SLOVENSKI STANDARD
oSIST prEN 1991-3:2024

01-junij-2024

Evrokod 1 - Vplivi na konstrukcije – 3. del: Vpliv žerjavov in drugih strojev

Eurocode 1 - Actions on structures - Part 3: Actions induced by cranes and machines

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 3: Einwirkungen infolge von Kranen und Maschinen

Eurocode 1 - Actions sur les structures - Partie 3: Actions induites par les appareils de levage et les machines

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ICS:

53.020.20	Dvigala	Cranes
91.010.30	Tehnični vidiki	Technical aspects

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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March 2024

ICS 91.010.30

Will supersede EN 1991-3:2006

English Version

Eurocode 1 - Actions on structures - Part 3: Actions induced by cranes and machines

Eurocode 1 - Actions sur les structures - Partie 3: Actions induites par les appareils de levage et les machines

Eurocode 1 - Einwirkungen auf Tragwerke - Teil 3: Einwirkungen infolge von Kranen und Maschinen

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

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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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Ref. No. prEN 1991-3:2024 E

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European foreword

This document (prEN 1991-3:2024) 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 1991-3:2006.

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 Eurocodes 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 1991 (all parts)

EN 1991 (all parts) specifies actions 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.

EN 1991 (all parts) does not cover the specific requirements of actions for seismic design. Provisions related to such requirements are given in EN 1998 (all parts), which complement and are consistent with EN 1991.

EN 1991 is also applicable to existing structures for their:

— structural assessment,

— strengthening or repair,

— change of use.

NOTE 1 In these cases additional or amended provisions can be necessary.

EN 1991 (all parts) is applicable for the design of structures where materials or actions outside the scope of the other Eurocodes are involved.

NOTE 2 In this case additional or amended provisions can be necessary.

EN 1991 is subdivided in various parts:

— EN 1991-1-1, *Eurocode 1 — Actions on structures — Part 1-1: Specific weight of materials, self-weight of construction works and imposed loads for buildings*

— EN 1991-1-2, *Eurocode 1 — Actions on structures — Part 1-2: Actions on structures exposed to fire*

— EN 1991-1-3, *Eurocode 1 — Actions on structures — Part 1-3: Snow Loads*

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

— EN 1991-1-5, *Eurocode 1 — Actions on structures — Part 1-5: Thermal Actions*

— EN 1991-1-6, *Eurocode 1 — Actions on structures — Part 1-6: Actions during execution*

— EN 1991-1-7, *Eurocode 1 — Actions on structures — Part 1-7: Accidental actions*

— EN 1991-1-8, *Eurocode 1 — Actions on structures — Part 1-8: Actions from waves and currents on coastal structures*

— EN 1991-1-9, *Eurocode 1 — Actions on structures — Part 1-9: Atmospheric icing*

— EN 1991-2, *Eurocode 1 — Actions on structures — Part 2: Traffic loads on bridges and other civil engineering works*

— EN 1991-3, *Eurocode 1 — Actions on structures — Part 3: Actions induced by cranes and machines*

— EN 1991-4, *Eurocode 1 — Actions on structures — Part 4: Silos and tanks*

0.3 Introduction to EN 1991-3

EN 1991-3 gives design guidance and actions for the structural and geotechnical design of buildings and civil engineering works that are subject to:

– actions from bridge, gantry and wall cranes on fixed runways;

– actions from machines that cause a harmonic dynamic loading on fixed supporting structures.

EN 1991-3 is intended to be used with EN 1990, the other parts of EN 1991 and the other Structural Eurocodes.

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 1991-3

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 1991-3 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 1991-3 through a note to the following clause:

6.2.2(2)

National choice is allowed in EN 1991-3 on the application of the following informative annexes:

Annex A Annex B Annex C

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

1 Scope

1.1 Scope of EN 1991-3

(1) EN 1991-3 defines actions imposed by cranes and other machines including dynamic effects, if relevant, for the structural design of crane or machine supporting structures.

(2) EN 1991-3 provides guidance on crane classification in terms of dynamic factors and fatigue actions.

(3) EN 1991-3 applies to supporting structures of

– bridge, gantry and wall cranes travelling on fixed runways;

– fixed machines that cause a harmonic dynamic loading on fixed supporting structures.

(4) The principles provided in EN 1991-3 can be applied also to determine actions on supporting structures of cranes other than those referred to in (3).

(5) EN 1991-3 does not provide partial factors for actions.

NOTE For partial factors for actions, see Annex A.5 to prEN 1990-1:2024.

(6) EN 1991-3 does not provide actions or provisions for the design of cranes and machines.

1.2 Assumptions

(1) The general assumptions of EN 1990-1 apply.

(2) The design of structures supporting cranes or machines is undertaken using information on actions provided by the manufacturer of the crane or machine.

