SLOVENSKI STANDARD
oSIST prEN 1998-4:2023

01-december-2023

Evrokod 8: Projektiranje potresnoodpornih konstrukcij – 4. del: Silosi, rezervoarji, cevovodi, stolpi, jambori in dimniki

Eurocode 8 - Design of structures for earthquake resistance - Part 4: Silos, tanks, pipelines, towers, masts and chimneys

Eurocode 8 - Auslegung von Bauwerken gegen Erdbeben - Teil 4: Silos, Tankbauwerke und Rohrleitungen, Türme, Maste und Schornsteine

Eurocode 8 - Calcul des structures pour leur résistance au séisme - Part 4: Silos, réservoirs, canalisations, tours, mâts et cheminées

iTeh Standards
(https://standards.iteh.ai)
Document Preview

Ta slovenski standard je istoveten z: **prEN 1998-4**

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afae6-a037-4a44-a355-e0f377411908/osist-pren-1998-4-2023

ICS:

91.010.30	Tehnični vidiki	Technical aspects
91.060.40	Dimniki, jaški, kanali	Chimneys, shafts, ducts
91.120.25	Zaščita pred potresi in vibracijami	Seismic and vibration protection

oSIST prEN 1998-4:2023 **en,fr,de**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

oSIST prEN 1998-4:2023

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1998-4

September 2023

ICS

Will supersede EN 1998-4:2006, EN 1998-6:2005

English Version

Eurocode 8 - Design of structures for earthquake resistance - Part 4: Silos, tanks, pipelines, towers, masts and chimneys

Eurocode 8 - Calcul des structures pour leur résistance au séisme - Part 4: Silos, réservoirs, tuyauteries, tours, mâts et cheminées

Eurocode 8 - Auslegung von Bauwerken gegen Erdbeben - Teil 4: Silos, Tankbauwerke und Rohrleitungen, Türme, Maste und Schornsteine

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 250.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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-CENELEC Management Centre has the same status as the official versions.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2023 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. prEN 1998-4:2023 E

oSIST prEN 1998-4:2023

Contents

Page

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

oSIST prEN 1998-4:2023

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN 1998-4:2023

oSIST prEN 1998-4:2023

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afaeb-a037-4a44-a353-c0137711191f8/osist-pren-1998-4-2023

oSIST prEN 1998-4:2023

iTeh Standards (https://standards.iteh.ai) Document Preview

oSIST prEN 1998-4:2023

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

oSIST prEN 1998-4:2023

European foreword

This document (prEN 1998-4:2023) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1998-4:2007 and EN 1998-6:2005.

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by the Eurocodes.

The Eurocodes recognise the responsibility of each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level through the use of National Annexes.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

oSIST prEN 1998-4:2023

0 Introduction

0.1 Introduction to the Eurocodes

The Structural Eurocodes comprise the following standards generally consisting of a number of parts:

— EN 1990 Eurocode: Basis of structural and geotechnical design

— EN 1991 Eurocode 1: 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 of structures for earthquake resistance

— EN 1999 Eurocode 9: Design of aluminium structures

— New parts are under development, e.g. Eurocode for design of structural glass

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, software developers, and committees drafting standards for related product, testing and execution standards.

NOTE Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

0.2 Introduction to EN 1998 (all parts)

oSIST prEN 1998-4:2023

EN 1998 (all parts) defines the rules for the seismic design of new buildings and engineering works and the assessment and retrofit of existing ones, including geotechnical aspects, as well as temporary structures.

NOTE This standard also covers the verification of structures in the seismic situation during construction, when required.

Attention should be paid to the fact that, for the design of structures in seismic regions, the provisions of EN 1998 should be applied in addition to the relevant provisions of EN 1990 to EN 1997 (all parts) and EN 1999 (all parts). In particular, EN 1998 should be applied to structures of consequence classes CC1, CC2 and CC3, as defined in EN 1990:2023, 4.3. Structures of consequence class CC4 are not fully covered by the Eurocodes but may be required to follow EN 1998, or parts of it, by the relevant Authorities.

