



SLOVENSKI STANDARD

SIST EN 1993-3-2:2007

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Evrokod 3: Projektiranje jeklenih konstrukcij – 3-2. del: Stolpi, jambori in dimniki - Dimniki

Eurocode 3 - Design of steel structures - Part 3-2: Towers, masts and chimneys - Chimneys

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 3-2: Türme, Maste und Schornsteine - Schornsteine

Eurocode 3 - Calcul des structures en acier - Partie 3-2: Tours, mâts et cheminées - Cheminées

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ICS:

91.010.30	V^@ã}ãããã	Technical aspects
91.060.40	Dimniki, jaški, kanali	Chimneys, shafts, ducts
91.080.10	Kovinske konstrukcije	Metal structures

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English Version

Eurocode 3 - Design of steel structures - Part 3-2: Towers,
masts and chimneys - Chimneys

Eurocode 3 - Calcul des structures en acier - Partie 3-2:
Tours, mâts et cheminées - Cheminées

Eurocode 3 - Bemessung und Konstruktion von
Stahlbauten - Teil 3-2: Türme, Maste und Schornsteine -
Schornsteine

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.

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

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Foreword

This European Standard EN 1993-3-2, Eurocode 3: Design of steel structures: Part 3-2 Towers, masts and chimneys – Chimneys, 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 ENV 1993-3-2.

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.

National Annex for EN 1993-3-2

This standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1993-3-2 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 1993-3-2 through paragraphs:

- 2.3.3.1(1)
- 2.3.3.5(1)
- 2.6(1)
- 4.2(1)
- 5.1(1)
- 5.2.1(3)
- 6.1(1)P
- 6.2.1(6)
- 6.4.1(1)
- 6.4.2(1)
- 6.4.3(2)
- 7.2(1)
- 7.2(2)
- 9.1(3)
- 9.1(4)
- 9.5(1)
- A.1(1)
- A.2(1) (2 places)
- C.2(1)

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1 General

1.1 Scope

- (1) This Part 3.2 of EN 1993 applies to the structural design of vertical steel chimneys of circular or conical section. It covers chimneys that are cantilevered, supported at intermediate levels or guyed.
- (2) The provisions in this Part supplement those given in Part 1.1 of EN 1993.
- (3) This Part 3.2 is concerned only with the requirement for resistance (strength, stability and fatigue) of steel chimneys.

NOTE: In this context (i.e. resistance) the term chimney refers to:

- a) chimney structures
- b) the steel cylindrical elements of towers
- c) the steel cylindrical shafts of guyed masts

- (4) For provisions concerning aspects, such as chemical attack, thermo-dynamical performance or thermal insulation see EN 13084-1. For the design of liners see EN 13084-6.
- (5) Foundations in reinforced concrete for steel chimneys are covered in EN 1992 and EN 1997. See also 4.7 and 5.4 of EN 13084-1.
- (6) Wind loads are specified in EN 1991-1-4.

NOTE: Procedures for the wind response of guyed chimneys are given in annex B of EN 1993-3-1.

- (7) This Part does not cover special provisions for seismic design, which are given in EN 1998-6. See also 5.2.4.1 of EN 13084-1.

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- (8) Provisions for the guys and their attachments are given in EN 1993-3-1 and EN 1993-1-11.

- (9) For the execution of steel chimneys, reference should be made to EN 1090, Part 2 and EN 13084-1.

NOTE: Execution is covered to the extent that is necessary to indicate the quality of the construction materials and products that should be used and the standard of workmanship on site needed to comply with the assumptions of the design rules.

- (10) The following subjects are dealt with in EN 1993-3-2:

Section 1: General

Section 2: Basis of design

Section 3: Materials

Section 4: Durability

Section 5: Structural analysis

Section 6: Ultimate limit states

Section 7: Serviceability limit states

Section 8: Design assisted by testing

Section 9: Fatigue

1.2 Normative references

(1) The following normative documents contain provisions which, through references in this text, constitute provisions of this European standard. For dated references, subsequent amendments to or revisions of any of these publications do not apply. However, parties to agreements based on this European standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the normative document referred to applies.

EN 1090	<i>Execution of steel structures and aluminium structures</i>
EN 10025	<i>Hot rolled products of non-alloy structural steels. Technical delivery conditions</i>
EN 10088	<i>Stainless steels</i>
EN 13084-1	<i>Free standing industrial chimneys – Part 1 : General Requirements</i>
EN ISO 5817	<i>Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections</i>

1.3 Assumptions

(1) See 1.3 of EN 1993-1-1.

1.4 Distinction between principles and application rules

(1) See 1.4 of EN 1993-1-1.

