BS EN 13001-3-1:2012+A2:2018

BSI Standards Publication

Cranes - General Design

Part 3-1: Limit States and proof competence of steel structure

National foreword

This British Standard is the UK implementation of EN 13001-3-1:2012+A2:2018. It supersedes BS EN 13001-3-1:2012+A1:2013, which is withdrawn.

This standard, together with BS EN 13001-1:2004+A1:2009, BS EN 13001-2:2014, BS EN 13001-3-2:2014, BS EN 13001-3-3:2014, BS EN 13001-3-4 and DD CEN/TS 13001-3-5:2010, supersedes BS 2573-1:1983 and BS 2573-2:1980, which will be withdrawn on publication of all parts of the BS EN 13001 series.

Users' attention is drawn to the fact that neither BS 2573-1:1983 nor BS 2573-2:1980 should be used in conjunction with the EN 13001 series as they are not complementary. The BS 2573 series will remain current until all parts of the BS EN 13001 series cited above have been published to ensure that a coherent package of standards remains available in the UK during the transition to European standards.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by ▌A1⟩ ⟨A1▐.

The UK participation in its preparation was entrusted to Technical Committee MHE/3/1, Crane design.

A list of organizations represented on this committee can be obtained on request to its secretary.

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30 September 2013	Implementation of CEN amendment A1:2013
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31 August 2018	Implementation of CEN amendment A2:2018

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EN 13001-3-1:2012+A2

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English Version

Cranes - General Design - Part 3-1: Limit States and proof competence of steel structure

Appareils de levage à charge suspendue - Conception générale - Partie 3-1 : Etats limites et vérification d'aptitude des charpentes en acier

Krane - Konstruktion allgemein - Teil 3-1: Grenzzustände und Sicherheitsnachweis von Stahltragwerken

This European Standard was approved by CEN on and includes Amendment 2 approved by CEN on 30 October 2017.

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European foreword

This document (EN 13001-3-1:2012+A2:2018) has been prepared by Technical Committee CEN/TC 147 “Cranes - Safety”, the secretariat of which is held by BSI.

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 July 2018, and conflicting national standards shall be withdrawn at the latest by July 2018.

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

This document includes Amendment 1 approved by CEN on 11 May 2013.

This document includes Amendment 2 approved by CEN on 30 October 2017.

This document supersedes [A2] EN 13001-3-1:2012+A1:2013 [/A2].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [/A1] or [A2] [/A2].

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

[A1] CEN/TC 147/WG 2 has made a new edition of EN 13001-3-1 to adapt the standard as follows:

- Subclause 4.2.1 is changed in such a way that Table 2 is permanently valid and requirements for other materials are added, and
- editorial changes are done to improve the document. [/A1]

[A2] CEN/TC 147/WG 2 has made a new consolidation of EN 13001-3-1 to adapt the standard as follows:

— New steel qualities from EN 10149-2 and stainless steels from EN 10088-2 added to 4.2.1.

— Application of bolt preloading scatter in 5.2.3.3 was modified.

— Table 8 changed to exclude matching material for ultra-high strength steel.

— Fatigue strength specific resistance factors were adjusted in 6.1.

— Requirements for fatigue testing were modified.

— Formula for assessing combined effect of normal and shear stresses was changed in 6.5.4.

— Annex C improved for calculation of fillet welds.

— Characteristic fatigue strengths modified for notch cases D.1.1, D.1.2, D.3.29 and D.3.30.

— Number of minor changes for reasons of editorial and technical accuracy. 〈A2〉

This European Standard is one Part of EN 13001, *Cranes — General design*. The other parts are as follows:

— *Part 1: General principles and requirements*;
— *Part 2: Load actions*;
— *Part 3-2: Limit states and proof of competence of wire ropes in reeving systems*;
— *Part 3-3: Limit states and proof of competence of wheel/rail contacts*;
— *Part 3-4: Limit states and proof of competence of machinery*;
— *Part 3-5: Limit states and proof of competence of forged hooks*.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard has been prepared to be a harmonized standard to provide one means for the mechanical design and theoretical verification of cranes to conform ▌A2⟩ to ⟨A2▌ the essential health and safety requirements of the Machinery Directive, as amended. This standard also establishes interfaces between the user (purchaser) and the designer, as well as between the designer and the component manufacturer, in order to form a basis for selecting cranes and components.

This European Standard is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

1 Scope

This European Standard is to be used together with EN 13001-1 and EN 13001-2 and as such they specify general conditions, requirements and methods to prevent mechanical hazards of cranes by design and theoretical verification.

