SLOVENSKI STANDARD
SIST EN 61400-1:2006/A1:2011

01-januar-2011

Vetrne turbine - 1. del: Zahteve za načrtovanje - Dopolnilo A1 (IEC 61400-1:2005/A1:2010)

Wind turbines - Part 1: Design requirements (IEC 61400-1:2005/A1:2010)

Windenergieanlagen - Teil 1: Auslegungsanforderungen (IEC 61400-1:2005/A1:2010)

Eoliennes - Partie 1: Exigences de conception (CEI 61400-1:2005/A1:2010)

Ta slovenski standard je istoveten z: **EN 61400-1:2005/A1:2010**

ICS:

27.180	Sistemi turbin na veter in drugi alternativni viri energije	Wind turbine systems and other alternative sources of energy

SIST EN 61400-1:2006/A1:2011 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61400-1/A1

November 2010

ICS 27.180

English version

Wind turbines - Part 1: Design requirements

(IEC 61400-1:2005/A1:2010)

Eoliennes - Partie 1: Exigences de conception (CEI 61400-1:2005/A1:2010)

Windenergieanlagen - Teil 1: Auslegungsanforderungen (IEC 61400-1:2005/A1:2010)

This amendment A1 modifies the European Standard EN 61400-1:2005; it was approved by CENELEC on 2010-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 Central Secretariat or to any CENELEC member.

This amendment 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 Central Secretariat 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 61400-1:2005/A1:2010 E

Foreword

The text of document 88/374/FDIS, future amendment 1 to IEC 61400-1:2005, prepared by IEC TC 88, Wind turbines, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61400-1:2005 on 2010-11-01.

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

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2011-08-01
– latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow)	2013-11-01

Endorsement notice

The text of amendment 1:2010 to the International Standard IEC 61400-1:2005 was approved by CENELEC as an amendment to the European Standard without any modification.

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

IEC 60034 series	NOTE	Harmonized in EN 60034 series (partially modified).
IEC 60146 series	NOTE	Harmonized in EN 60146 series (not modified).
IEC 60269 series	NOTE	Harmonized in EN 60269 series (partially modified).
IEC 60439 series	NOTE	Harmonized in EN 60439 series (partially modified).
IEC 60446:2007	NOTE	Harmonized as EN 60446:2007 (not modified).
IEC 60529:1989	NOTE	Harmonized as EN 60529:1991 (not modified).
IEC 60617	NOTE	Harmonized in EN 60617 series (not modified).
IEC 60898	NOTE	Harmonized as EN 60898.
IEC 61310-1:2007	NOTE	Harmonized as EN 61310-1:2008 (not modified).
IEC 61310-2:2008	NOTE	Harmonized as EN 61310-2:2008 (not modified).
ISO 9001	NOTE	Harmonized as EN ISO 9001.

Replace Annex ZA of EN 61400-1:2005 with the following:

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60204-1	-	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	-
IEC 60204-11	-	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	-
IEC 60364	Series	Low-voltage electrical installations	EN 60364	Series
IEC 60364-5-54	-	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors	HD 60364-5-54[1)]	-
IEC 60721-2-1	-	Classification of environmental conditions - Part 2-1: Environmental conditions appearing in nature - Temperature and humidity	HD 478.2.1 S1[2)]	-
IEC 61000-6-1	-	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments	EN 61000-6-1	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2	-
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments	EN 61000-6-4	-
IEC 61400-2	-	Wind turbine - Part 2: Design requirements for small wind turbines	EN 61400-2	-
IEC 61400-21	-	Wind turbines - Part 21: Measurement and assessment of power quality characteristics of grid connected wind turbines	EN 61400-21	-

[1)] At draft stage

[2)] HD 478.2.1 S1 includes A1 to IEC 60721-2-1.

Publication	Year	Title	EN/HD	Year
IEC 61400-24	-	Wind turbines - Part 24: Lightning protection	EN 61400-24	-
IEC 62305-3	-	Protection against lightning - Part 3: Physical damages to structures and life hazard	EN 62305-3[3)]	-
IEC 62305-4	-	Protection against lightning - Part 4: Electrical and electronic systems within structures	EN 62305-4[4)]	-
ISO 76	2006	Rolling bearings - Static load ratings	-	-
ISO 281	-	Rolling bearings - Dynamic load ratings and rating life	-	-
ISO 2394	1998	General principles on reliability for structures	-	-
ISO 2533	1975	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 81400-4	-	Wind turbines - Part 4: Design and specification of gearboxes	-	-

[3)] At draft stage.

[4)] At draft stage.

IEC 61400-1

Edition 3.0 2010-10

INTERNATIONAL STANDARD

AMENDMENT 1

Wind turbines – Part 1: Design requirements

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE U

ICS 27.180

ISBN 978-2-88912-201-1

FOREWORD

This amendment has been prepared by IEC technical committee 88: Wind turbines.

The text of this amendment is based on the following documents:

FDIS	Report on voting
88/374/FDIS	88/378/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC web site 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.

A bilingual version may be issued at a later date.

2 Normative references

Replace the existing list of normative references by the following new list:

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

IEC 60204-11, *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*

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

IEC 60364-5-54, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors*

IEC 60721-2-1, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Temperature and humidity*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61400-2, *Wind turbines – Part 2: Design requirements for small wind turbines*

IEC 61400-21, *Wind turbines – Part 21: Measurement and assessment of power quality characteristics of grid connected wind turbines*

IEC 61400-24, *Wind turbines – Part 24: Lightning protection*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

IEC 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures*

ISO 76:2006, *Rolling bearings – Static load ratings*

ISO 281, *Rolling bearings – Dynamic load ratings and rating life*

ISO 2394:1998, *General principles on reliability for structures*

ISO 2533:1975, *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 81400-4, *Wind turbines – Part 4: Design and specification of gearboxes*

3 Terms and definitions

3.26 – limit state

Replace ISO 2394 *by* 2.2.9 of ISO 2394.