1.5 Terms and definitions

(1) The terms and definitions that are defined in EN 1990 for common use in the Structural Eurocodes apply to this Part 3.2 of EN 1993.

(2) Supplementary to Part 1 of EN 1993, for the purposes of this Part 3.2, the following definitions apply. Definitions used for chimney structures are shown in Figure 1.1.

1.5.1

chimney

Vertical construction works or building components that conduct waste gases, or other flue gases, supply or exhaust air to the atmosphere.

1.5.2

self-supported chimney

A chimney whose supporting shaft is not connected with any other construction above the base level.

1.5.3

guyed chimney

A chimney whose supporting shaft is held in place by guys at one or more height levels.

1.5.4

single-wall chimney

A chimney whose structural shell also conducts the flue gases. It may be fitted by thermal insulation and/or internal lining.

1.5.5

double-wall chimney

A chimney consisting of an outer steel structural shell and one inner liner which carries the flue gases.

1.5.6**multi-flue chimney**

A group of two or more chimneys structurally interconnected or a group of two or more liners within a structural shell.

1.5.7**liner**

The structural element (membrane) of the lining system, contained within the structural shell.

1.5.8**lining system**

Total system, if any, which separates the flue gases from the structural shell. This comprises a liner and its supports, the space between the liner and structural shell and insulation, where existing.

1.5.9**structural shell**

The main load-bearing steel structure of the chimney, excluding any flanges.

1.5.10**aerodynamic device**

A device fitted to the chimney to reduce vortex excitation without increasing the structural damping.

1.5.11**damping device**

A device fitted to the chimney to reduce vortex excited oscillations by increasing the structural damping.

1.5.12**spoiler**

A device attached to the surface of a chimney with the objective of reducing cross wind response.

1.5.13**helical strakes, shrouds or slats**

Devices fitted to the outer surface of the chimney to reduce cross wind response.

1.5.14**base plate**

A horizontal plate fixed to the base of a chimney.

1.5.15**anchor bolt**

A bolt for the connection of the chimney to the foundation.

