

Geregistreeerde Belgische norm

NBN EN 1993-1-9

1e uitg., oktober 2005

Normklasse: B 51

Eurocode 3: Ontwerp en berekening van staalconstructies - Deel 1-9: Algemene regels - Vermoeiing (+ AC:2009)

Eurocode 3: Calcul des structures en acier - Partie 1-9: Fatigue (+ AC:2009)

Eurocode 3: Design of steel structures - Part 1-9: Fatigue (+ AC:2009)

Toelating tot publicatie: 08 juli 2005

Vervangt NBN ENV 1993-1-1 (2002), NBN ENV 1993-1-1/A1 (1995), NBN ENV 1993-1-1/A2 (1998), NBN E 27-071 (1987), NBN B 52-001 (1995), NBN 212 (1970).

Deze Europese norm NBN EN 1993-1-9:2005 heeft de status van een Belgische norm.

Deze Europese norm bestaat in drie officiële versies (Duits, Engels, Frans).

Er is bij het NBN ook een Nederlandstalige versie beschikbaar, die dezelfde status heeft als de officiële versies.

Deze norm mag in België slechts samen met zijn nationale bijlage (ANB) worden toegepast. Deze laatste legt hoofdzakelijk de waarden van de parameters vast die op nationaal vlak worden bepaald.



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***norme belge
enregistrée***

NBN EN 1993-1-9

1e éd., octobre 2005

Indice de classement: B 51

Eurocode 3: Calcul des structures en acier - Partie 1-9: Fatigue (+ AC:2009)

Eurocode 3: Ontwerp en berekening van staalconstructies - Deel 1-9: Algemene regels - Vermoeiing (+ AC:2009)

Eurocode 3: Design of steel structures - Part 1-9: Fatigue (+ AC:2009)

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Remplace NBN ENV 1993-1-1 (2002), NBN ENV 1993-1-1/A1 (1995), NBN ENV 1993-1-1/A2 (1998), NBN E 27-071 (1987), NBN B 52-001 (1995), NBN 212 (1970).

La présente norme européenne NBN EN 1993-1-9:2005 a le statut d'une norme belge.

La présente norme européenne existe en trois versions officielles (allemand, anglais et français).

Une version en néerlandais, ayant le même statut que les versions officielles, est également disponible au NBN.

Cette norme ne peut être utilisée en Belgique qu'en combinaison avec son annexe nationale (ANB) qui fixe principalement la valeur des paramètres à déterminer au niveau national



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AVANT-PROPOS NATIONAL À LA NBN EN 1993-1-9:2005

1. La norme NBN EN 1993-1-9:2005 "Eurocode 3 – Calcul des structures en acier - Partie 1-9 : Fatigue (+ AC:2009) " comprend l'annexe nationale NBN EN 1993-1-9 ANB:2010 qui a un caractère normatif en Belgique. Elle remplace à partir de la date de publication au Moniteur Belge de l'homologation de la norme NBN EN 1993-1-8 ANB:2010 les parties correspondantes des normes suivantes :

NBN ENV 1993-1-1:2002 "	Eurocode 3 : Calcul des structures en acier - Partie 1-1 : Règles générales et règles pour les bâtiments" y compris le document d'application belge (version homologuée avec DAN).
NBN ENV 1993-1-1/A1:1995	Eurocode 3 - Calcul des structures en acier - Partie 1-1 : Règles générales - Règles générales et règles pour les bâtiments.
NBN ENV 1993-1-1/A2:1998	Eurocode 3 - Calcul des structures en acier - Partie 1-1: Règles générales - Règles générales et règles pour les bâtiments.
NBN E 27-071:1987	Boulons à haute résistance, à larges surplats, pour constructions en acier - Conception et calcul des assemblages (avec erratum).
NBN B 52-001:1995	Ponts en acier
NBN 212:1970	Constructions en acier - Calcul des contraintes dans les assemblages soudés soumis à une sollicitation statique.

Pour être conforme à la version néerlandaise disponible au NBN, cette version française doit en principe être accompagnée du corrigendum suivant : EN 1993-1-9:2005/AC:2005.

Le corrigendum EN 1993-1-9 :2005/AC:2009, tel que publié par le CEN, est joint à cette norme.

2. La version en langue française de l'EN 1993-1-9:2005 a été rédigée en France par l'AFNOR.
En conséquence, on y rencontre certaines expressions d'usage moins courant en Belgique.

