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Wind energy generation systems - Part 21-2: Measurement and assessment of electrical characteristics - Wind power plants

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. 07/23

Obsahuje: EN IEC 61400-21-2:2023, IEC 61400-21-2:2023

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 61400-21-2

May 2023

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English Version

Wind energy generation systems - Part 21-2: Measurement and assessment of electrical characteristics - Wind power plants (IEC 61400-21-2:2023)

Systèmes de génération d'énergie éolienne - Partie 21-2: Mesurage et évaluation des caractéristiques électriques - Centrales éoliennes (IEC 61400-21-2:2023)

Windenergieanlagen - Teil 21-2: Messung und Bewertung der elektrischen Kennwerte - Windkraftwerke (IEC 61400-21-2:2023)

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European foreword

The text of document 88/933/FDIS, future edition 1 of IEC 61400-21-2, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61400-21-2:2023.

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)	2024-02-03
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2026-05-03

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Endorsement notice

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

IEC 60255 (series)	NOTE Approved as EN 60255 (series)
IEC 61000 (series)	NOTE Approved as EN IEC 61000 (series)
IEC 61000-4-7	NOTE Approved as EN 61000-4-7
IEC 61400-25 (series)	NOTE Approved as EN 61400-25 (series)
IEC 61400-25-1	NOTE Approved as EN 61400-25-1
IEC 61800-3	NOTE Approved as EN IEC 61800-3
IEC 61850-9-2	NOTE Approved as EN 61850-9-2
IEC 62008	NOTE Approved as EN 62008

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 60038	-	IEC standard voltages	EN 60038	-
IEC 60255-121	2014	Measuring relays and protection equipment - Part 121: Functional requirements for distance protection	EN 60255-121	2014
IEC 60255-127	2010	Measuring relays and protection equipment - Part 127: Functional requirements for over/under voltage protection	EN 60255-127	2014
IEC 60255-151	2009	Measuring relays and protection equipment - Part 151: Functional requirements for over/under current protection	EN 60255-151	2009
IEC 60255-181	2019	Measuring relays and protection equipment - Part 181: Functional requirements for frequency protection	EN IEC 60255-181	2019
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 61000-4-15	-	Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications	EN 61000-4-15	-
IEC 61000-4-30	-	Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods	EN 61000-4-30	-
IEC 61400-21-1	2019	Wind energy generation systems - Part 21-1: Measurement and assessment of electrical characteristics - Wind turbines	EN IEC 61400-21-1	2019
-	-		+ A11	2020
IEC 61400-27-1	-	Wind energy generation systems - Part 27-1: Electrical simulation models - Generic models	EN IEC 61400-27-1	-

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IEC 61400-27-2	-	Wind energy generation systems - Part 27-2: Electrical simulation models - Model validation	EN IEC 61400-27-2	-
IEC 61869-2	-	Instrument transformers - Part 2: Additional requirements for current transformers	EN 61869-2	-
IEC 61869-3	-	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers	EN 61869-3	-
IEC/IEEE 61850-9-3	-	Communication networks and systems for power utility automation - Part 9-3: Precision time protocol profile for power utility automation	-	-

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Wind energy generation systems – Part 21-2: Measurement and assessment of electrical characteristics – Wind power plants

Systèmes de génération d'énergie éolienne – Partie 21-2: Mesurage et évaluation des caractéristiques électriques – Centrales éoliennes

IEC 61400-21-2:2023-03(en-fr)

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INTERNATIONAL STANDARD

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Wind energy generation systems – Part 21-2: Measurement and assessment of electrical characteristics – Wind power plants

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WIND ENERGY GENERATION SYSTEMS –

Part 21-2: Measurement and assessment of electrical characteristics – Wind power plants

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 61400-21-2 has been prepared by 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
88/933/FDIS	88/943/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/standardsdev/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,
- replaced by a revised edition, or
- amended.

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 IEC 61400 defines a uniform method that will ensure the measurement, testing and assessment of the electrical characteristics of grid connected wind power plants. These characteristics include: power quality aspects, control characteristics such as power control, reactive power control, voltage control, frequency control, fault ride-through behaviour, as well as grid protection testing.

The measurements and assessment refer to the point of connection (POC) of the power plant. The procedure describes standardized methods, which will allow the developer as well as system operators (e.g. transmission system operators (TSOs) and distribution system operators (DSOs)) to analyze the fulfilment of the grid connection rules with respect to the above-mentioned characteristics.

This document includes the following aspects:

– definition and specification of the quantities to be determined for characterizing the electrical characteristics of grid connected power plants;
– measurement and test procedures for quantifying the electrical characteristics of a power plant;
– measurement and test procedures of the power plant controller;
– procedures and methods for the estimation of electrical capabilities, using results from each of the wind turbine measurements to assess compliance with electrical connection requirements on power plant level;
– test and measurement procedures that can be used as a reference, for example commissioning tests for existing or newly connected power plants;
– procedures for measurement and fault recording for the validation and verification of wind power plant simulation models as described in IEC 61400-27-1 and IEC 61400-27-2.