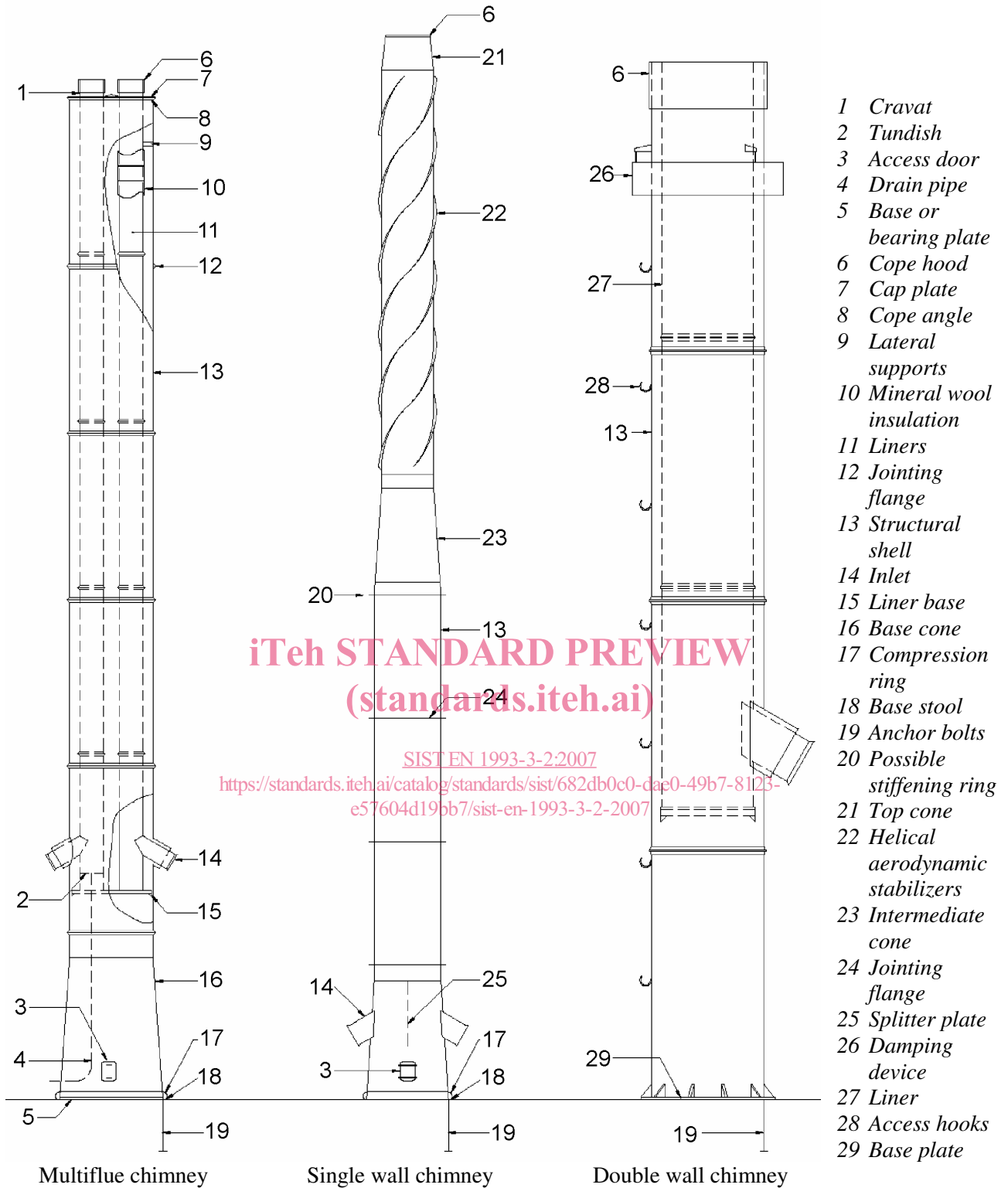
1.5.16**stiffening rings**

Horizontal members to prevent ovaling and to hold the chimney shell round during fabrication and transport. Horizontal members to provide stiffeners at cut outs and openings or possibly at changes in slope of the structural shell.

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1.6 Symbols used in Part 3.2 of Eurocode 3

(1) In addition to those given in EN 1993-1-1 the following main symbols are used.

c corrosion allowance
 N number of cycles
 b diameter
 d bolt diameter

h height
 m slope
 t time
 w wind pressure

ref reference
 crit critical value
 ext external
 F load
 f fatigue
 int internal
 lat lateral (cross wind)
 top top
 R rupture
 Temp temperature

λ equivalence factor
 η factor to account for second order effects

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(2) Further symbols are defined where they first occur.

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2 Basis of design

2.1 Requirements

2.1.1 Basic Requirements

(1) See EN 1993-1-1.

(2)P A chimney shall be designed so that provided it is properly constructed and maintained it is capable of satisfying the fundamental requirements specified in EN 1990 and in EN 13084-1.

(3) The structural design of guyed chimneys should be in accordance with the relevant clauses of EN 1993-3-1 as well as this Part.

2.1.2 Reliability management

(1) Different levels of reliability may be adopted for the ultimate limit states verifications for chimneys, depending on the possible economic and social consequences of their collapse.

NOTE: For the definition of different levels of reliability see Annex A.

2.2 Principles of limit state design

- (1) See 2.2 of EN 1993-1-1.

2.3 Actions and environmental influences

2.3.1 General

- (1)P The general requirements of section 4 of EN 1990 shall be satisfied.
- (2) The strength and stability of chimneys should be verified for the actions described in 2.3.2 and 2.3.3.

2.3.2 Permanent actions

- (1) In calculating self-weight, the full thickness of steelwork should be considered, with no loss due to corrosion.
- (2) The permanent actions should include the estimated weight of all permanent structures and other elements, including fittings, insulation, dust loads, clinging ash, coatings and other loads. The weight of the chimney and its lining should be determined according to EN 1991-1-1 taking account of long-term effects of fluids or moisture on the density of linings if relevant.

2.3.3 Variable actions

2.3.3.1 Imposed loads

- (1) Imposed loads should be applied on platforms and railings.

NOTE 1: The National Annex may give information on imposed loads on platforms and railings. The following characteristic values of imposed loads are recommended:

- Imposed loads on platforms: **2,0 kN/m²** (see also EN 13084-1) ... (2.1a)
- Horizontal loads on railings: **0,5 kN/m** ... (2.1b)

NOTE 2: These loads may be assumed to act in the absence of other climatic loads.

2.3.3.2 Wind actions

- (1) Wind action should be taken from EN 1991-1-4.
- (2) Wind loads should be applied on the external surfaces of a chimney as a whole and on accessory components, for example a ladder. Besides the drag forces due to the gusty wind acting in general in the wind direction, forces due to vortex shedding that cause cross wind vibrations of a chimney should be considered.

NOTE: For guyed chimneys see also Annex B to EN 1993-3-1.

- (3) Other wind actions, for instance due to uneven wind pressure distribution (ovalling) or interference effects, should be taken into account if the relevant criteria are exceeded, see 5.2.1.
- (4) Actions caused by interference galloping or classical galloping should be assessed according to EN 1991-1-4.
- (5) If chimneys are predicted to be subject to excessive wind vibrations, measures may be taken to reduce these in the design, or by installation of damping devices, see Annex B.