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.

prEN 1990-1:2024,[1] *Eurocode — Basis of structural and geotechnical design — Part 1: New structures*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1 General terms and definitions

3.1.1.1
machine
assembly, fitted with or intended to be fitted with a drive system consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application

[1] At draft stage

[SOURCE: EN ISO 12100, modified]

Note 1 to entry: The design of machines is outside the scope of the Structural Eurocodes, since machines are covered by the Machinery Directive.

3.1.1.2
crane
machine intended for the hoisting and moving in space of a load suspended by means of a hook or other load-handling device

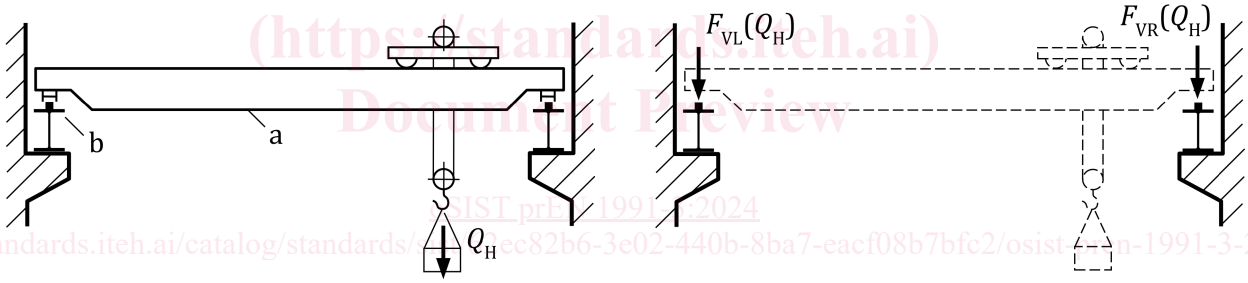
[SOURCE: ISO 4306-1, modified]

Note 1 to entry: If the term "machine" is used in the following, it refers to machines others than cranes.

3.1.1.3
crane or machine supporting structure
arrangement of elements that is considered part of a civil engineering structure and that is exposed to crane or machine induced actions

3.1.1.4
crane or machine induced actions
actions from cranes or machines exerted on their supporting structures, see Figure 3.1b

Note 1 to entry: Cranes are subjects to actions such as crane self-weight, hoist load etc. as shown in Figure 3.1a. The crane reactions caused by these actions are the actions on the crane supporting structure. The actions on cranes are defined in 3.1.5 and 3.1.6.



a) Actions on a bridge crane due to hoist load Q_H

b) Actions, e.g. wheel loads F_{VL} and F_{VR}, from the crane exerted on its supporting structure

Key

a	crane
b	crane supporting structure

Figure 3.1 — Distinction between actions on and from cranes (exemplified for a bridge crane)

3.1.1.5
technical data file
part of the instruction manual of a crane or machine comprising relevant technical data including actions on the supporting structure under normal and exceptional service conditions

3.1.1.6
normal service conditions
all operations of a crane or machine that occur if the crane or machine is used for its intended purpose

3.1.1.7
exceptional service conditions
abnormal crane or machine operations for example caused by foreseeable wrong use

3.1.1.8
dynamic factor
ratio of the dynamic response of a structure to its static response

Note 1 to entry: Dynamic factors can be defined for cranes, machines and their supporting structures.

3.1.1.9
natural frequency
frequency of free vibration of a system

Note 1 to entry: For a multiple degree-of-freedom system, the natural frequencies are the frequencies of the normal modes of vibration.

3.1.1.10
free vibration
vibration of a system that occurs in the absence of forced vibration

3.1.1.11
forced vibration
vibration of a system if the response is imposed by an excitation

