Irish Standard
I.S. EN 1991-3:2006

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

I.S. EN 1991-3:2006

Incorporating amendments/corrigenda/National Annexes issued since publication:
EN 1991-3:2006/AC:2012

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I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

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I.S. EN 1991-3:2006

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1991-3:2006/AC

December 2012
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English version
Version Française
Deutsche Fassung

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

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 corrigendum becomes effective on 5 December 2012 for incorporation in the three official language versions of the EN.

Ce corrigendum prendra effet le 5 décembre 2012 pour incorporation dans les trois versions linguistiques officielles de la EN.

Die Berichtigung tritt am 5. Dezember 2012 zur Einarbeitung in die drei offiziellen Sprachfassungen der EN in Kraft.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No.:EN 1991-3:2006/AC:2012 D/E/F

EN 1991-3:2006/AC:2012 (E)

1 Modifications to 1.2

Just above the reference to EN 1990, add the following new reference:

"

EN 1090-2	Execution of steel structures and aluminium structures – Part 2: Technical requirements for steel structures

".

On the last line, replace:

"

EN 1993-6	Design of steel structures – Part 6: Crane runway beams

"

with:

"

EN 1993-6	Design of steel structures – Part 6: Crane supporting structures

".

2 Modification to 1.3

In Paragraph (1), replace "prEN 1991" *with* "EN 1991".

3 Modification to 1.5

In Paragraph (2), in the list Greek lower case letters, replace:

"

$\varphi_1, \varphi_2, \varphi_3$ $\varphi_4, \varphi_5, \varphi_6, \varphi_7$	dynamic factor applied to actions induced by cranes

"

with:

"

$\varphi_1, \varphi_2, \varphi_3$ $\varphi_4, \varphi_5, \varphi_6, \varphi_7$	dynamic factor applied to actions induced by cranes

".

4 Modification to 2.1

Replace the two bullet points with the following ones:

“

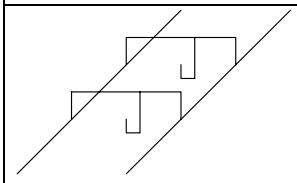
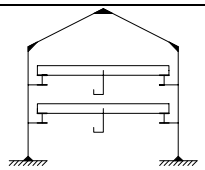
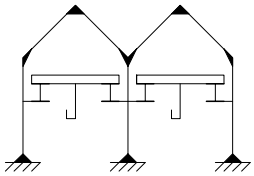
– monorail hoist blocks, see 2.5.1,
– overhead travelling cranes, see 2.5.2.

”.

5 Modification to 2.5.3

In Paragraph (2), replace Table 2.3 with the following:

“

	For crane runway	For crane supporting structures	
		Single-bay building	Multi-bay building
			
Vertical crane action	3	4 NOTE: The most unfavourable position of the 4 cranes might be: a) 3 cranes behind each other and 1 on a further runway or b) 2 cranes behind each other and 2 on a further runway or c) 2 cranes behind each other and 2 above each other on 2 further runways	6 NOTE: The most unfavourable position of the 6 cranes might be: a) crane position as in a single bay building plus 2 additional cranes in another bay or b) 6 cranes distributed over several bays
Horizontal crane action	1 NOTE: Consider two cranes if they operate together in order to lift heavy loads and if that is more unfavourable	2 NOTE: 2 cranes per bay operating above each other	4 NOTE: Under consideration of conditions for crane runways and for single-bay buildings

”.

6 Modification to 2.6

In Paragraph (2)P, replace the whole Table 2.4 with the following one:

“

Table 2.4 — Dynamic factors φ_i for vertical loads

	Values of dynamic factors
φ_1	$0,9 < \varphi_1 < 1,1$ The two values 1,1 and 0,9 reflect the upper and lower values of the vibrational pulses.
φ_2	$\varphi_2 = \varphi_{2,\min} + \beta_2 v_h$ v_h - steady hoisting speed in m/s $\varphi_{2,\min}$ and β_2 see Table 2.5
φ_3	$\varphi_3 = 1 - \frac{\Delta m}{m}(1+\beta_3)$ where Δm released or dropped part of the hoisting mass m total hoisting mass $\beta_3 = 0,5$ for cranes equipped with grabs or similar slow-release devices $\beta_3 = 1,0$ for cranes equipped with magnets or similar rapid-release devices
φ_4	$\varphi_4 = 1,0$ provided that the class 1 functional tolerances for rail tracks as specified in EN 1090-2 are observed.
NOTE: If Class 1 functional tolerances for rail tracks as specified in EN 1090-2 are not observed, the dynamic factor φ_4 can be determined with the model provided by EN 13001-2.	

