Wind energy generation systems - Part 1: Design requirements

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 61400-1:2019 sisaldab Euroopa standardi EN IEC 61400-1:2019 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 61400-1:2019 consists of the English text of the European standard EN IEC 61400-1:2019.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 05.04.2019.	Date of Availability of the European standard is 05.04.2019.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 27.180

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61400-1

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English Version

Wind energy generation systems - Part 1: Design requirements (IEC 61400-1:2019)

Systèmes de génération d'énergie éolienne - Partie 1: Exigences de conception (IEC 61400-1:2019)

Windenergieanlagen - Teil 1: Auslegungsanforderungen (IEC 61400-1:2019)

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

Ref. No. EN IEC 61400-1:2019 E

European foreword

The text of document 88/696/FDIS, future edition 4 of IEC 61400-1, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61400-1:2019.

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) 2019-12-15
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-03-15

This document supersedes EN 61400-1:2005.

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

Endorsement notice

The text of the International Standard IEC 61400-1:2019 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 standards indicated:

IEC 60146 (series)	NOTE	Harmonized as EN 60146 (series)
IEC 60269 (series)	NOTE	Harmonized as EN 60269 (series)
IEC 60898 (series)	NOTE	Harmonized as EN 60898 (series)
IEC 61000-6-1	NOTE	Harmonized as EN IEC 61000-6-1
IEC 61000-6-4	NOTE	Harmonized as EN 61000-6-4
IEC 61310-1:2007	NOTE	Harmonized as EN 61310-1:2008 (not modified)
IEC 61310-2:2007	NOTE	Harmonized as EN 61310-2:2008 (not modified)
IEC 61400-2	NOTE	Harmonized as EN 61400-2
IEC 61400-3-1[1]	NOTE	Harmonized as EN IEC 61400-3-1[2]
IEC 61400-6[3]	NOTE	Harmonized as EN IEC 61400-6[4]

[1] To be published. Stage at time of publication: IEC CDV 61400-3-1:2017

[2] To be published. Stage at time of publication: FprEN IEC 61400-3-1:2018

[3] To be published. Stage at time of publication: IEC CDV 61400-6:2017

[4] To be published. Stage at time of publication: pr EN IEC 61400-6:2017

IEC 61400-12-1	NOTE	Harmonized as EN 61400-12-1
IEC 61400-13	NOTE	Harmonized as EN 61400-13
IEC 61400-21	NOTE	Harmonized as EN 61400-21
IEC 61508 (series)	NOTE	Harmonized as EN 61508 (series)
IEC 61508-1:2010	NOTE	Harmonized as EN 61508-1:2010 (not modified)
IEC 61508-6	NOTE	Harmonized as EN 61508-6
IEC 62061:2005	NOTE	Harmonized as EN 62061:2005 (not modified)
IEC 62061:2005/AMD1:2012	NOTE	Harmonized as EN 62061:2005/A1:2013 (not modified)
IEC 62061:2005/AMD2:2015	NOTE	Harmonized as EN 62061:2005/A2:2015 (not modified)
IEC 62305-1	NOTE	Harmonized as EN 62305-1
ISO 12100:2010	NOTE	Harmonized as EN ISO 12100:2010 (not modified)
ISO 9001	NOTE	Harmonized as EN ISO 9001
ISO 13849-2	NOTE	Harmonized as EN ISO 13849-2

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.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60034	series	Rotating electrical machines	-	series
IEC 60038	-	IEC standard voltages	EN 60038	-
IEC 60071-1	-	Insulation co-ordination - Part 1: Definitions, principles and rules	EN 60071-1	-
IEC 60071-2	-	Insulation co-ordination - Part 2: Application guidelines	EN IEC 60071-2	-
IEC 60076	series	Power transformers	EN 60076	series
IEC 60204-1	-	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	-
IEC 60204-11	2000	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV	EN 60204-11	2000
-	-		+ corrigendum Feb.	2010
IEC 60364	series	Low-voltage electrical installations	HD 60364	series
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 60664-1	-	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	-
IEC 60664-3	-	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	-
IEC 60721	series	Classification of environmental conditions -	EN 60721	series
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments	EN IEC 61000-6-2	-

