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Wind energy generation systems - Part 8: Design of wind turbine structural components

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 10/24

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61400-8

August 2024

ICS 27.180

English Version

Wind energy generation systems - Part 8: Design of wind turbine structural components (IEC 61400-8:2024)

Systèmes de génération d'énergie éolienne - Partie 8: Conception des composants structurels des éoliennes (IEC 61400-8:2024)

Windenergieanlagen - Teil 8: Design von Windenergieanlagen-Strukturkomponenten (IEC 61400-8:2024)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 88/1010/FDIS, future edition 1 of IEC 61400-8, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61400-8:2024.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2025-05-07
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2027-08-07

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Endorsement notice

The text of the International Standard IEC 61400-8:2024 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

ISO 12944-5:2019 NOTE Approved as EN ISO 12944-5:2019 (not modified)

ISO 1461:2022 NOTE Approved as EN ISO 1461:2022 (not modified)

ISO 14713-1:2017 NOTE Approved as EN ISO 14713-1:2017 (not modified)

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 61400-1	2019	Wind energy generation systems - Part 1: Design requirements	EN IEC 61400-1	2019
IEC 61400-3-1	2019	Wind energy generation systems - Part 3-1: Design requirements for fixed offshore wind turbines	EN IEC 61400-3-1	2019
-	-		+ A11	2020
IEC/TS 61400-3-2	2019	Wind energy generation systems - Part 3-2: Design requirements for floating offshore wind turbines	-[1]	-
IEC 61400-5	2020	Wind energy generation systems - Part 5: Wind turbine blades	EN IEC 61400-5	2020
IEC 61400-6	2020	Wind energy generation systems - Part 6: Tower and foundation design requirements	EN IEC 61400-6	2020
IEC 61400-13	2015	Wind turbines - Part 13: Measurement of mechanical loads	EN 61400-13	2016
ISO/IEC 17025	2017	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	2017
ISO 148-1	2016	Metallic materials - Charpy pendulum impact test - Part 1: Test method	EN ISO 148-1	2016
ISO 945-1	2019	Microstructure of cast irons - Part 1: Graphite classification by visual analysis	EN ISO 945-1	2019
ISO 1083	2018	Spheroidal graphite cast irons - Classification	-	-
ISO 1099	2017	Metallic materials - Fatigue testing - Axial force-controlled method	-	-
ISO 1143	2021	Metallic materials - Rotating bar bending fatigue testing	-	-

[1] To be published. Stage at time of publication: FprEN IEC 61400-3-2:2024.

ISO 2394	2015	General principles on reliability for structures	-	-
ISO 3800	1993	Threaded fasteners; axial load fatigue testing; test methods and evaluation of results	-	-
ISO 6892-1	2019	Metallic materials - Tensile testing - Part 1: Method of test at room temperature	EN ISO 6892-1	2019
ISO 7500-1	2018	Metallic materials - Calibration and verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Calibration and verification of the force-measuring system	EN ISO 7500-1	2018
ISO 12107	2012	Metallic materials - Fatigue testing - Statistical planning and analysis of data	-	-
ISO 12108	2018	Metallic materials - Fatigue testing - Fatigue crack growth method	-	-
ISO 12135	2021	Metallic materials - Unified method of test for the determination of quasistatic fracture toughness	-	-
ISO/TR 14345	2012	Fatigue - Fatigue testing of welded components - Guidance	-	-
ISO 16269-6	2014	Statistical interpretation of data - Part 6: Determination of statistical tolerance intervals	-	-
ASTM-E466-21	2021	Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials	-	-
BS 7910	2013	Guide to methods for assessing the acceptability of flaws in metallic structures	-	-
-	-	Personal fall protection equipment - Anchor devices - Recommendations for anchor devices for use by more than one person simultaneously	CEN/TS 16415	2013
-	-	Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures	EN 1090-2	2018
-	-	Execution of steel structures and aluminium structures - Part 3: Technical requirements for aluminium structures	EN 1090-3	2019
-	-	Founding - Magnetic particle testing	EN 1369	2012
-	-	Founding - Magnetic particle inspection	EN 1369	1996
-	-	Founding - Liquid penetrant testing - Part 1: Sand, gravity die and low pressure die castings	EN 1371-1	2011
-	-	Founding - Liquid penetrant inspection - Part 1: Sand, gravity die and low pressure die castings	EN 1371-1	1997
-	-	Eurocode 3: Design of steel structures - Part 1-8: Design of joints	EN 1993-1-8	2007

-	-	Eurocode 3: Design of steel structures - Part 1-9: Fatigue	EN 1993-1-9	2007
-	-	Eurocode 3: Design of steel structures - Part 1-10: Material toughness and through-thickness properties	EN 1993-1-10	2007
-	-	Eurocode 9: Design of aluminium structures - Part 1-1: General structural rule	EN 1991-1-1	2008
-	-	Eurocode 9: Design of aluminium structures - Part 1-3: Structures susceptible to fatigue	EN 1999-1-3	2007
-	-	Ultrasonic examination - Part 3: Spheroidal graphite cast iron castings	EN 12680-3	2011
-	-	Wind turbines - Protective measures - Requirements for design, operation and maintenance	EN 50308	2004
DIN 50100	2016	Load controlled fatigue testing - Execution and evaluation of cyclic tests at constant load amplitudes on metallic specimens and components	-	-
FKM Guideline	2018	Fracture Mechanics Proof of Strength for Engineering Components (FKM – RBM-04-18)	-	-
IIW-Doc. 2259-152259-15	2014	Recommendations for fatigue design of welded joints and components, International Institute of Welding	-	-
IIW-Doc. XIII-2240r2-08/XV-1289r2-08	2010	Guideline for the Fatigue Assessment by Notch Stress Analysis for Welded Structures	-	-
VDI 2230-1	2015	Systematic calculation of highly stressed bolted joints - Joints with one cylindrical bolt	-	-
VDI 2230-2	2014	Systematic calculation of high duty bolted joints - Joints with several cylindrical bolts	-	-
VDMA 23902	2014	Guideline for fracture mechanical strength assessment of planet carriers made of nodular cast iron EN-GJS-700-2 for wind turbine gear boxes, Verband Deutscher Maschinen- und Anlagenbau e.V.	-	-