These measurement procedures are valid for power plants, including the power plant controller (PPC) and other connected equipment necessary for the operation of the power plant. The measurement procedures are valid for any size of power plant connected to the POC with a single interface.

The results of the measurements and assessment of the power plant’s electrical characteristics can be used as input for the verification of the electrical simulation models for wind power plants as described in IEC 61400-27-2.

Any aspects described in this document can be tested and reported individually, and it is not mandatory to perform all of the described tests and measurements.

The validation of control functions on the power plant is a combination of the performance of the individual power generation units (PGUs), any additional plant components, the communication system and the PPC.

The control performance of the power plant can be proved by a combination of performance tests on site and functionality tests carried out on a hardware-in-the-loop (HIL) setup.

The validation tests for the control performance are therefore divided into two parts:

1) performance tests
2) functionality tests

Functionality tests can be carried out either on a specific test setup (HIL test) or on site.

Performance tests, which are site-dependent, are done at each specific site under the specific site conditions and provide together with the functionality tests the complete control performance of the power plant.

Additional tests and measurements may be carried out and reported on for more detailed assessment of simulation models and compliance with specific grid code requirements.

As the described tests can be used for the validation of other renewable power plants, this document uses the following generic abbreviations:

- PGU: power generation unit as an abbreviated term for a wind turbine
- PP: power plant as the abbreviated term for wind power plant

WIND ENERGY GENERATION SYSTEMS –

Part 21-2: Measurement and assessment of electrical characteristics – Wind power plants

1 Scope

This part of IEC 61400 defines and specifies the quantities that are determined to characterize the electrical characteristics of grid-connected power plants (PPs).

This document defines the measurement and test procedures for quantifying the electrical characteristics as basis for the verification of compliance of PPs, including:

- power quality aspects,
- steady state operation,
- dynamic response (undervoltage and overvoltage fault ride-through),
- disconnection from grid (grid protection),
- control performance.

This document defines a uniform functionality test and measurement procedure for the power plant controller (PPC), as a basis for the unit test of the power plant controller.

This document defines the procedures for assessing compliance with electrical connection requirements, including the aggregation methods for power quality aspects such as voltage variations, flicker, harmonics and interharmonics.

This document defines the procedures for measurement and fault recording, for example for the verification of power plant electrical simulation models in relation to undervoltage and overvoltage ride-through events.

These measurement procedures are valid for power plants, including the power plant controller and other connected equipment, necessary for the operation of the power plant. The measurement procedures are valid for any size of power plant connected to the point of connection (POC) at one connection point.

The procedures for assessing and verifying the compliance with grid connection requirements are valid for power plants in power systems with fixed frequency and a sufficient short-circuit power.

Out of the scope of this document are:

– evaluation of several power plants, i.e. the control by a cluster management of several power plants (PPs) or evaluation where the power plant is connected to several connection points;
– compliance test and performance requirements, including pass or fail criteria;
– specific component test and validation of the PP equipment (switchgear, cables, transformers, etc.), which are covered by other IEC standards;
– wind power plant model validation, as defined in IEC 61400-27-2;
– load flow calculation methods and load flow study guidelines;
– test and measurement of the communication interface and system of the PP as defined in the IEC 61400-25 series.

NOTE For the purposes of this document, the following terms for system voltage apply, based on IEC 60038:

– low voltage (LV) refers to 100 V < U_n ≤ 1 kV;

– medium voltage (MV) refers to 1 kV < U_n ≤ 35 kV;

– high voltage (HV) refers to 35 kV < U_n ≤ 230 kV;

– extra high voltage (EHV) refers to U_n > 230 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 60038, *IEC standard voltages*

IEC 60255-121:2014, *Measuring relays and protection equipment – Part 121: Functional requirements for distance protection*

IEC 60255-127:2010, *Measuring relays and protection equipment – Part 127: Functional requirements for over/under voltage protection*

IEC 60255-151:2009, *Measuring relays and protection equipment – Part 151: Functional requirements for over/under current protection*

IEC 60255-181:2019, *Measuring relays and protection equipment – Part 181: Functional requirements for frequency protection*

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 61000-4-15, *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 61400-21-1:2019, *Wind energy generation systems – Part 21-1: Measurement and assessment of electrical characteristics – Wind turbines*

IEC 61400-27-1, *Wind energy generation systems – Part 27-1: Electrical simulation models – Generic models*

IEC 61400-27-2, *Wind energy generation systems – Part 27-2: Electrical simulation models – Model validation*

IEC 61869-2, *Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

IEC/IEEE 61850-9-3, *Communication networks and systems for power utility automation – Part 9-3: Precision time protocol profile for power utility automation*