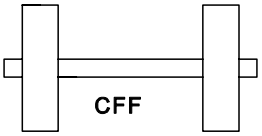
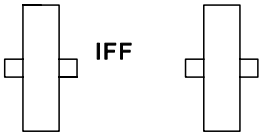
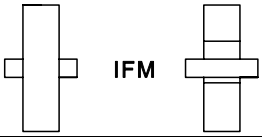
”.

7 Modification to 2.7.4

Paragraph (4), replace Tables 2.8 and 2.9 with the following ones:

“

Table 2.8 — Determination of the distance *h*

Fixing of wheels according to lateral movements	Combination of wheel pairs		*h*
	coupled (c)	independent (i)	
Fixed/Fixed FF			$\frac{m\xi_1\xi_2\ell^2+\Sigma e_j^2}{\Sigma e_j}$
Fixed/Movable FM			$\frac{m\xi_1\ell^2+\Sigma e_j^2}{\Sigma e_j}$

Where:

h is the distance between the instantaneous centre of rotation and the relevant guidance means;

m is the number of pairs of coupled wheels (m = 0 for independent wheel pairs);

$\xi_1\ell$ is the distance of the instantaneous centre of rotation from rail 1;

$\xi_2\ell$ is the distance of the instantaneous centre of rotation from rail 2;

ℓ is the span of the appliance;

e_j is the distance of the wheel pair j from the relevant guidance means.

Table 2.9 — Determination of distance $\lambda_{S,i,j,k}$ values

System	$\lambda_{S,j}$	$\lambda_{S,1,j,L}$	$\lambda_{S,1,j,T}$	$\lambda_{S,2,j,L}$	$\lambda_{S,2,j,T}$
CFF	$1-\frac{\sum e_j}{nh}$	$\frac{\xi_1\xi_2}{n}\frac{\ell}{h}$	$\frac{\xi_2}{n}\left(1-\frac{e_j}{h}\right)$	$\frac{\xi_1\xi_2}{n}\frac{\ell}{h}$	$\frac{\xi_1}{n}\left(1-\frac{e_j}{h}\right)$
IFF		0	$\frac{\xi_2}{n}\left(1-\frac{e_j}{h}\right)$	0	$\frac{\xi_1}{n}\left(1-\frac{e_j}{h}\right)$
CFM	$\xi_2\left(1-\frac{\Sigma e_j}{nh}\right)$	$\frac{\xi_1\xi_2}{n}\frac{\ell}{h}$	$\frac{\xi_2}{n}\left(1-\frac{e_j}{h}\right)$	$\frac{\xi_1\xi_2}{n}\frac{\ell}{h}$	0
IFM		0	$\frac{\xi_2}{n}\left(1-\frac{e_j}{h}\right)$	0	0

Where:

n is the number of wheel pairs;

$\xi_1\ell$ is the distance of the instantaneous centre of rotation from rail 1;

$\xi_2\ell$ is the distance of the instantaneous centre of rotation from rail 2;

ℓ is the span of the appliance;

e_j is the distance of the wheel pair *j* from the relevant guidance means;

h is the distance between the instantaneous centre of rotation and the relevant guidance means.

”.

8 Modification to 2.12.2

In the NOTE, replace “EN 1993-6, 9.4.2.3” *with* “EN 1993-6, 9.4.2(3)”.

National Foreword

This Irish Standard is the official English language version of EN 1991-3:2006, prepared by Technical Committee CEN TC 250 "Structural Eurocodes". This document supersedes ENV 1991-5:1998.

This standard forms part of a package of 58 Eurocodes, which covers the basis of structural design, actions (loadings), the main structural materials, geotechnical design and design provisions for earthquakes. The European Commission document – Guidance Paper L – Application and Use of Eurocodes provides guidance on the elaboration, implementation and use of Eurocodes.

Where a normative part of this EN allows for a choice to be made at the national level the range, possible choices are given in the normative text, and a Note will qualify it as a Nationally Determined Parameter (NDP).

NF.A1 Following a period of public consultation, from May 30th to July 30th 2008, the NSAI National Eurocodes Advisory Committee has adopted the proposal that for national application:

- the recommended values should be used for all NDP's described within this Eurocode part; and
- Informative Annex B may be used.

I.S. EN 1991-3:2006 can now be used for design purposes in Ireland.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document

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I.S. EN 1991-3:2006

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1991-3

July 2006

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Supersedes ENV 1991-5:1998

English Version

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

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 European Standard was approved by CEN on 9 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.

CEN members are the national standards bodies of 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.

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

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Ref. No. EN 1991-3:2006: E

CONTENTS Page

Foreword

This European Standard (EN 1991-3:2006) 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.

This European Standard supersedes ENV 1991-5:1998.

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 October 2006, and conflicting national standards shall be withdrawn at the latest by March 2010.

