



SLOVENSKI STANDARD
SIST EN IEC 61400-26-1:2019

01-oktober-2019

Nadomešča:

SIST-TS CLC/TS 61400-26-1:2017

SIST-TS CLC/TS 61400-26-2:2017

SIST-TS CLC/TS 61400-26-3:2017

Sistemi za proizvodnjo energije na veter - 26-1. del: Razpoložljivost sistemov za proizvodnjo energije na veter (IEC 61400-26-1:2019)

Wind energy generation systems - Part 26-1: Availability for wind energy generation systems (IEC 61400-26-1:2019)

Windenergieanlagen - Teil 26-1: Verfügbarkeit von Windenergieanlagen (IEC 61400-26-1:2019)

Systèmes de génération d'énergie éolienne - Partie 26-1: Disponibilité des systèmes de génération d'énergie éolienne (IEC 61400-26-1:2019)

Ta slovenski standard je istoveten z: EN IEC 61400-26-1:2019

ICS:

27.180 Vetrne elektrarne Wind turbine energy systems

SIST EN IEC 61400-26-1:2019 en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN IEC 61400-26-1:2019

<https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019>

EUROPEAN STANDARD

EN IEC 61400-26-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2019

ICS 27.180

Supersedes CLC/TS 61400-26-1:2017,
CLC/TS 61400-26-2:2017,
CLC/TS 61400-26-3:2017
and all of their amendments and corrigenda (if any)

English Version

**Wind energy generation systems - Part 26-1: Availability for wind
energy generation systems
(IEC 61400-26-1:2019)**Systèmes de génération d'énergie éolienne - Partie 26-1:
Disponibilité des systèmes de génération d'énergie
éolienne
(IEC 61400-26-1:2019)Windenergieanlagen - Teil 26-1: Verfügbarkeit von
Windenergieanlagen
(IEC 61400-26-1:2019)

This European Standard was approved by CENELEC on 2019-07-03. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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**

EN IEC 61400-26-1:2019 (E)**European foreword**

The text of document 88/665/CDV, future edition 1 of IEC 61400-26-1, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61400-26-1:2019.

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) 2020-04-03
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-07-03

This document supersedes CLC/TS 61400-26-1:2017, CLC/TS 61400-26-2:2017 and CLC/TS 61400-26-3:2017 and all of their amendments and corrigenda (if any).

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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

Endorsement notice

[SIST EN IEC 61400-26-1:2019](https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019)

[https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-](https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019)

[d79befb6a34c/sist-en-iec-61400-26-1-2019](https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019)

The text of the International Standard IEC 61400-26-1:2019 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 61400-25-2:2006	NOTE	Harmonized as EN 61400-25-2:2007 (not modified)
IEC 61400-25-3:2006	NOTE	Harmonized as EN 61400-25-3:2007 (not modified)
IEC 61400-25-4:2008	NOTE	Harmonized as EN 61400-25-4:2008 (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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-415	-	International Electrotechnical Vocabulary - Part 415: Wind turbine generator systems	-	-
IEC 61400-1	-	Wind energy generation systems - Part 1: Design requirements	EN IEC 61400-1	-

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN IEC 61400-26-1:2019](https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019)

<https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN IEC 61400-26-1:2019

<https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019>



IEC 61400-26-1

Edition 1.0 2019-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Wind energy generation systems –
Part 26-1: Availability for wind energy generation systems

Systèmes de génération d'énergie éolienne –
Partie 26-1: Disponibilité des systèmes de génération d'énergie éolienne

