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**EN 1993-1-5:2006, IDT**  
(ICS 91.010.30; 91.080.10)

**SINGAPORE STANDARD**

**Eurocode 3 : Design of steel structures**

**– Part 1-5 : Plated structural elements**

This national standard is the identical implementation of EN 1993-1-6 : 2007 and is adopted with permission of CEN, Rue de la Science 23 B - 1040 Brussels

Incorporating Amendment No. 1  
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## **National Foreword**

This Singapore Standard was prepared by the Technical Committee on Building Structure and Sub-structure under the purview of the Building and Construction Standards Committee.

This SS EN is the identical implementation of EN 1993-1-5 : 2006 'Eurocode 3 : Design of steel structures – Part 1-5 : Plated structural elements' incorporating its Corrigendum EN 1993-1-5 : 2006/AC:2009, denoted by AC > < AC and its Amendments EN 1993-1-5:2006/A1:2017 and EN 1993-1-5:2006/A2:2019, denoted by A1 > < A1 and A2 > < A2 and is adopted with permission of CEN, Rue de la Science 23 B - 1040 Brussels.

Attention is drawn to the following:

- The comma has been used throughout as a decimal marker whereas in Singapore Standards, it is a practice to use a full point on the baseline as the decimal marker.
- The Singapore Standards which implement international or European publications referred to in this document may be found in the SS Electronic Catalogue at:  
<https://www.singaporestandardseshop.sg>

The EN gives values with notes indicating where national choices may be made. Where a normative part of the EN allows for national choice to be made, the range and possible choice will be given in the normative text, and a note will qualify it as a Nationally Determined Parameter (NDP). NDPs can be a specific value for a factor, a specific level or class, a particular method or a particular application rule if several are proposed in the EN.

The requirements of this SS EN 1993-1-5 : 2009 are to be read in conjunction with the Singapore National Annex (NA) to SS EN 1993-1-5 : 2009 which contains information on the Singapore Nationally Determined Parameters and is published separately.

National choice is allowed in EN 1993-1-5 through the following clauses:

- |          |            |            |
|----------|------------|------------|
| – 2.2(5) | – 8(2)     | – C.2(1)   |
| – 3.3(1) | – 9.1(1)   | – C.5(2)   |
| – 4.3(6) | – 9.2.1(9) | – C.8(1)   |
| – 5.1(2) | – 10(1)    | – C.9(3)   |
| – 6.4(2) | – 10(5)    | – D.2.2(2) |

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- 1. Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "mature standards". Mature standards will not be subject to further review unless there are requests to review such standards.*
- 2. An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*
- 3. Compliance with a SS or TR does not exempt users from any legal obligations.*

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 1993-1-5:2006/A2**

July 2019

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ICS 91.010.30; 91.080.10

English Version

## Eurocode 3 - Design of steel structures - Part 1-5: Plated structural elements

Eurocode 3 - Calcul des structures en acier - Partie 1-5:  
Plaques planes

Eurocode 3 - Bemessung und konstruktion von Stahlbauten  
- Teil 1-5: Plattenbeulen

This European Standard was approved by CEN on 13 January 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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.



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EN 1993-1-5:2006+A2:2019

## Foreword

This European Standard EN 1993-1-5, Eurocode 3: Design of steel structures Part 1.5: Plated structural elements, 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 April 2007 and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes E NV 1993-1-5.

According to the CEN-CENELEC Internal Regulations, the National Standard Organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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.

## Foreword to amendment A1

This document (EN 1993-1-5:2006/A1:2017) has been prepared by Technical Committee CEN/TC 250 “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 April 2018, and conflicting national standards shall be withdrawn at the latest by April 2018.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Foreword to amendment A2

This document (EN 1993-1-5:2006/A2:2019) has been prepared by Technical Committee CEN/TC 250 “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 July 2020, and conflicting national standards shall be withdrawn at the latest by April 2021.

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## National annex for EN 1993-1-5

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. The National Standard implementing EN 1993-1-5 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 1993-1-5 through:

- 2.2(5)
- 3.3(1)
- 4.3(6)
- 5.1(2)
- 6.4(2)
- 8(2)
- 9.1(1)
- 9.2.1(9)
- 10(1)
- 10(5)
- C.2(1)
- C.5(2)
- C.8(1)
- C.9(3)
- D.2.2(2)

# 1 Introduction

## 1.1 Scope

- (1) EN 1993-1-5 gives design requirements of stiffened and unstiffened plates which are subject to in-plane forces.
- (2) Effects due to shear lag, in-plane load introduction and plate buckling for I-section girders and box girders are covered. Also covered are plated structural components subject to in-plane loads as in tanks and silos. The effects of out-of-plane loading are outside the scope of this document.

**NOTE 1:** The rules in this part complement the rules for class 1, 2, 3 and 4 sections, see EN 1993-1-1.

**NOTE 2:** For the design of slender plates which are subject to repeated direct stress and/or shear and also fatigue due to out-of-plane bending of plate elements (breathing) see EN 1993-2 and EN 1993-6.

**NOTE 3:** For the effects of out-of-plane loading and for the combination of in-plane effects and out-of-plane loading effects see EN 1993-2 and EN 1993-1-7.

**NOTE 4:** Single plate elements may be considered as flat where the curvature radius  $r$  satisfies:

$$r \geq \frac{a^2}{t} \quad (1.1)$$

where  $a$  is the panel width

$t$  is the plate thickness

## 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 1993-1-1 *Eurocode 3 :Design of steel structures: Part 1-1: General rules and rules for buildings*

## 1.3 Terms and definitions

For the purpose of this standard, the following terms and definitions apply:

### 1.3.1

#### **elastic critical stress**

stress in a component at which the component becomes unstable when using small deflection elastic theory of a perfect structure

### 1.3.2

#### **membrane stress**

stress at mid-plane of the plate

### 1.3.3

#### **gross cross-section**

the total cross-sectional area of a member but excluding discontinuous longitudinal stiffeners

### 1.3.4

#### **effective cross-section and effective width**

the gross cross-section or width reduced for the effects of plate buckling or shear lag or both; to distinguish between their effects the word “effective” is clarified as follows:

“effective<sup>P</sup>” denotes effects of plate buckling