IEC 61400-8

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INTERNATIONAL STANDARD

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colour inside

Wind energy generation systems –
Part 8: Design of wind turbine structural components

Systèmes de génération d'énergie éolienne –
Partie 8: Conception des composants structurels des éoliennes

IEC 61400-8:2024-07(en-fr)

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WIND ENERGY GENERATION SYSTEMS –

Part 8: Design of wind turbine structural components

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC 61400-8 has been prepared by IEC technical committee 88: Wind energy generation systems. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
88/1010/FDIS	88/1023/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 61400 series, under the general title: *Wind energy generation systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of the IEC 61400 series outlines the minimum requirements for the design of wind turbine nacelle-based structures and is not intended for use as a complete design specification or instruction manual.

Several different groups can be responsible for undertaking the various elements of the design, manufacture, assembly, installation and maintenance of a wind turbine nacelle and for ensuring that the requirements of this document are met. The division of responsibilities between these parties is a contractual matter and is outside the scope of this document.

The requirements stated in this document may be altered if it can be sufficiently demonstrated that the structural integrity of the system is not compromised.

The specific scope of the document is provided in Clause 1. For cases out of the scope of this document, reference should be made to relevant IEC/ISO standards.

WIND ENERGY GENERATION SYSTEMS –

Part 8: Design of wind turbine structural components

1 Scope

This part of IEC 61400 outlines the minimum requirements for the design of wind turbine nacelle-based structures and is not intended for use as a complete design specification or instruction manual. This document focuses on the structural integrity of the structural components constituted within and in the vicinity of the nacelle, including the hub, mainframe, main shaft, associated structures of direct-drives, gearbox structures, yaw structural connection, nacelle enclosure. It also addresses connections of the structural components to control and protection mechanisms, as well as structural connections of electrical units and other mechanical systems. This document focuses primarily on ferrous material-based nacelle structures but can apply to other materials also as appropriate. The design of bolted and welded joints in the nacelle structures is included, as well as cast and forged components. Material testing requirements to use in the design process for nacelle structures are specified. While the structural connections of the gearbox and the main shaft are in the scope, the design of the gears and bearings are not included.

The safety level of the wind turbine designed according to this document shall be at or exceed the level inherent in IEC 61400-1:2019. Probabilistic methods to calibrate partial safety factors and for use in the design process are provided.

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.

IEC 61400-1:2019, *Wind energy generation systems – Part 1*: *Design requirements*

IEC 61400-3-1:2019, *Wind energy generation systems – Part 3: Design requirements for fixed offshore wind turbines*

IEC TS 61400-3-2:2019, *Wind energy generation systems – Part 3-2: Design requirements for floating offshore wind turbines*

IEC 61400-5:2020, *Wind energy generation systems – Part 5: Wind turbine blades*

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ISO 945-1:2019, *Microstructure of cast irons – Part 1: Graphite classification by visual analysis*

ISO 1083:2018, *Spheroidal graphite cast irons – Classification*

ISO 1099:2017, *Metallic materials – Fatigue testing – Axial force-controlled method*

ISO 1143:2021, *Metallic materials – Rotating bar bending fatigue testing*

ISO 2394:2015, *General principles on reliability for structures*

ISO 3800:1993, *Threaded fasteners – Axial load fatigue testing – Test methods and evaluation of results*

ISO 6892-1:2019, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature*

ISO 7500-1:2018, *Metallic materials – Calibration and verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Calibration and verification of the force-measuring system*

ISO 12107:2012, *Metallic materials – Fatigue testing – Statistical planning and analysis of data*

ISO 12108:2018, *Metallic materials – Fatigue testing – Fatigue crack growth method*

ISO 12135:2021, *Metallic materials – Unified method of test for the determination of quasistatic fracture toughness*

ISO/TR 14345:2012, *Fatigue − Fatigue testing of welded components − Guidance*

ISO 16269-6:2014, *Statistical interpretation of data − Part 6: Determination of statistical tolerance intervals*

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BS 7910:2013, *Guide to methods for assessing the acceptability of flaws in metallic structures*

CEN/TS 16415:2013, *Personal fall protection equipment – Anchor devices – Recommendations for anchor devices for use by more than one person simultaneously*

EN 1090-2:2018, *Execution of steel structures and aluminium structures – Part 2: Technical requirements for steel structures*

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EN 1369:2012*, Founding – Magnetic particle testing*

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EN 1993-1-8:2007, *Eurocode 3: Design of steel structures – Part 1-8: Design of joints*

EN 1993-1-9:2007, *Eurocode 3: Design of steel structures – Part 1-9: Fatigue*

EN 1993-1-10:2007, *Eurocode 3: Design of steel structures – Part 1-10: Material toughness and through-thickness properties*

EN 1999-1-1:2008, *Eurocode 9: Design of aluminium structures – Part 1-1: General structural rule*

EN 1999-1-3:2007, *Eurocode 9: Design of aluminium structures – Part 1-3: Structures susceptible to fatigue*

EN 12680-3:2011, *Ultrasonic examination – Part 3: Spheroidal graphite cast iron castings*

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