas föreskrivande myndigheter i sin författning anger vad man väljer. För att underlätta användningen av eurokoderna nationellt och ge den eftersträvade transparensen för de internationellt verkande företagen, har man kommit överens om att de nationellt valda parametrarna ska återges i en informativ bilaga till respektive nationellt implementerade eurokod.

Föreliggande standard innehåller den informativa nationella bilagan NA, som anger de nationella valen. Bilagan publiceras även som ett separat dokument på engelska.

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Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1993-1-7

April 2007

ICS 91.010.30; 91.080.10

Supersedes ENV 1993-1-7:1999

English Version

Eurocode 3 - Design of steel structures - Part 1-7: Plated structures subject to out of plane loading

Eurocode 3 - Calcul des structures en acier - Partie 1-7: Résistance et stabilité des structures en plaques planes chargées hors de leur plan

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-7: Plattenförmige Bauteile mit Querbelastung

This European Standard was approved by CEN on 12 June 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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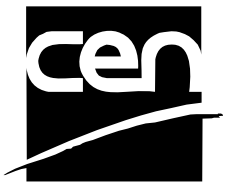

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

Ref. No. EN 1993-1-7:2007: E

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Foreword

Foreword

This European Standard EN 1993-1-7, Eurocode 3: Design of steel structures: Part 1-7 Plated structures subject to out of plane loading, has been prepared by Technical Committee CEN/TC250 « Structural Eurocodes », the Secretariat of which is held by BSI. CEN/TC250 is responsible for all Structural Eurocodes.

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 October 2007, and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes ENV 1993-1-7.

According to the CEN-CENELEC Internal Regulations, the National Standard 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, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

National annex for EN 1993-1-7

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. The National Standard implementing EN 1993-1-7 should have a National Annex containing all Nationally Determined Parameters to be used for the design of steel structures to be constructed in the relevant country.

National choice is allowed in EN 1993-1-7 through:

- 6.3.2(4)

1 General

1.1 Scope

(1)P EN 1993-1-7 provides basic design rules for the structural design of unstiffened and stiffened plates which form part of plated structures such as silos, tanks or containers, that are loaded by out of plane actions. It is intended to be used in conjunction with EN 1993-1-1 and the relevant application standards.

(2) This document defines the design values of the resistances: the partial factor for resistances may be taken from National Annexes of the relevant application standards. Recommended values are given in the relevant application standards.

(3) This Standard is concerned with the requirements for design against the ultimate limit state of:

- plastic collapse;
- cyclic plasticity;
- buckling;
- fatigue.

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

(5) The rules in this Standard 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.

(6) For the verification of unstiffened and stiffened plated structures loaded only by in-plane effects see EN 1993-1-5. In EN 1993-1-7 rules for the interaction between the effects of inplane and out of plane loading are given.

(7) For the design rules for cold formed members and sheeting see EN 1993-1-3.

(8) The temperature range within which the rules of this Standard are allowed to be applied are defined in the relevant application parts of EN 1993.

(9) The rules in this Standard refer to structures constructed in compliance with the execution specification of EN 1090-2.

(10) Wind loading and bulk solids flow should be treated as quasi-static actions. For fatigue, the dynamic effects must be taken into account according to EN 1993-1-9. The stress resultants arising from the dynamic behaviour are treated in this part as quasi-static.

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

EN 1993	Eurocode 3:	Design of steel structures:
	Part 1.1:	General rules and rules for buildings
	Part 1.3:	Cold-formed members and sheeting
	Part 1.4:	Stainless steels
	Part 1.5:	Plated structural elements

Part 1.6: Strength and stability of shell structures

Part 1.8: Design of joints

Part 1.9: Fatigue strength of steel structures

Part 1.10: Selection of steel for fracture toughness and through-thickness properties

Part 1.12: Additional rules for the extension of EN 1993 up to steel grades S700

Part 4.1: Silos

Part 4.2: Tanks

1.3 Terms and definitions

(1) The rules in EN 1990, clause 1.5 apply.