Publication	Year	Title	EN/HD	Year
IEC 61400-3	-	Wind turbines - Part 3: Design requirements for offshore wind turbines	EN 61400-3	-
IEC 61400-4	-	Wind turbines - Part 4: Design requirements for wind turbine gearboxes	EN 61400-4	-
IEC 61400-24	-	Wind turbines - Part 24: Lightning protection	EN 61400-24	-
IEC 61439	series	Low-voltage switchgear and controlgear assemblies	EN 61439	series
IEC 61800-4	-	Adjustable speed electrical power drive systems - Part 4: General requirements - Rating specifications for a.c. power drive systems above 1 000 V a.c. and not exceeding 35 kV	EN 61800-4	-
IEC 61800-5-1	-	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy	EN 61800-5-1	-
IEC 62271	series	High-voltage switchgear and controlgear	EN 62271	series
IEC 62305-3	-	Protection against lightning - Part 3: Physical damage to structures and life hazard	EN 62305-3	-
IEC 62305-4	-	Protection against lightning - Part 4: Electrical and electronic systems within structures	EN 62305-4	-
IEC 62477-1	2012	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN 62477-1	2012
-	-		+ A11	2014
ISO 76	-	Rolling bearings - Static load ratings	-	-
ISO 281	-	Rolling bearings - Dynamic load ratings and rating life	-	-
ISO 2394	-	General principles on reliability for structures	-	-
ISO 2533	-	Standard Atmosphere	-	-
ISO 4354	-	Wind actions on structures	-	-
ISO 6336-2	-	Calculation of load capacity of spur and helical gears – Part 2: Calculation of surface durability (pitting)	-	-
ISO 6336-3	2006	Calculation of load capacity of spur and helical gears – Part 3: Calculation of tooth bending strength	-	-
ISO 12494	2001	Atmospheric icing of structures	-	-
ISO 13850	-	Safety of machinery - Emergency stop function - Principles for design	EN ISO 13850	-
ISO/TS 16281	-	Rolling bearings -- Methods for calculating the modified reference rating life for universally loaded bearings	-	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WIND ENERGY GENERATION SYSTEMS –

Part 1: Design requirements

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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International Standard IEC 61400-1 has been prepared by IEC technical committee 88: Wind energy generation systems.

This fourth edition cancels and replaces the third edition published in 2005 and Amendment 1:2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) general update and clarification of references and requirements;
b) extension of wind turbine classes to allow for tropical cyclones and high turbulence;
c) Weibull distribution of turbulence standard deviation for normal turbulence model (NTM);
d) updated design load cases (DLCs), in particular DLC 2.1 and 2.2;
e) revision of partial safety factor specifications;
f) major revision of Clauses 8, 10 and 11;

g) introduction of cold climate requirements, Clause 14;

h) new Annex B on design load cases for site-specific or special class S wind turbine design or site suitability assessment;

i) new Annex J on prediction of the extreme wind speed of tropical cyclones by using Monte Carlo simulation method;

j) new Annex K on calibration of structural material safety factors and structural design assisted by testing;

k) new Annex L on assessment and effects of icing climate;

l) new Annex M on medium wind turbines.

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

FDIS	Report on voting
88/696/FDIS	88/701/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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 IEC 61400 outlines minimum design requirements for wind turbines and is not intended for use as a complete design specification or instruction manual.

Any of the requirements of this document may be altered if it can be suitably demonstrated that the safety of the system is not compromised. This provision, however, does not apply to the classification and the associated definitions of external conditions in Clause 6. Compliance with this document does not relieve any person, organization, or corporation from the responsibility of observing other applicable regulations.

This document is not intended to give requirements for wind turbines installed offshore, in particular for the support structure. For offshore installations, reference is made to the IEC 61400-3 series.

WIND ENERGY GENERATION SYSTEMS –

Part 1: Design requirements

1 Scope

This part of IEC 61400 specifies essential design requirements to ensure the structural integrity of wind turbines. Its purpose is to provide an appropriate level of protection against damage from all hazards during the planned lifetime.

This document is concerned with all subsystems of wind turbines such as control and protection functions, internal electrical systems, mechanical systems and support structures.

This document applies to wind turbines of all sizes. For small wind turbines, IEC 61400-2 can be applied. IEC 61400-3-1 provides additional requirements to offshore wind turbine installations.

This document is intended to be used together with the appropriate IEC and ISO standards mentioned in Clause 2.

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 60034 (all parts), *Rotating electrical machines*

IEC 60038, *IEC standard voltages*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60071-2, *Insulation co-ordination – Part 2: Application guidelines*

IEC 60076 (all parts), *Power transformers*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60204-11:2000, *Safety of machinery – Electrical equipment of machines – Part 11: Requirements for HV equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*

IEC 60364 (all parts), *Low voltage electrical installations*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*