SLOVENSKI STANDARD
oSIST prEN 1991-1-9:2023

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Evrokod 1 - Vplivi na konstrukcije - 1-9. del: Splošni vplivi - Atmosferska zaledenitev

Eurocode 1 - Actions on structures - Part 1-9: General actions - Atmospheric icing

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-9: Allgemeine Einwirkungen - Atmosphärische Eisbildung

Eurocode 1 - Actions sur les structures - Partie 1-9 : Givrage atmosphérique

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EUROPEAN STANDARD

NORME EUROPÉENNE

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English Version

Eurocode 1 - Actions on structures - Part 1-9: General actions - Atmospheric icing

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 1-9: Allgemeine Einwirkungen - Atmosphärische Eisbildung

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.

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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.

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

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European foreword

This document (prEN 1991-1-9:2023) 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 is a new part of EN 1991-1.

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 recognize 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.

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 structure*

— 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 >

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 1991

(1) EN 1991 provides the actions to be considered for the structural design of buildings, bridges and other civil engineering works, or parts thereof, including temporary structures, in conjunction with EN 1990 and the other Eurocodes.

(2) The actions on structures, including in some cases geotechnical structures in conjunction with EN 1997 as appropriate, provided in EN 1991 are intended to be applied in conjunction with the other Eurocodes for the verification of safety, serviceability and durability, as well as robustness of structures, including the execution phase.

(3) The application of this document for the verifications mentioned in (2) follows the limit state principle and is based on the partial factor method, unless explicitly prescribed differently.

(4) EN 1991 does not cover actions for structures in seismic regions, unless explicitly prescribed by EN 1998. Provisions related to such requirements are given in EN 1998, which complements and is consistent with EN 1991.

(5) EN 1991 is also applicable in the case of existing structures for their:

— structural assessment,

— design of repairs, improvements and alterations,

— assessment for changes of use.

NOTE In this case additional or amended provisions can be necessary.

(6) EN 1991 is also applicable to the design of structures where materials or actions outside the scope of the other Eurocodes are involved.

NOTE In this case additional or amended provisions can be necessary.

0.3 Introduction to EN 1991-1-9

EN 1991-1-9 gives design guidance for actions due to atmospheric icing on structures and civil engineering works.

EN 1991-1-9 is intended to be used with EN 1990, the other Parts of EN 1991 and EN 1992 to1999 for the design of structures.

Atmospheric icing on electrical overhead lines is covered by the CENELEC (European Committee for Electrotechnical Standardization) standard EN 50341-1.

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.

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 EN 1991-1-9

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 EN 1991-1-9 can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works 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 standard, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by appropriate parties.

National choice is allowed in EN 1991-1-9 through notes to the following clauses:

6.1 (2) NOTE

6.1 (3) NOTE 1

6.1 (4) NOTE

6.1 (5) NOTE 1

6.1 (5) NOTE 2

6.1 (5) NOTE 3

6.1 (5) NOTE 4

6.4.1 (3) NOTE

6.4.2.1 (1) NOTE 1

6.5 (5) NOTE 2

7.2 (1) NOTE

National choice is allowed in EN 1991-1-9 on the application of the following informative annexes:

— Annex A Falling ice considerations (A.1 (1));

— Annex B Information on how ice loads act on structures (B.1 (1));

— Annex C Types of icing and data collection (C.1 (1));

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.

1 Scope

1.1 Scope of EN 1991-1-9

(1) EN 1991-1-9 gives principles and rules to determine the values of loads due to atmospheric icing to be used for following types of structures:

— masts,

— towers,

— antennas and antenna structures,

— cables, stays, guy ropes, etc.,

— rope ways (cable railways),

— structures for ski-lifts,

— buildings or parts of them exposed to potential icing,

— towers for special types of construction such as for example transmission lines and wind turbines.

NOTE Atmospheric icing on electrical overhead lines is covered by EN 50341-1.

(2) EN 1991-1-9 specifies values for:

— dimensions and weight of accreted ice,

— shapes of accreted ice.

(3) EN 1991-1-9 cover types of icing, ice loads acting on structures, and falling ice considerations.

NOTE Wind actions on iced structures are covered by EN 1991-1-4.

1.2 Assumptions

The assumptions given in FprEN 1990:2022, 1.2 apply to EN 1991-1-9.

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.

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.

FprEN 1990:2022, *Eurocode — Basis of structural and geotechnical design*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in FprEN 1990:2022 and the following apply.

3.1.1
in-cloud icing
icing due to super cooled water droplets in a cloud or fog

3.1.2
precipitation icing
icing due to either

a) freezing rain or drizzle, or

b) accumulation of wet snow

3.1.3
accretion
process of building up ice on the surface of an object, resulting in different types of icing on structures

3.1.4
fundamental basic ice load
theoretical maximum characteristic value of rime ice mass or characteristic value of glaze ice thickness obtained on a reference collector, irrespective of wind direction, orientation of the object of icing and of the time of year, at 10 m above the ground level in open country, with an annual probability of exceedance of 0,02

3.1.5
glaze
clear, high-density ice

3.1.6
rime
white ice that forms when water droplets freeze to the outer surface of an object, trapping air

3.1.7
reference collector
30 mm diameter cylinder not less than 0,5 m in length, which slowly rotates around its own axis

3.1.8
ice class
IC
classification of the characteristic values of ice load that is expected to occur with an annual probability of exceedance of 0,02 on a reference ice collector situated in this particular location at 10 m height above the ground

3.1.9
characteristic rime ice mass
rime ice mass on the reference collector with an annual probability of exceedance of 0,02

3.1.10
characteristic glaze ice thickness
glaze ice thickness on the reference collector with an annual probability of exceedance of 0,02

3.1.11
basic ice load
fundamental basic ice load modified to account for the direction of icing wind, the characteristics of the object of icing (e.g. fixed or rotating object, surface property, colour), the orientation of the iced object (e.g. vertical or horizontal), the season and the variation with height above the ground

3.1.12
directional factor
factor taking into account the reduction of the basic ice load in cases where the icing is not uniform with respect to wind direction

3.1.13
object factor
factor taking into account the reduction of the basic ice load due to ice shedding from non-rotating objects triggered by e.g. solar radiation, temperature variations, turbulent wind or other local meteorological conditions

3.1.14
orientation factor
factor taking into account the reduction of the basic ice load in cases where the ice load depends on the object orientation, e.g. a reduction for glaze ice on vertical elements in areas where icing occur under low wind speed condition

3.1.15
seasonal factor
factor taking into account the reduction of the basic ice load in cases of temporary structures (in order of seasons length) and for structures in the execution phase

3.1.16
ice action
accreted ice on a structure, both as gravity load due to the self-weight of the ice and additional wind action on the iced structure

3.2 Symbols and abbreviations

For the purpose of this European standard, the symbols given in FprEN 1990:2022, 3.2 apply together with the following additional notations which are specific to this Part.

NOTE The notation used is based on ISO 3898:2013.

3.2.1 Latin upper case letters

D	Diameter of accreted ice or total width of object including ice
H	Height above the ground
L	Length of ice vane measured in windward direction
T	Air temperature
W_c	Width of object (excluding ice) perpendicular to wind direction
W_{dir}	Wind direction