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.180

ISBN 978-2-8322-6797-4

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope.....	12
2 Normative references	12
3 Terms, definitions and abbreviated terms	13
3.1 Terms and definitions.....	13
3.2 Abbreviated terms.....	15
4 Information model.....	18
4.1 Basic model	18
4.2 Information categories	18
4.3 Information category priority	19
4.4 Services.....	20
4.5 Service delivery layers	21
4.5.1 General	21
4.5.2 Time layer	21
4.5.3 Actual service delivery layer	21
4.5.4 Potential service delivery layer	21
4.5.5 Lost service	22
4.6 Modelling multiple services	22
4.7 Determination of information categories for the WPS	24
4.8 Application of the information model to components of the WEGS.....	25
5 Information categories	25
5.1 INFORMATION AVAILABLE.....	25
5.2 OPERATIVE	26
5.3 IN SERVICE	26
5.3.1 General	26
5.3.2 FULL PERFORMANCE	26
5.3.3 PARTIAL PERFORMANCE	27
5.3.4 READY STANDBY	27
5.4 OUT OF SERVICE	28
5.4.1 General	28
5.4.2 TECHNICAL STANDBY	28
5.4.3 OUT OF ENVIRONMENTAL SPECIFICATION	28
5.4.4 REQUESTED SHUTDOWN.....	29
5.4.5 OUT OF ELECTRICAL SPECIFICATION	29
5.5 NON-OPERATIVE.....	30
5.5.1 General	30
5.5.2 SCHEDULED MAINTENANCE	30
5.5.3 PLANNED CORRECTIVE ACTION	30
5.5.4 FORCED OUTAGE	31
5.5.5 SUSPENDED.....	31
5.6 FORCE MAJEURE.....	32
5.7 INFORMATION UNAVAILABLE.....	32
Annex A (informative) Entry and exit conditions overview for WEGS.....	33
Annex B (informative) Optional information categories for WEGS information model – illustrative explanation and examples.....	34

B.1	General.....	34
B.2	PARTIAL PERFORMANCE – optional categories	34
B.2.1	Introduction of optional categories	34
B.2.2	Derated	34
B.2.3	Degraded.....	35
B.3	OUT OF ENVIRONMENTAL SPECIFICATION – optional categories	36
B.3.1	Introduction of optional categories	36
B.3.2	Calm winds.....	36
B.3.3	Other environmental	36
B.4	PLANNED CORRECTIVE ACTION – optional categories	37
B.4.1	Introduction of optional categories	37
B.4.2	Retrofit	37
B.4.3	Upgrade	37
B.4.4	Other planned corrective action	37
B.5	FORCED OUTAGE – optional category.....	38
B.5.1	Introduction of optional categories	38
B.5.2	Response	38
B.5.3	Diagnostic	39
B.5.4	Logistic.....	39
B.5.5	Repair	39
B.6	SUSPENDED – optional categories	40
B.6.1	Introduction of optional categories.....	40
B.6.2	Suspended scheduled maintenance.....	40
B.6.3	Suspended planned corrective action	40
B.6.4	Suspended forced outage	40
B.7	Considerations of competing assignment of lost service.....	41
Annex C	(informative) Examples of availability indicators.....	42
C.1	General.....	42
C.1.1	Introduction to the scope of this annex	42
C.1.2	Time-based availability	42
C.1.3	Production-based availability	42
C.1.4	Mapping of availability and unavailability	43
C.2	Time-based availability	43
C.2.1	General	43
C.2.2	Time-based availability – "operational availability"	43
C.2.3	Time based availability – "technical availability"	45
C.3	Production-based availability	46
C.3.1	General	46
C.3.2	Production-based availability – "operational availability"	46
C.3.3	Production-based availability – "technical availability".....	47
C.4	Capacity factor and other performance indicators	48
C.4.1	General	48
C.4.2	Capacity factor	49
C.4.3	Production ratio	49
C.4.4	Mean-value based information	49
Annex D	(informative) Verification scenarios – examples	50
D.1	General.....	50
D.2	Time-based scenarios for a WTGS.....	50
D.2.1	Introduction to verification scenarios.....	50

