

DIN EN 1993-6



ICS 53.020.20; 91.010.30; 91.080.10

Supersedes: see below

**Eurocode 3: Design of steel structures –
Part 6: Crane supporting structures
(includes Corrigendum AC:2009)
English translation of DIN EN 1993-6:2010-12**

Eurocode 3: Bemessung und Konstruktion von Stahlbauten –
Teil 6: Kranbahnen
(enthält Berichtigung AC:2009)
Englische Übersetzung von DIN EN 1993-6:2010-12

Eurocode 3: Calcul des structures en acier –
Partie 6: Chemins de roulement
(Corrigendum AC:2009 inclus)
Traduction anglaise de DIN EN 1993-6:2010-12

Supersedes DIN EN 1993-6:2007-07;
together with DIN EN 1993-6/NA:2010-12, supersedes DIN 4132:1981-02 and
DIN 4132 Supplement 1:1981-02;
supersedes DIN EN 1993-6 Corrigendum 1:2009-09

Document comprises 39 pages

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original shall be considered authoritative.



A comma is used as the decimal marker.

National foreword

This standard has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes” (Secretariat: BSI, United Kingdom).

The responsible German body involved in its preparation was the *Normenausschuss Bauwesen* (Building and Civil Engineering Standards Committee), Working Committee NA 005-08-01 AA *Kranbahnen*.

EN 1993-6:2007 was approved by CEN on 12 June 2006.

This European Standard is part of a series of standards dealing with structural design (Eurocodes) which are intended to be used as a “package”. In Guidance Paper L on the application and use of Eurocodes, issued by the EU Commission, reference is made to transitional periods for the introduction of the Eurocodes in the Member states. The transitional periods are given in the Foreword of this standard.

In Germany, this standard is to be applied in conjunction with the National Annex.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. DIN [and/or DKE] shall not be held responsible for identifying any or all such patent rights.

The start and finish of text introduced or altered by amendment is indicated in the text by tags  .

Amendments

This standard differs from DIN V ENV 1993-6:2001-02 as follows:

- a) the comments received from the national member bodies of CEN have been incorporated;
- b) the prestandard status has been changed to that of a full standard;
- c) the standard has been completely revised.

Compared with DIN EN 1993-6:2007-07, DIN EN 1993-6 Corrigendum 1:2009-09, DIN 4132:1981-02 and DIN 4132 Supplement 1:1981-02, the following corrections have been made:

- a) the standard has been based on European design rules;
- b) superseding notes have been corrected;
- c) this standard is the consolidated version of the previous 2007 edition with Corrigendum 1:2009-09;
- d) the standard has been editorially revised.

Previous editions

DIN 120-1: 1936-11xxxx

DIN 120-2: 1936-11

DIN 4132: 1981-02

DIN 4132 Supplement 1: 1981-02

DIN V ENV 1993-6: 2001-02

DIN EN 1993-6: 2007-07

DIN EN 1993-6 Corrigendum 1: 2009-09

English version

Eurocode 3: Design of steel structures — Part 6: Crane supporting structures

Eurocode 3: Calcul des structures en acier —
Partie 6: Chemins de roulement

Eurocode 3: Bemessung und Konstruktion von
Stahlbauten — Teil 6: Kranbahnen

EN 1993-6:2007 was approved by CEN on 2006-06-12 and Amendment AC:2009 on 2009-07-01.

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 Management Centre or to any CEN member.

The European Standards exist 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 Management Centre has the same status as the official versions.