NBN EN 1993-1-9 ANB:2010 (F)

Une liste de termes équivalents est donnée ci-après :

Terme de l'EN 1993-1-9	Terme équivalent en Belgique
Attache	Assemblage

NATIONAAL VOORWOORD VAN NBN EN 1993-1-9:2005

1. De norm NBN EN 1993-1-9:2005 «Eurocode 3 - Ontwerp en berekening van staalconstructies – Deel 1-9: Algemene regels - Vermoeiing + AC:2009» omvat de nationale bijlage NBN EN 1993-1-9 ANB:2010 met een normatief karakter in België. Hij vervangt vanaf de datum van de publicatie in het Belgische Staatsblad van de bekrachtiging van de norm NBN EN 1993-1-9 ANB:2010 de overeenstemmende delen van de volgende normen:

NBN ENV 1993-1-1:2002	Eurocode 3 - Ontwerp van stalen draagsystemen - Deel 1-1: Algemene regels en regels voor gebouwen samen met Belgische toepassingsrichtlijn (gehomologeerde versie + NAD)
NBN ENV 1993-1-1/A1:1995	Eurocode 3 - Ontwerp van stalen draagsystemen - Deel 1-1: Algemene regels - Algemene regels en regels voor gebouwen
NBN ENV 1993-1-1/A2:1998	Eurocode 3 - Berekening van stalen draagsystemen - Deel 1-1: Algemene regels - Algemene regels en regels voor gebouwen
NBN E27-071:1987	Bouten met hoge treksterkte, met brede sleutelwijdte voor staalbouw - Opvatting en berekening van de verbindingen (met erratum)
NBN B 52-001:1995	Stalen bruggen
NBN 212:1970	Staalconstructies – Berekening van spanningen in gelaste constructies onderworpen aan een statische belasting

In de Nederlandstalige versie is het volgende corrigendum verwerkt:
EN 1993-1-9:2005/AC:2005.

Het corrigendum EN 1993-1-9:2005/AC:2009, zoals door CEN gepubliceerd, is na deze norm toegevoegd.

2. De Nederlandstalige versie van EN 1993-1-9 is tot stand gekomen op basis van een voorkeurterminologie die in samenwerking tussen het NBN en het NEN is opgesteld. Daarbij werd voor elk begrip een unieke woordkeuze gemaakt. Dit heeft als gevolg dat in de norm uitdrukkingen voorkomen die in één van de twee landen minder gebruikelijk zijn. Hierna volgt een lijst met synoniemen:

NBN EN 1993-1-9 ANB:2010 (NL)

Oorspronkelijke term (Engels)	Verplichte term (Nederlands)	Synoniem (B); (N)
action-effect	belastingeffect, of snedegrootheid	(aangrijpende) snedekracht
civil engineering	civiele techniek	burgerlijke bouwkunde (B)
concentrated load	geconcentreerde belasting	puntlast
construction work	bouwwerk	werk (B)
diameter	diameter	middellijn
defined	vastgesteld	gegeven
design resistance	rekenwaarde van de weerstand	weerstandbiedende snedekracht (B)
first moment of area	statisch moment, lineair oppervlaktemoment	statisch moment (B)
haunch	kniestuk	verzwaring
moment resistance	momentweerstand	moment met betrekking tot de capaciteit (N)
internal force	snedekracht	inwendige kracht
internal moment	snedemoment	inwendig moment
principle	beginsel	principe (B)
permanent action	blijvende belasting	permanente belasting (N)
redundancy	redundantie	overtolligheid
relevant	van toepassing	voorkomend
resistance	weerstand	capaciteit
second moment of area	traagheidsmoment, kwadratisch oppervlaktemoment	traagheidsmoment (B)
serviceability limit state	bruikbaarheidsgrenstoestand	gebruiksgrenstoestand (B)
situation	situatie	toestand (B)
spacing	hart-op-hartafstand	steekmaat, tussenafstand
specified	voorgeschreven	gegeven, bepaald, opgelegd
verification	toetsing	verificatie, controle (N)

2bis. De Europese normen (EN) waarnaar de tekst van deze norm met hun Engelse titel verwijst, dragen in België de volgende Nederlandstalige titels:

Verwijzingsnormen (§ 1.2)