(2) The following terms and definitions are supplementary to those used in EN 1993-1-1:

1.3.1 Structural forms and geometry

1.3.1.1 Plated structure

A structure that is built up from nominally flat plates which are joined together. The plates may be stiffened or unstiffened, see Figure 1.1.

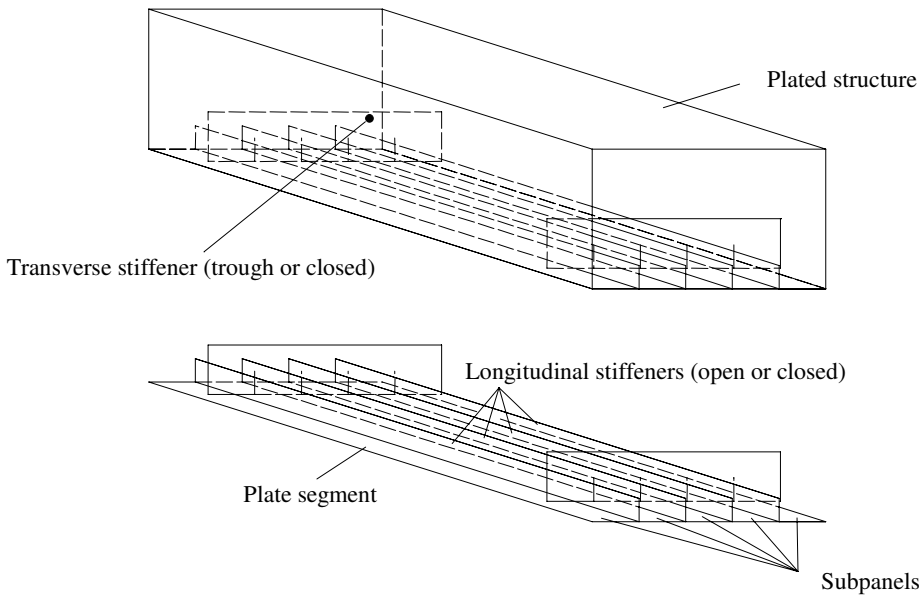

Figure 1.1: Components of a plated structure

1.3.1.2 Plate segment

A plate segment is a flat plate which may be unstiffened or stiffened. A plate segment should be regarded as an individual part of a plated structure.

1.3.1.3 Stiffener

A plate or a section attached to the plate with the purpose of preventing buckling of the plate or reinforcing it against local loads. A stiffener is denoted:

- longitudinal if its longitudinal direction is in the main direction of load transfer of the member of which it forms a part.
- transverse if its longitudinal direction is perpendicular to the main direction of load transfer of the member of which it forms a part.

1.3.1.4 Stiffened plate

Plate with transverse and/or longitudinal stiffeners.

1.3.1.5 Sub-panel

Unstiffened plate surrounded by stiffeners or, on a web, by flanges and/or stiffeners or, on a flange, by webs and/or stiffeners.

1.3.2 Terminology

1.3.2.1 Plastic collapse

A failure mode at the ultimate limit state where the structure loses its ability to resist increased loading due to the development of a plastic mechanism.

1.3.2.2 Tensile rupture

A failure mode in the ultimate limit state where failure of the plate occurs due to tension.

1.3.2.3 Cyclic plasticity

Where repeated yielding is caused by cycles of loading and unloading.

1.3.2.4 Buckling

Where the structure looses its stability under compression and/or shear.

1.3.2.5 Fatigue

Where cyclic loading causes cracking or failure.

1.3.3 Actions

1.3.3.1 Out of plane loading

The load applied normal to the middle surface of a plate segment.

1.3.3.2 In-plane forces

Forces applied parallel to the surface of the plate segment. They are induced by in-plane effects (for example temperature and friction effects) or by global loads applied at the plated structure.