By nature, perfect protection (a null seismic risk) against earthquakes is not feasible in practice, namely because the knowledge of the hazard itself is characterized by a significant uncertainty. Therefore, in Eurocode 8, the seismic action is represented in a conventional form, proportional in amplitude to earthquakes likely to occur at a given location and representative of their frequency content. This representation is not the prediction of a particular seismic movement, and such a movement could give rise to more severe effects than those of the seismic action considered, inflicting damage greater than the one described by the Limit States contemplated in this standard.

oSIST prEN 1998-4:2023

Not only the seismic action cannot be predicted, but in addition, it should be recognised that engineering methods are not perfectly predictive when considering the effects of this specific action, under which structures are assumed to respond in the non-linear regime. Such uncertainties are taken into account according to the general framework of EN 1990, with a residual risk of underestimation of their effects.

EN 1998 is subdivided in various parts

EN 1998-1-1, *Eurocode 8 — Design of structures for earthquake resistance – Part 1-1: General rules and seismic action;*

EN 1998-1-2, *Eurocode 8 —Design of structures for earthquake resistance – Part 1-2: Buildings;*

EN 1998-2, *Eurocode 8 — Design of structures for earthquake resistance – Part 2: Bridges;*

EN 1998-3, *Eurocode 8 —Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings and bridges;*

EN 1998-4, *Eurocode 8 — Design of structures for earthquake resistance – Part 4 Silos, tanks, pipelines, towers, masts and chimneys;*

EN 1998-5, *Eurocode 8 —Design of structures for earthquake resistance – Part 5: Geotechnical aspects, foundations, retaining and underground structures.*

0.3 Introduction to prEN 1998-4

prEN 1998-4 provides specific requirements for earthquake resistant design of new on-ground and elevated silos, on-ground, elevated and underground tanks, above-ground and buried pipeline systems, towers, masts and chimneys and ancillary elements attached to the aforementioned structures or in industrial facilities, which are additional to the ones in other Eurocodes.

prEN 1998-4 is subdivided in ten clauses and includes seven annexes, where Annex A is normative and Annexes B, C, D, E, F, G are informative.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

0.4 Verbal forms used in the Eurocodes

The verb “shall” expresses a requirement strictly to be followed and from which no deviation is permitted in order to comply with the Eurocodes.

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-e037-4a44-a355-c0f37711198f/osist-pren-1998-4-2023

The verb “should” expresses a highly recommended choice or course of action. Subject to national regulation and/or any relevant contractual provisions, alternative approaches could be used/adopted where technically justified.

The verb “may" expresses a course of action permissible within the limits of the Eurocodes.

The verb “can" expresses possibility and capability; it is used for statements of fact and clarification of concepts.

0.5 National annex for prEN 1998-4

National choice is allowed in this standard where explicitly stated within notes. National choice includes the selection of values for Nationally Determined Parameters (NDPs).

The national standard implementing prEN 1998-4 can have a National Annex containing all national choices to be used for the design of buildings to be constructed in the relevant country.

When no national choice is given, the default choice given in this standard is to be used.

When no national choice is made and no default is given in this document, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by the relevant parties.

National choice is allowed in prEN 1998-4 through notes to the following clauses:

oSIST prEN 1998-4:2023

4.2(2)	4.2(3)	4.3(6)	4.3(7)

National choice is also allowed in prEN 1998-4 on the application of the following informative annexes:

Annex B	Annex C	Annex D	Annex E
Annex F	Annex G		

The National Annex can contain, directly or by reference, non-contradictory complementary information for ease of implementation, provided it does not alter any provisions of the Eurocodes.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

oSIST prEN 1998-4:2023

1 Scope

1.1 Scope of prEN 1998-4

(1) This document is applicable to the seismic design of on-ground and elevated silos, on-ground, elevated and underground tanks, above-ground and buried pipeline systems, towers, masts and chimneys and ancillary elements attached to the aforementioned structures or in industrial facilities.

