BS EN 1993-1-6:2007+A1:2017

BSI Standards Publication

Eurocode 3 — Design of steel structures

Part 1-6: Strength and Stability of Shell Structures

bsi.

National foreword

This British Standard is the UK implementation of EN 1993-1-6:2007+A1:2017. It supersedes BS EN 1993-1-6:2007, which is withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CEN corrigendum April 2009 is indicated in the text by ⟨AC1⟩ ⟨AC1⟩.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by ⟨A1⟩ ⟨A1⟩.

The structural Eurocodes are divided into packages by grouping Eurocodes for each of the main materials: concrete, steel, composite concrete and steel, timber, masonry and aluminium; this is to enable a common date of withdrawal (DOW) for all the relevant parts that are needed for a particular design. The conflicting national standards will be withdrawn at the end of the co-existence period, after all the EN Eurocodes of a package are available.

Following publication of the EN, there is a period allowed for national calibration during which the National Annex is issued, followed by a coexistence period of a maximum three years. During the co-existence period Member States are encouraged to adapt their national provisions. At the end of this co-existence period, the conflicting parts of national standard(s) will be withdrawn.

In the UK there are no conflicting national standards.

The UK participation in its preparation was entrusted to Technical Committee CB/203, Design & execution of steel structures.

A list of organizations represented on this committee can be obtained on request to its secretary.

Where a normative part of this EN allows for a choice to be made at the national level, the range and possible choice will be given in the normative text as Recommended Values, 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.

UK National Annex to BS EN 1993-1-6
To enable EN 1993-1-6 to be used in the UK, the committee has decided that no National Annex will be issued and recommend the following:

— all the Recommended Values should be used;

— all Informative Annexes may be used; and

— no NCCI have currently been identified.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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ICS 91.080.10; 91.010.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2007.

Amendments/corrigenda issued since publication

Date	Text affected
28 February 2010	Implementation of CEN corrigendum April 2009, and correction to national foreword
31 December 2017	Implementation of CEN amendment A1:2017

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1993-1-6:2007+A1

April 2017

Incorporating corrigendum April 2009

ICS 91.010.30; 91.080.10

English Version

Eurocode 3 - Design of steel structures - Part 1-6: Strength and Stability of Shell Structures

Eurocode 3 - Calcul des structures en acier - Partie 1-6: Ré sistance et stabilité des structures en coque

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-6: Festigkeit und Stabilität von Schalen

This European Standard was approved by CEN on 12 June 2006.

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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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Foreword

This European Standard EN 1993-1-6, Eurocode 3: Design of steel structures: Part 1-6 Strength and stability of shell structures, 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 August 2007, and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes ENV 1993-1-6.

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.

Foreword to amendment A1

This document (EN 1993-1-6:2007/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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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

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National annex for EN 1993-1-6

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1993-1-6 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 1993-1-6 through:

– 3.1.(4)
– 4.1.4 (3)
– 5.2.4 (1)
– [A1] 6.2.1 (6) [A1]
– 6.3 (5)
– 7.3.1 (1)
– 7.3.2 (1)
– 8.4.2 (3)
– 8.4.3 (2)
– 8.4.3 (4)
– 8.4.4 (4)
– 8.4.5 (1)
– 8.5.2 (2)
– 8.5.2 (4)
– [A1] 8.6.3 (5) [A1]
– 8.8.2 (9)
– 8.8.2 (18)
– 8.8.2 (20) (2 times)
– 9.2.1 (2)P

1. General

1.1 Scope

(1) EN 1993-1-6 gives basic design rules for plated steel structures that have the form of a shell of revolution.

(2) This Standard is intended for use in conjunction with EN 1993-1-1, EN 1993-1-3, EN 1993-1-4, EN1993-1-9 and the relevant application parts of EN 1993, which include:

Part 3.1 for towers and masts;
Part 3.2 for chimneys;
Part 4.1 for silos;
Part 4.2 for tanks;
Part 4.3 for pipelines.

(3) This Standard defines the characteristic and design values of the resistance of the structure.

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

plastic limit;
cyclic plasticity;
buckling;
fatigue.

(5) 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 are included in the relevant application parts of EN 1993.

(6) The provisions in this Standard apply to axisymmetric shells and associated circular or annular plates and to beam section rings and stringer stiffeners where they form part of the complete structure. General procedures for computer calculations of all shell forms are covered. Detailed expressions for the hand calculation of unstiffened cylinders and cones are given in the Annexes.

(7) Cylindrical and conical panels are not explicitly covered by this Standard. However, the provisions can be applicable if the appropriate boundary conditions are duly taken into account.

(8) This Standard is intended for application to steel shell structures. Where no standard exists for shell structures made of other metals, the provisions of this standards may be applied provided that the appropriate material properties are duly taken into account.

(9) The provisions of this Standard are intended to be applied within the temperature range defined in the relevant EN 1993 application parts. The maximum temperature is restricted so that the influence of creep can be neglected if high temperature creep effects are not covered by the relevant application part.

(10) The provisions in this Standard apply to structures that satisfy the brittle fracture provisions given in EN 1993-1-10.

(11) The provisions of this Standard apply to structural design under actions that can be treated as quasi-static in nature.

(12) In this Standard, it is assumed that both wind loading and bulk solids flow can, in general, be treated as quasi-static actions.

(13) Dynamic effects should be taken into account according to the relevant application part of EN 1993, including the consequences for fatigue. However, the stress resultants arising from dynamic behaviour are treated in this part as quasi-static.

(14) The provisions in this Standard apply to structures that are constructed in accordance with EN 1090-2.

(15) This Standard does not cover the aspects of leakage.

(16) This Standard is intended for application to structures within the following limits:

design metal temperatures within the range –50°C to +300°C;
radius to thickness ratios within the range 20 to 5000.

NOTE: It should be noted that the stress design rules of this standard may be rather conservative if applied to some geometries and loading conditions for relatively thick-walled shells.

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 1090-2	*Execution of steel structures and aluminium structures – Part 2: Technical requirements for steel structures;*
EN 1990	*Basis of structural design;*
EN 1991	*Eurocode 1: Actions on structures;*
EN 1993	*Eurocode 3: Design of steel structures:*
〚A1〛 Part 1.1:2005 〚A1〛	*General rules and rules for buildings;*
Part 1.3:	*Cold formed thin gauged members and sheeting;*
Part 1.4:	*Stainless steels;*
Part 1.5:	*Plated structural elements;*
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 S 700*
Part 2:	*Steel bridges;*
Part 3.1:	*Towers and masts;*
Part 3.2:	*Chimneys;*
Part 4.1:	*Silos;*
Part 4.2:	*Tanks;*
Part 4.3:	*Pipelines;*
Part 5:	*Piling.*

1.3 Terms and definitions

The terms that are defined in EN 1990 for common use in the Structural Eurocodes apply to this Standard. Unless otherwise stated, the definitions given in ISO 8930 also apply in this Standard. Supplementary to EN 1993-1-1, for the purposes of this Standard, the following definitions apply:

1.3.1 Structural forms and geometry

1.3.1.1 shell

A structure or a structural component formed from a curved thin plate.

1.3.1.2 shell of revolution

A shell whose geometric form is defined by a middle surface that is formed by rotating a meridional generator line around a single axis through 2ϖ radians. The shell can be of any length.

1.3.1.3 complete axisymmetric shell

A shell composed of a number of parts, each of which is a shell of revolution.