D.2.2	Scenario 1 – communication aspects	51
D.2.3	Scenario 2 – partial operational aspects	52
D.2.4	Scenario 3 – maintenance aspects	53
D.2.5	Scenario 4 – operational aspects	54
D.2.6	Scenario 5 – grid/electrical network aspects	57
D.2.7	Scenario 6 – environmental aspects	58
D.3	Production-based scenarios for a WTGS	60
D.3.1	Introduction to verification scenarios	60
D.3.2	Scenarios under FULL PERFORMANCE	60
D.3.3	Scenarios under PARTIAL PERFORMANCE	62
D.3.4	Scenarios under READY STANDBY	64
D.3.5	Scenarios under TECHNICAL STANDBY	65
D.3.6	Scenarios under OUT OF ENVIRONMENTAL SPECIFICATION	66
D.3.7	Scenarios under REQUESTED SHUTDOWN	67
D.3.8	Scenarios under OUT OF ELECTRICAL SPECIFICATION	68
D.3.9	Scenarios under SCHEDULED MAINTENANCE	69
D.3.10	Scenarios under PLANNED CORRECTIVE ACTION	69
D.3.11	Scenarios under FORCED OUTAGE	70
D.3.12	Scenarios under SUSPENDED	71
D.3.13	Scenarios under FORCE MAJEURE	72
D.4	Production-based scenarios for a WTGS – calculation of lost production	72
D.4.1	Introduction to verification scenarios	72
D.4.2	Production-based availability algorithm based on mandatory information categories ("operational availability")	72
D.4.3	Production-based availability algorithm – including optional categories ("technical availability")	75
D.5	Production-based scenarios for a WPS	76
D.5.1	Introduction to verification scenarios	76
D.5.2	Example 1: Normal operation – all WPS	76
D.5.3	Example 2: Normal operation – part of WPS	77
D.5.4	Example 3: Contaminated WTGSs blades – all WPS	78
D.5.5	Example 4: Contaminated WTGSs blades – part of WPS	79
D.5.6	Example 5: BOP limitations – all WPS	80
D.5.7	Example 6: BOP limitations – part of WPS	81
D.5.8	Example 7: "Spinning reserve" – part of WPS	82
D.5.9	Example 8: "Spinning reserve" – all WPS	83
D.5.10	Example 9: Noise restrictions – warranty related	84
D.5.11	Example 10: Noise restrictions – environmentally related	86
D.5.12	Example 11: Ice storm on grid – all WPS	87
Annex E (informative)	Possible methods for determination of potential WEGS energy production	89
E.1	General	89
E.2	Specific power curve and velocities methods	89
E.2.1	General	89
E.2.2	Nacelle anemometer wind measurement with power curve	89
E.2.3	Upstream wind measurement with power curve	90
E.2.4	Met mast wind measurement with correction factors and power curve	90
E.3	Power-based methods	91
E.3.1	General	91

E.3.2	Average production of WPS	91
E.3.3	Average production of representative comparison WTGSs.....	92
E.3.4	Data acquisition with comparison chart/database.....	93
E.3.5	Average wind speed of WPS.....	93
E.4	Determination of potential production for a WPS – examples	94
E.4.1	Overview	94
E.4.2	Primary service.....	94
E.4.3	Secondary services	94
Annex F (informative)	Balance of plant integration	96
F.1	WPS functions and services.....	96
F.2	Externally required functions and services	96
F.3	Internally required functions and services	96
F.4	Expansion of the information model for BOP functions and services	97
Bibliography	98
Figure 1	– Data stakeholders for a wind energy generation system	10
Figure 2	– Information category overview.....	19
Figure 3	– Information category priority.....	20
Figure 4	– Three-layer information model.....	21
Figure 5	– Information categories, definitions for layer 2 and layer 3, mandatory categories.....	23
Figure 6	– Examples of an information model representing active energy, reactive energy, high and low frequency response services	24
Figure A.1	– Overview of the entry and exit conditions of all mandatory information categories described in this document.....	33
Figure B.1	– Information category overview – mandatory and optional	35
Figure B.2	– Workflow breakdown structure	38
Figure B.3	– Example of simultaneous degrading and derating	41
Figure E.1	– Step 1: Calculation of wind speed based on working WEGS 1 to n	93
Figure E.2	– Step 2: Estimation of lost production for WEGS not in FULL PERFORMANCE	94
Table C.1	– Example of mapping of available and unavailable information categories.....	43
Table D.1	– Verification scenarios – time allocation to information categories.....	50
Table D.2	– Verification scenarios – communication aspects	51
Table D.3	– Verification scenarios – partial operational aspects.....	52
Table D.4	– Verification scenarios – maintenance aspects.....	53
Table D.5	– Verification scenarios – operational aspects	54
Table D.6	– Verification scenarios – grid / electrical network aspects.....	57
Table D.7	– Verification scenarios – environmental aspects.....	58
Table D.8	– FULL PERFORMANCE: By definition, actual energy production is equal to the potential energy production.....	60
Table D.9	– FULL PERFORMANCE: Actual energy production is less than potential energy production but within agreed uncertainty	61
Table D.10	– FULL PERFORMANCE: Actual energy production greater than potential energy production	61
Table D.11	– PARTIAL PERFORMANCE – derated: Grid constraint.....	62