(2) Unless specifically stated, EN 1998-1-1:—[2], and EN 1998-5:—[4] apply.

(3) prEN 1998-4 is applicable in complement to the other relevant Eurocodes.

NOTE This document contains only those provisions that, in addition to the provisions of the other relevant Eurocodes, are used for the design of new structures, as listed in (1), in seismic regions. prEN 1998-4 complements in this respect the other Eurocodes.

1.2 Assumptions

(1) The assumptions of EN 1998-1-1:—[2], 1.2, are assumed to be applied.

(2) It is assumed that the changes in a) and b) will not take place during the construction phase or during the subsequent life span for all structures covered by prEN 1998-4, unless proper justification and verification is provided:

a) substantial changes in the structural systems, supporting structures or attached ancillary elements listed in 1.1 (1);

b) substantial changes of masses or mass distribution. This includes, in particular, changes in production, such as specific changes of filling loads, filling states and ancillary elements.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

oSIST prEN 1998-4:2023

NOTE See the Bibliography for a list of other documents cited that are not normative references, including those referenced as recommendations (i.e. in ‘should’ clauses), permissions (‘may’ clauses), possibilities ('can' clauses), and in notes.

EN 1990:2023, *Eurocode — Basis of structural and geotechnical design*

EN 1991-1-4:—[1], *Eurocode 1 – Actions on structures – Part 1-4: Wind Actions*

EN 1998-1-1:—[2], *Eurocode 8 – Design of structures for earthquake resistance – Part 1-1: General rules and seismic action*

EN 1998-1-2:—[3], *Eurocode 8 - Design of structures for earthquake resistance - Part 1-2: Buildings*

EN 1998-5:—[4], *Eurocode 8 – Design of structures for earthquake resistance – Part 5: Geotechnical aspects, foundations, retaining and underground structures*

EN ISO 80000 (all parts), *Quantities and units*

[1] Under development.

[2]. Under preparation. Stage at the time of publication: prEN 1998-1-1:2022.

[3] Under preparation. Stage at the time of publication: prEN 1998-1-2:2023.

[4] Under preparation. Stage at the time of publication: prEN 1998-5:2022.

oSIST prEN 1998-4:2023

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990, EN 1991-1-4:—[1], EN 1998-1-1:—[2], EN 1998-5:—[4], and the following, apply.

3.1.1
ancillary element
architectural, mechanical or electrical element, system and technical plant component such as container, pipeline, pump, conveyor and many other plant-specific components connected to or supported by the structures of 1.2 (1). An ancillary element is not considered in seismic design as load-carrying element but required for the safe operation of the facility and may be the cause of risk to persons or to the structure in case of earthquake

3.1.2
floating roof
height adjustable roof of tanks. The roof rises and falls with the liquid level in the tank

3.1.3
freeboard
space kept between the top of liquid level and the bottom of the roof slab of the tank or the depth between the overflow pipe and the base of the roof slab

3.1.4
lattice structure
structure in which the joints are not designed to resist the plastic moment of the connected members

iTeh Standards
(https://standards.iteh.ai)
Document Preview

3.1.5
masonry chimney
industrial chimney constructed of masonry units and mortar

oSIST prEN 1998-4:2023
https://standards.iteh.ai/catalog/standards/sist/3d4afacb-a037-4a44-a355-c0f3771119f8/osist-pren-1998-4-2023

3.1.6
silo battery
group of silos with individual cells connected to each other or stand-alone and permitting different types of similar solids to be stored separately

3.1.7
tangent tower
transmission tower used where the cable line is straight or has an angle not exceeding 3^0 in plan. It supports vertical loads, a transverse load from the angular pull of the wires, a longitudinal load due to unequal spans, and forces resulting from the wire-stringing operation, or a broken wire

3.1.8
telescope joint
joint between tubular elements without a flange, the internal diameter of one being equal to the external diameter of the other