SVENSK STANDARD SS-EN IEC 61400-21-1

Fastställd	Utgåva	Sida	Ansvarig kommitté
2020-01-28	1	1 (1+146)	SEK TK 88

Vindkraftverk –
Del 21-1: Mätning och bedömning av elektriska egenskaper –
Vindturbiner

Wind energy generation systems –
Part 21-1: Measurement and assessment of electrical characteristics –
Wind turbines

Som svensk standard gäller europastandarden EN IEC 61400-21-1:2019. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61400-21-1:2019.

Nationellt förord

Europastandarden EN IEC 61400-21-1:2019

består av:

- **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
- **IEC 61400-21-1, First edition, 2019 - Wind energy generation systems - Part 21-1: Measurement and assessment of electrical characteristics - Wind turbines**

utarbetad inom International Electrotechnical Commission, IEC.

ICS 27.180.00

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Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

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Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61400-21-1

July 2019

ICS 27.180

English Version

Wind energy generation systems - Part 21-1: Measurement and assessment of electrical characteristics - Wind turbines (IEC 61400-21-1:2019)

Systèmes de génération d'énergie éolienne - Partie 21-1: Mesurage et évaluation des caractéristiques électriques - Éoliennes
(IEC 61400-21-1:2019)

Windenergieerzeugungsanlagen - Teil 21-1: Messung und Bewertung der elektrischen Kennwerte - Windenergieanlagen
(IEC 61400-21-1:2019)

This European Standard was approved by CENELEC on 2019-06-24. CENELEC 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 CEN-CENELEC Management Centre or to any CENELEC 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 CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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 61400-21-1:2019 E

European foreword

The text of document 88/711/FDIS, future edition 1 of IEC 61400-21-1, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61400-21-1:2019.

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)	2020-03-24
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2022-06-24

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 61400-21-1:2019 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61400-27-1:2015 NOTE Harmonized as EN 61400-27-1:2015 (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.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 61000-3-2	2014	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)	EN 61000-3-2	2014
IEC 61000-3-3	-	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subject to conditional connection	EN 61000-3-3	-
IEC 61000-4-7	2002	Electromagnetic compatibility (EMC) - Part 4-7: Testing and measurement techniques - General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto	EN 61000-4-7	2002
+ A1	2008		+ A1	2009
IEC 61000-4-15	2010	Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications	EN 61000-4-15	2011
IEC 61000-4-30	-	Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods	EN 61000-4-30	-
IEC 62008	-	Performance characteristics and calibration methods for digital data acquisition systems and relevant software	EN 62008	-
IEC/TR 61000-3-6	-	Electromagnetic compatibility (EMC) - Part 3-6: Limits - Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems	-	-
IEC/TR 61000-3-7:2008	-	Electromagnetic compatibility (EMC) - Part 3-7: Limits - Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems	-	-
IEC/TR 61000-3-14	-	Electromagnetic compatibility (EMC) - Part 3-14: Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems	-	-
IEC/TR 61869-103	2012	Instrument transformers - The use of instrument transformers for power quality measurement	-	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WIND ENERGY GENERATION SYSTEMS –

Part 21-1: Measurement and assessment of electrical characteristics – Wind turbines

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 61400-21-1 has been prepared by IEC technical committee 88: Wind energy generation systems.

This first edition cancels and replaces the second edition of 61400-21 published in 2008. This edition constitutes a technical revision.

This edition includes the following new items with respect to 61400-21:

a) frequency control measurement;
b) updated reactive power control and capability measurement, including voltage and cos φ control;
c) inertia control response measurement;
d) overvoltage ride through test procedure;
e) updated undervoltage ride through test procedure based on Wind Turbine capability;

f) new methods for the harmonic assessment.

Parts of the assessments related to the wind power plant evaluation are moved to Annex E, as they will be replaced by IEC 61400-21-2, *Measurement and assessment of electrical characteristics – Wind power plants*.

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

FDIS	Report on voting
88/711/FDIS	88/716/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 in the IEC 61400 series, published 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 "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.