According to the CEN/CENELEC Internal Regulations, the national standards 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 the United Kingdom.

Background of the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980s.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement[1] between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to the CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links *de facto* the Eurocodes with the provisions of all the Council's Directives and/or Commission's Decisions dealing with European standards (e.g. the Council Directive 89/106/EEC on construction products - CPD - and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

[1] Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990	Eurocode :	Basis of Structural 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

Eurocode standards recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognise that Eurocodes serve as reference documents for the following purposes:

– as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 – Mechanical resistance and stability – and Essential Requirement N°2 – Safety in case of fire ;

– as a basis for specifying contracts for construction works and related engineering services ;

– as a framework for drawing up harmonised technical specifications for construction products (ENs and ETAs)

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents[2] referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards[3]. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical Committees and/or EOTA Working Groups working on product

[2] According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonised ENs and ETAGs/ETAs.

[3] According to Art. 12 of the CPD the interpretative documents shall :

a) give concrete form to the essential requirements by harmonising the terminology and the technical bases and indicating classes or levels for each requirement where necessary ;

b) indicate methods of correlating these classes or levels of requirement with the technical specifications, e.g. methods of calculation and of proof, technical rules for project design, etc. ;

c) serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals.

The Eurocodes, *de facto*, play a similar role in the field of the ER 1 and a part of ER 2.

standards with a view to achieving full compatibility of these technical specifications with the Eurocodes.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

National Standards implementing Eurocodes

The National Standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a National title page and National foreword, and may be followed by a National annex.

The National annex may only contain information on those parameters which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, i.e. :

– values and/or classes where alternatives are given in the Eurocode,
– values to be used where a symbol only is given in the Eurocode,
– country specific data (geographical, climatic, etc.), e.g. snow map,
– the procedure to be used where alternative procedures are given in the Eurocode.

It may also contain:

– decisions on the application of informative annexes,
– references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and harmonised technical specifications (ENs and ETAs) for products

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works[4]. Furthermore, all the information accompanying the CE Marking of the construction products which refer to Eurocodes should clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific for EN 1991-3

EN 1991-3 gives design guidance and actions for the structural design of buildings and civil engineering works, including the following aspects:

– actions induced by cranes, and
– actions induced by machinery.

EN 1991-3 is intended for clients, designers, contractors and public authorities.

[4] see Art.3.3 and Art.12 of the CPD, as well as clauses 4.2, 4.3.1, 4.3.2 and 5.2 of ID 1.

EN 1991-3 is intended to be used with EN 1990, the other Parts of EN 1991 and EN 1992 to EN 1999 for the design of structures.

National annex for EN 1991-3

This Standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices have to be made. Therefore the National Standard implementing EN 1991-3 should have a National Annex containing all Nationally Determined Parameters to be used for the design of members to be constructed in the relevant country.

National choice is allowed in EN 1991-3 through the following paragraphs:

Paragraph	**Item**
2.1 (2)	Procedure when actions are given by the crane supplier
2.5.2.1 (2)	Eccentricity of wheel loads
2.5.3 (2)	Maximum number of cranes to be considered in the most unfavourable position
2.7.3 (3)	Value of friction factor
A2.2 (1)	Definition of γ-values for cases STR and GEO
A2.2 (2)	Definition of γ-values for case EQU
A2.3 (1)	Definition of ψ-values

Section 1 General

1.1 Scope

(1) Part 3 of EN 1991 specifies imposed loads (models and representative values) associated with cranes on runway beams and stationary machines which include, when relevant, dynamic effects and braking, acceleration and accidental forces.

(2) Section 1 defines common definitions and notations.

(3) Section 2 specifies actions induced by cranes on runways.

(4) Section 3 specifies actions induced by stationary machines.

1.2 Normative References

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 (including amendments).

ISO 3898 Basis of design of structures - Notations. General symbols

ISO 2394 General principles on reliability for structures

ISO 8930 General principles on reliability for structures. List of equivalent terms

EN 1990	Eurocode: Basis of Structural Design
EN 13001-1	Cranes – General design – Part 1: General principles and requirements
EN 13001-2	Cranes – General design – Part 2: Load effects
EN 1993-1-9	Design of steel structures – Part 1-9: Fatigue
EN 1993-6	Design of steel structures – Part 6: Crane runway beams

1.3 Distinction between Principles and Application Rules

(1) Depending on the character of the individual clauses, distinction is made in this Part of prEN 1991 between Principles and Application Rules.

(2) The Principles comprise:

– general statements and definitions for which there is no alternative, as well as

– requirements and analytical models for which no alternative is permitted unless specifically stated.

(3) The Principles are identified by the letter P following the paragraph number.