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



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	4
1 General.....	7
1.1 Scope.....	7
1.2 Normative references	7
1.3 Assumptions.....	8
1.4 Distinction between principles and application rules	8
1.5 Terms and definitions.....	8
1.6 Symbols.....	8
2 Basis of design.....	9
2.1 Requirements	9
2.1.1 Basic requirements	9
2.1.2 Reliability management	9
2.1.3 Design working life, durability and robustness	9
2.2 Principles of limit state design	9
2.3 Basic variables	9
2.3.1 Actions and environmental influences.....	9
2.3.2 Material and product properties.....	9
2.4 Verification by the partial factor method	9
2.5 Design assisted by testing	10
2.6 Clearances to overhead travelling cranes	10
2.7 Underslung cranes and hoist blocks	10
2.8 Crane tests	10
3 Materials	11
3.1 General.....	11
3.2 Structural steels	11
3.2.1 Material properties.....	11
3.2.2 Ductility requirements	11
3.2.3 Fracture toughness.....	11
3.2.4 Through thickness properties.....	11
3.2.5 Tolerances	11
3.2.6 Design values of material coefficients.....	11
3.3 Stainless steels.....	11
3.4 Fasteners and welds.....	11
3.5 Bearings	11
3.6 Other products for crane supporting structures	12
3.6.1 General	12
3.6.2 Rail steels	12
3.6.3 Special connecting devices for rails	12
4 Durability.....	12
5 Structural analysis.....	13
5.1 Structural modelling for analysis	13
5.1.1 Structural modelling and basic assumptions.....	13
5.1.2 Joint modelling	13
5.1.3 Ground structure interaction	13
5.2 Global analysis.....	13
5.2.1 Effects of deformed geometry of the structure	13
5.2.2 Structural stability of frames	13
5.3 Imperfections	13
5.3.1 Basis	13
5.3.2 Imperfections for global analysis of frames	13
5.3.3 Imperfections for analysis of bracing systems.....	13
5.3.4 Member imperfections.....	13
5.4 Methods of analysis.....	13
5.4.1 General	13
5.4.2 Elastic global analysis	13
5.4.3 Plastic global analysis.....	13
5.5 Classification of cross-sections	14
5.6 Runway beams	14

5.6.1 Effects of crane loads	14
5.6.2 Structural system	14
5.7 Local stresses in the web due to wheel loads on the top flange	15
5.7.1 Local vertical compressive stresses	15
5.7.2 Local shear stresses	17
5.7.3 Local bending stresses in the web due to eccentricity of wheel loads	17
5.8 Local bending stresses in the bottom flange due to wheel loads	18
5.9 Secondary moments in triangulated components	20
6 Ultimate limit states	22
6.1 General	22
6.2 Resistance of cross-section	22
6.3 Buckling resistance of members	22
6.3.1 General	22
6.3.2 Lateral-torsional buckling	23
6.4 Built up compression members	23
6.5 Resistance of the web to wheel loads	23
6.5.1 General	23
6.5.2 Length of stiff bearing	24
6.6 Buckling of plates	24
6.7 Resistance of bottom flanges to wheel loads	24
7 Serviceability limit states	27
7.1 General	27
7.2 Calculation models	27
7.3 Limits for deformations and displacements	27
7.4 Limitation of web breathing	29
7.5 Reversible behaviour	30
7.6 Vibration of the bottom flange	30
8 Fasteners, welds, surge connectors and rails	31
8.1 Connections using bolts, rivets or pins	31
8.2 Welded connections	31
8.3 Surge connectors	31
8.4 Crane rails	32
8.4.1 Rail material	32
8.4.2 Design working life	32
8.4.3 Rail selection	32
8.5 Rail fixings	33
8.5.1 General	33
8.5.2 Rigid fixings	33
8.5.3 Independent fixings	33
8.6 Rail joints	33
9 Fatigue assessment	34
9.1 Requirement for fatigue assessment	34
9.2 Partial factors for fatigue	34
9.3 Fatigue stress spectra	34
9.3.1 General	34
9.3.2 Simplified approach	34
9.3.3 Local stresses due to wheel loads on the top flange	35
9.3.4 Local stresses due to underslung trolleys	35
9.4 Fatigue assessment	35
9.4.1 General	35
9.4.2 Multiple crane actions	35
9.5 Fatigue strength	36
Annex A [informative] – Alternative assessment method for lateral-torsional buckling	37