NOTE Specific requirements for particular types of cranes are given in the appropriate European Standard for the particular crane type.

The following is a list of significant hazardous situations and hazardous events that could result in risks to persons during intended use and reasonably foreseeable misuse. Clauses 4 to 8 of this standard are necessary to reduce or eliminate risks associated with the following hazards:

a) exceeding the limits of strength (yield, ultimate, fatigue);

b) exceeding temperature limits of material or components;

c) elastic instability of the crane or its parts (buckling, bulging).

This European Standard is not applicable to cranes which are manufactured before the date of its publication as EN and serves as reference base for the European Standards for particular crane types (see Annex I).

NOTE EN 13001-3-1 deals only with the limit state method in accordance with EN 13001-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

〚A2〛 deleted reference 〚A2〛

EN 1993-1-8:2005, *Eurocode 3: Design of steel structures — Part 1-8: Design of joints*

EN 10025-2:2004, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10025-3:2004, *Hot rolled products of structural steels — Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*

EN 10025-4:2004, *Hot rolled products of structural steels — Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels*

EN 10025-6:2004, *Hot rolled products of structural steels — Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition*

EN 10029:2010, *Hot rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

〚A2〛 deleted references 〚A2〛

[A2] EN 10088-2:2014, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

EN 10149-2:2013, *Hot-rolled flat products made of high yield strength steels for cold forming — Part 2: Delivery conditions for thermomechanically rolled steels*

EN 10149-3:2013, *Hot-rolled flat products made of high yield strength steels for cold forming — Part 3: Delivery conditions for normalized or normalized rolled steels* [A2]

EN 10160:1999, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*

EN 10163-1:2004, *Delivery requirements for surface conditions of hot-rolled steel plates, wide flats and sections — Part 1: General requirements*

EN 10163-2:2004, *Delivery requirements for surface conditions of hot-rolled steel plates, wide flats and sections — Part 2: Plate and wide flats*

EN 10163-3:2004, *Delivery requirements for surface conditions of hot-rolled steel plates, wide flats and sections – Part 3: Sections*

EN 10164:2004, *Steel products with improved deformation properties perpendicular to the surface of the product — Technical delivery conditions*

EN 13001-1, *Cranes — General design — Part 1: General principles and requirements*

EN 13001-2, *Crane safety — General design — Part 2: Load actions*

EN 20273:1991, *Fasteners — Clearance holes for bolts and screws (ISO 273:1979)*

[A2] EN ISO 148-1:2016 *Metallic materials — Charpy pendulum impact test — Part 1: test method* [A2]

EN ISO 286-2:2010, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts (ISO 286-2:2010)*

[A2] EN ISO 898 1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898 1:2013)* [A2]

[A2] EN ISO 5817:2014, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2014)* [A2]

EN ISO 9013:2002, *Thermal cutting — Classification of thermal cuts — Geometrical product specification and quality tolerances (ISO 9013:2002)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 17659:2004, *Welding — Multilingual terms for welded joints with illustrations (ISO 17659:2002)*

ISO 4306-1:2007, *Cranes — Vocabulary — Part 1: General*

3 Terms ,definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 [A2] *deleted text* [A2] apply. For the definitions of loads, Clause 6 of ISO 4306-1:2007 applies.

3.2 Symbols and abbreviations

The symbols and abbreviations used in this Part of the EN 13001 are given in Table 1.

Table 1 — Symbols and abbreviations (1 of 4)

Symbols, abbreviations	Description
A	cross section
A_n	net cross section
A_S	stress area of a bolt
A_S	shear area of the tear-out section (pinned connections)
a	length of plate in buckling
a	throat thickness of fillet welds
a_r	effective weld thickness
b	width of plate
c	edge stress ratio factor (buckling)
D_o, D_i	outer, inner diameter of hollow pin
d	diameter (shank of bolt, pin)
d_o	diameter of hole
E	modulus of elasticity
F_b	tensile force in bolt
F_d	limit force
[A1] F_k [A1]	characteristic value (force)
F_p	preloading force in bolt
F_{Rd}	limit design force
F_e	external force (on bolted connection)
$F_{b,Rd}$	limit design bearing force
$F_{b,Sd}$; $F_{bi,Sd}$	design bearing force
$F_{cs,Rd}$	limit design tensile force
$F_{p,d}$	design preloading force
F_{cr}	reduction in compression force due to external tension