Table D.12 – PARTIAL PERFORMANCE – derated: Grid constraint, actual energy production less than requested	62
Table D.13 – Partial performance – derated: Output constraint due to excessive noise of the WTGS	63
Table D.14 – PARTIAL PERFORMANCE – derated: Dirt on blades constrained performance	63
Table D.15 – PARTIAL PERFORMANCE – derated: Ice accumulated on blades has been detected, WTGS is allowed to operate although the power performance is ‘derated’	64
Table D.16 – PARTIAL PERFORMANCE – degraded: WTGS deterioration known to the WTGS user	64
Table D.17 – READY STANDBY: Avian detection system	64
Table D.18 – READY STANDBY: Automatic generation control – Var support	65
Table D.19 – TECHNICAL STANDBY: WTGS is cable unwinding	65
Table D.20 – OUT OF ENVIRONMENTAL SPECIFICATION – calm winds	66
Table D.21 – OUT OF ENVIRONMENTAL SPECIFICATION – high winds	66
Table D.22 – OUT OF ENVIRONMENTAL SPECIFICATION – temperature too high	66
Table D.23 – REQUESTED SHUTDOWN: ice on blades is detected and WTGS user requests shutdown of the WTGS	67
Table D.24 – REQUESTED SHUTDOWN: Sector management	67
Table D.25 – REQUESTED SHUTDOWN: Noise nuisance – warranty claim	68
Table D.26 – OUT OF ELECTRICAL SPECIFICATION: Low voltage	68
Table D.27 – SCHEDULED MAINTENANCE: WTGS is under scheduled maintenance work by the WTGS manufacturer or maintenance provider within the time allowance agreed by the maintenance contract	69
Table D.28 – PLANNED CORRECTIVE ACTION: WTGS manufacturer or maintenance provider performs corrective action to the WTGS at his discretion outside the time allowance of scheduled maintenance	69
Table D.29 – FORCED OUTAGE: Short circuit	70
Table D.30 – FORCED OUTAGE: Corrosion	70
Table D.31 – FORCED OUTAGE: Overheating	71
Table D.32 – SUSPENDED: Suspended repair work due to storm with lightning	71
Table D.33 – FORCE MAJEURE: No access to the WTGS due to flooding impacting infrastructure	72
Table D.34 – Production-based availability algorithm based on mandatory information categories only , ‘operational availability’	73
Table D.35 – Production-based availability algorithm – including optional categories, ‘technical availability’	75
Table D.36 – Scenario, Example 1: Normal operation – all WPS	77
Table D.37 – Scenario, Example 2: Normal operation – part of WPS	78
Table D.38 – Scenario, Example 3: Contaminated WTGSs blades – all WPS	79
Table D.39 – Scenario, Example 4: Contaminated WTGSs blades – part of WPS	80
Table D.40 – Scenario, Example 5: BOP limitations – all WPS	81
Table D.41 – Scenario, Example 6: BOP limitations – part of WPS	82
Table D.42 – Scenario, Example 8: ‘Spinning reserve’ – part of WPS	83
Table D.43 – Scenario, Example 7: ‘Spinning reserve’ – all WPS	84
Table D.44 – Scenario, Example 9: Noise restrictions – all WPS	85

Table D.45 – Scenario, Example 10: Noise restrictions – all WPS.....	86
Table D.46 – Scenario, Example 11: Ice storm on grid – all WPS.....	87
Table E.1 – Examples on how to determine potential production.....	95

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN IEC 61400-26-1:2019](https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019)

<https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND ENERGY GENERATION SYSTEMS –

Part 26-1: Availability for wind energy generation systems

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61400-26-1 has been prepared by IEC technical committee 88: Wind energy generation systems.

This first edition cancels and replaces IEC TS 61400-26-1:2011, IEC TS 61400-26-2:2014 and IEC TS 61400-26-3:2016.

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

CDV	Report on voting
88/665/CDV	88/705/RVC

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

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.

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.

Mandatory information categories defined in this document are written in capital letters; optional information categories are written in bold letters.

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

(standards.iteh.ai)

[SIST EN IEC 61400-26-1:2019](https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019)

<https://standards.iteh.ai/catalog/standards/sist/cb2397c2-2941-4d0e-857d-d79befb6a34c/sist-en-iec-61400-26-1-2019>