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 provides a uniform methodology that will ensure consistency and accuracy in reporting, testing and assessment of electrical characteristics of grid connected wind turbines (WTs). The electrical characteristics include wind turbine specifications and capabilities, voltage quality (emissions of flicker and harmonics), under- and overvoltage ride-through response, active power control, frequency control, voltage control, and reactive power control, grid protection and reconnection time.

This part of IEC 61400 has been prepared with the anticipation that it would be applied by:

– the WT manufacturer, striving to meet well-defined electrical characteristics;
– the WT purchaser, in specifying such electrical characteristics;
– the WT operator, who may be required to verify that stated, or required electrical characteristics are met;
– the WT planner or regulator, who has to be able to accurately and fairly determine the impact of a WT on the voltage quality to ensure that the installation is designed so that voltage quality requirements are respected;
– the WT certification authority or testing organization, in evaluating the electrical characteristics of the wind turbine type;
– the planner or regulator of the electric network, who has to be able to determine the grid connection required for a WT.

This part of IEC 61400 provides recommendations for preparing the measurements and assessment of electrical characteristics of grid connected WTs. This document will benefit those parties involved in the manufacture, installation planning, obtaining of permission, operation, usage, testing and regulation of WTs. The measurement and analysis techniques, recommended in this document, should be applied by all parties to ensure that the continuing development and operation of WTs are carried out in an atmosphere of consistent and accurate communication.

This part of IEC 61400 presents measurement and analysis procedures expected to provide consistent results that can be replicated by others. Any selection of tests can be done and reported separately.

WIND ENERGY GENERATION SYSTEMS –

Part 21-1: Measurement and assessment of electrical characteristics – Wind turbines

1 Scope

This part of IEC 61400 includes:

- definition and specification of the quantities to be determined for characterizing the electrical characteristics of a grid-connected wind turbine;
- measurement procedures for quantifying the electrical characteristics;
- procedures for assessing compliance with electrical connection requirements, including estimation of the power quality expected from the wind turbine type when deployed at a specific site.

The measurement procedures are valid for single wind turbines with a three-phase grid connection. The measurement procedures are valid for any size of wind turbine, though this part of IEC 61400 only requires wind turbine types intended for connection to an electricity supply network to be tested and characterized as specified in this part of IEC 61400.

The measured characteristics are valid for the specific configuration and operational mode of the assessed wind turbine product platform. If a measured property is based on control parameters and the behavior of the wind turbine can be changed for this property, it is stated in the test report. Example: Grid protection, where the disconnect level is based on a parameter and the test only verifies the proper functioning of the protection, not the specific level.

The measurement procedures are designed to be as non-site-specific as possible, so that electrical characteristics measured at for example a test site can be considered representative for other sites.

This document is for the testing of wind turbines; all procedures, measurements and tests related to wind power plants are covered by IEC 61400-21-2.

The procedures for assessing electrical characteristics are valid for wind turbines with the connection to the PCC in power systems with stable grid frequency.

NOTE

For the purposes of this document, the following terms for system voltage apply:

– Low voltage (LV) refers to $U_n \leq 1$ kV;

– Medium voltage (MV) refers to 1 kV < $U_n \leq 35$ kV;

– High voltage (HV) refers to 35 kV < $U_n \leq 220$ kV;

– Extra high voltage (EHV) refers to $U_n > 220$ kV.

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 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limits of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16 A per phase and not subject to conditional connection*

IEC TR 61000-3-6, *Electromagnetic compatibility (EMC) – Part 3-6: Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems*

IEC TR 61000-3-7, *Electromagnetic compatibility (EMC) – Part 3-7: Limits – Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems*

IEC TR 61000-3-14, *Electromagnetic compatibility (EMC) – Part 3-14: Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems*

IEC 61000-4-7:2002, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*
IEC 61000-4-7:2002/AMD1:2008

IEC 61000-4-15:2010, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications*

IEC 61000-4-30, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods*

IEC TR 61869-103:2012, *Instrument transformers – The use of instrument transformers for power quality measurement*

IEC 62008, *Performance characteristics and calibration methods for digital data acquisition systems and relevant software*