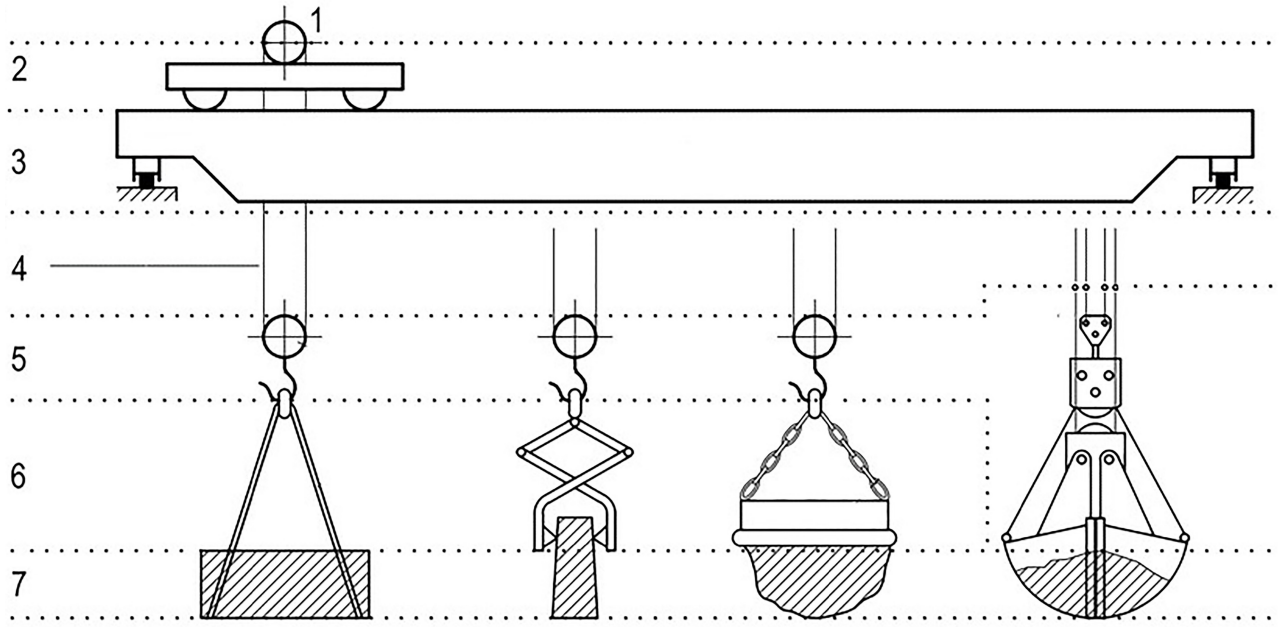
3.1.1.12
damping
dissipation of energy during vibration

Note 1 to entry: Damping causes the attenuation of the response behaviour of a structure after an excitation.

3.1.2 Terms and definitions commonly used in crane design

3.1.2.1
hoist
load-lifting and/or load-lowering mechanism; denoted as ‘1’ in Figure 3.2

[SOURCE: ISO 4306-1:2007, 4.7, modified]



Key

1	hoist
2	trolley
3	crane bridge
4	hoist medium
5	fixed load-lifting attachment
6	non-fixed load-lifting attachment
7	payload

Figure 3.2 — Crane-related terms (exemplified for a bridge crane)

3.1.2.2
trolley
assembly designed to traverse the suspended load; denoted as '2' in Figure 3.2

[SOURCE: ISO 4306-1:2007, 4.12, modified]

3.1.2.3
main structure of crane
major structural part of the crane, including if exist counterweight(s), mechanical and electrical equipment; denoted as '3' in Figure 3.2

3.1.2.4
hoist medium
wire rope(s), chain(s) or any other equipment hanging down from the crane used to lift and lower loads suspended from the lower end(s) of the hoist medium(s); denoted as '4' in Figure 3.2

[SOURCE: ISO 4306-1:2007, 6.1.6, modified]

Note 1 to entry: Hoist mediums are part of the crane.

3.1.2.5
fixed load-lifting attachment
any equipment, from which the net load can be suspended and which is permanently fastened to the lower end(s) of the hoist medium(s); denoted as '5' in Figure 3.2

Note 1 to entry: Fixed load-lifting attachments are part of the crane.

[SOURCE: ISO 4306-1:2007, 6.1.4, modified]

3.1.2.6
non-fixed load-lifting attachment
any equipment which connects the payload with the crane and which is neither part of the crane nor the payload; denoted as '6' in Figure 3.2

Note 1 to entry: Non-fixed load-lifting attachments are easily detachable from the crane and from the payload.

[SOURCE: ISO 4306-1:2007, 6.1.2, modified]

3.1.2.7
payload
load which is lifted by the crane and suspended from the non-fixed load-lifting attachment(s) or, if such an attachment is not used, directly from the fixed load-lifting attachments; denoted as '7' in Figure 3.2

Note 1 to entry: If cranes are used for lifting gates at hydro-power stations or for lifting the load from water, the payload can also include forces due to waterflow suction or water adhering by suction.

[SOURCE: ISO 4306-1:2007, 6.1.1, modified]

3.1.2.8
net load
load, which is lifted by the crane and suspended from the fixed load-lifting attachment(s)

Note 1 to entry: Net load contains the payload and the non-fixed load-lifting attachment(s).

[SOURCE: ISO 4306-1:2007, 6.1.3, modified]

3.1.2.9
rated capacity
maximum net load that the crane is designed to lift for a given crane configuration and load location during normal operation

[SOURCE: ISO 4306-1:2007, 6.1.8, modified]

3.1.2.10
skewing
deviation from free-rolling, natural travelling or traversing direction

3.1.3 Terms and definitions specific for travelling cranes

3.1.3.1
travelling crane
crane capable of moving itself during operation with need for a fixed crane supporting structure (runways)

[SOURCE: ISO 4306-1:2007, 1.3.5, modified]