1.4 Symbols

(1) In addition to those given in EN 1990 and EN 1993-1-1, the following symbols are used:

(2) Membrane stresses in rectangular plate, see Figure 1.2:

σ_{mx} is the membrane normal stress in the x-direction due to membrane normal stress resultant per unit width n_x;

σ_{my} is the membrane normal stress in the y-direction due to membrane normal stress resultant per unit width n_y;

τ_{mxy} is the membrane shear stress due to membrane shear stress resultant per unit width n_{xy}.

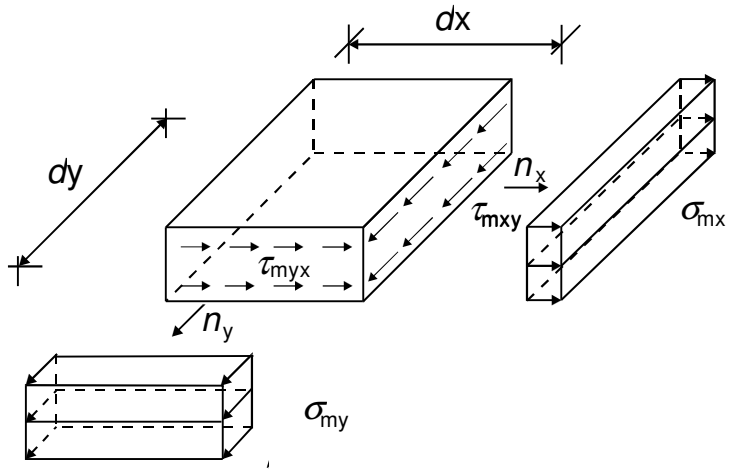

Figure 1.2: Membrane stresses

(3) Bending and shear stresses in rectangular plates due to bending, see Figure 1.3:

σ_{bx} is the stress in the x-direction due to bending moment per unit width m_x;

σ_{by} is the stress in the y-direction due to bending moment per unit width m_y;

τ_{bxy} is the shear stress due to the twisting moment per unit width m_{xy};

τ_{bxz} is the shear stress due to transverse shear forces per unit width q_x associated with bending;

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

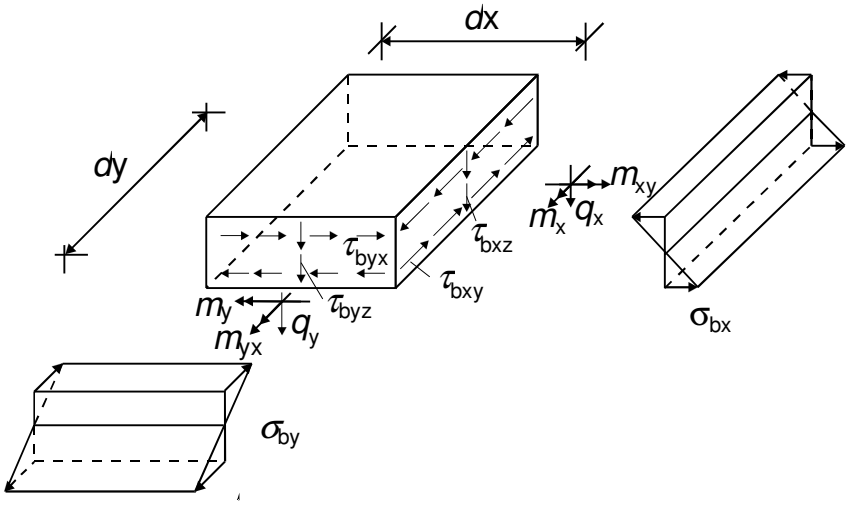

Figure 1.3: Normal and shear stresses due to bending

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.

(4) Greek lower case letters:

α aspect ratio of a plate segment (a/b);

ε strain;

α_R load amplification factor;

ρ reduction factor for plate buckling;

σ_i Normal stress in the direction i, see Figure 1.2 and Figure 1.3;