Vermelde norm	Nederlandstalige titel (NBN)
EN 1090 Execution of steel structures – Technical requirements	NBN EN 1090 Uitvoering van staalconstructies – Technische eisen
EN 1990 Basis of structural design	NBN EN 1990 Grondslagen van het constructief ontwerp
EN 1991 Actions on structures	NBN EN 1991 Belastingen op constructies
EN 1993 Design of Steel Structures	NBN EN 1993 Ontwerp en berekening van staalconstructies
EN 1994-2 Design of Composite Steel and Concrete structures Part 2: Bridges	NBN EN 1994-2 Ontwerp en berekening van staal-betonconstructies Deel 2: Bruggen

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1993-1-9

May 2005

ICS 91.010.30

Supersedes ENV 1993-1-1:1992

English version

Eurocode 3: Design of steel structures - Part 1-9: Fatigue

Eurocode 3: Calcul des structures en acier - Partie 1-9:
Fatigue

Eurocode 3: Bemessung und Konstruktion von Stahlbauten
- Teil 1-9: Ermüdung

This European Standard was approved by CEN on 23 April 2004.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



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Foreword

This European Standard EN 1993, Eurocode 3: Design of steel structures, 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 November 2005, and conflicting National Standards shall be withdrawn at latest by March 2010.

This Eurocode supersedes ENV 1993-1-1.

According to the CEN-CENELEC Internal Regulations, the National Standard Organizations of the following countries are bound to implement these 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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Background to 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 harmonization of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonized 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 agreement¹ between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to 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).

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

EN 1990	Eurocode 0:	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

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).

EN 1993-1-9 : 2005 (E)

Eurocode standards recognize 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 recognize 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 harmonized 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 Documents² referred to in Article 12 of the CPD, although they are of a different nature from harmonized product standards³. 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 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 contain

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

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 harmonized 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 harmonizing 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 harmonized 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.

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

There is a need for consistency between the harmonized technical specifications for construction products and the technical rules for works⁴. 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.

National annex for EN 1993-1-9

This standard gives alternative procedures, values and recommendations with notes indicating where national choices may have to be made. The National Standard implementing EN 1993-1-9 should have a National Annex containing all Nationally Determined Parameters for the design of steel structures to be constructed in the relevant country.

National choice is allowed in EN 1993-1-9 through:

- 1.1(2)
- 2(2)
- 2(4)
- 3(2)
- 3(7)
- 5(2)
- 6.1(1)
- 6.2(2)
- 7.1(3)
- 7.1(5)
- 8(4)

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.

1 General

1.1 Scope

(1) EN 1993-1-9 gives methods for the assessment of fatigue resistance of members, connections and joints subjected to fatigue loading.

(2) These methods are derived from fatigue tests with large scale specimens, that include effects of geometrical and structural imperfections from material production and execution (e.g. the effects of tolerances and residual stresses from welding).

NOTE 1 For tolerances see EN 1090. The choice of the execution standard may be given in the National Annex, until such time as EN 1090 is published.

NOTE 2 The National Annex may give supplementary information on inspection requirements during fabrication.

(3) The rules are applicable to structures where execution conforms with EN 1090.

NOTE Where appropriate, supplementary requirements are indicated in the detail category tables.

(4) The assessment methods given in this part are applicable to all grades of structural steels, stainless steels and unprotected weathering steels except where noted otherwise in the detail category tables. This part only applies to materials which conform to the toughness requirements of EN 1993-1-10.

(5) Fatigue assessment methods other than the $\Delta\sigma_R$ -N methods as the notch strain method or fracture mechanics methods are not covered by this part.

(6) Post fabrication treatments to improve the fatigue strength other than stress relief are not covered in this part.

(7) The fatigue strengths given in this part apply to structures operating under normal atmospheric conditions and with sufficient corrosion protection and regular maintenance. The effect of seawater corrosion is not covered. Microstructural damage from high temperature (> 150 °C) is not covered.

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).

The following general standards are referred to in this standard.

EN 1090	Execution of steel structures – Technical requirements
EN 1990	Basis of structural design
EN 1991	Actions on structures
EN 1993	Design of Steel Structures
EN 1994-2	Design of Composite Steel and Concrete Structures: Part 2: Bridges

1.3 Terms and definitions

(1) For the purpose of this European Standard the following terms and definitions apply.