3.55 – ultimate limit state

Replace ISO 2394 *by* 2.2.10 of ISO 2394.

4 Symbols and abbreviated terms

4.1 Symbols and units

Switch the definitions of σ_2 and σ_3. The vertical wind velocity standard deviation should be σ_3, not σ_2.

6 External conditions

6.3.1.3 Normal turbulence model (NTM)

Replace the existing Figures 1a and 1b by the following new figures:

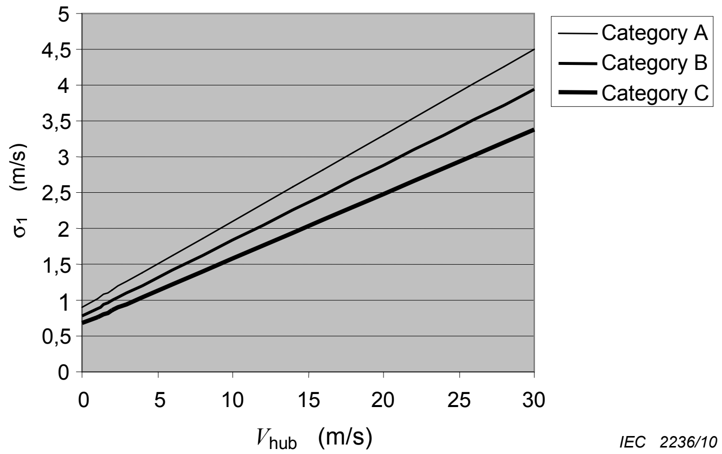

Figure 1a –Turbulence standard deviation for the normal turbulence model (NTM)

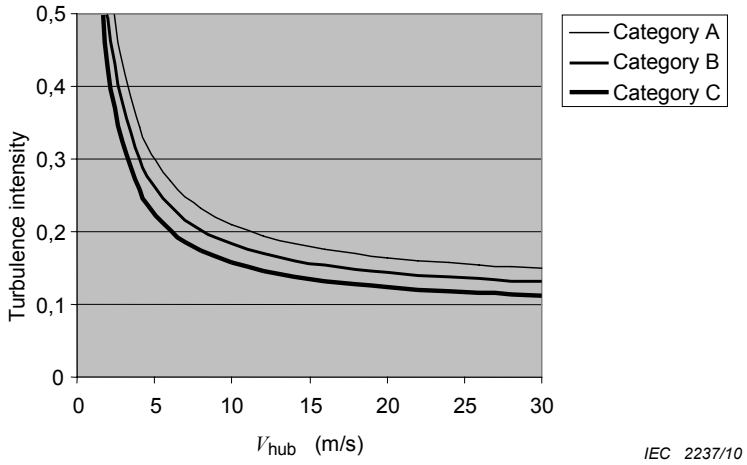

Figure 1b – Turbulence intensity for the normal turbulence model (NTM)

6.3.2.6 Extreme wind shear (EWS)

Replace the number 2,5 in equations (26) and (27) to 2,5 [m/s]. (The number 2,5 in equations (26) and (27) is not dimensionless.)

7 Structural design

7.4.2 Power production plus occurrence of fault or loss of electrical network connection (DLC 2.1 – 2.4)

Add, as 2nd paragraph, the following new text:

As an alternative to the specification of DLC 2.3 above and in Table 2, DLC 2.3 may instead be considered as a normal event (i.e. a partial safety factor for load of 1,35) to be analyzed using stochastic wind simulations (NTM - $V_{in}<V_{hub}<V_{out}$) combined with an internal or external electrical system fault (including loss of electrical network connection). In this case, 12 response simulations shall be carried out for each considered mean wind speed. For each response simulation, the extreme response after the electrical fault has occurred is sampled. The fault must be introduced after the effect of initial conditions has become negligible. For each mean wind speed, a nominal extreme response is evaluated as the mean of the 12 sampled extreme responses plus three times the standard deviation of the 12 samples. The characteristic response value for DLC 2.3 is determined as the extreme value among the nominal extreme responses.

7.5 Load calculations

Add, after second paragraph, the following new text:

When turbulent winds are used for dynamic simulations, attention should be given to the grid resolution regarding the spatial[1] and time resolution.

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1 Concerning the spatial resolution, the maximum distance between adjacent points should be smaller than 25 % of $\Lambda 1$ (Equation (5)) and no larger than 15 % of the rotor diameter. This distance is meant to be the diagonal distance between points in each grid cell defined by four points. In the case of a non-uniform grid, an average value over the rotor surface of the distance between grid points can be considered as the representative spatial resolution, but this distance should always decrease towards the blade tip.

Replace the last paragraph by the following new text:

Ultimate load components may also be combined in a conservative manner assuming the extreme component values occur simultaneously. In case this option is pursued, both minimum and maximum extreme component values shall be applied in all possible combinations to avoid introducing non-conservatism.

Guidance for the derivation of extreme design loads from contemporaneous loads taken from a number of stochastic realisations is given in Annex H.

7.6.1.2 Partial safety factor for consequence of failure and component classes

Add, after the bullets defining the component classes, the following new text:

The consequences of failure factor shall be included in the test load when performing tests as for example full scale blade testing.

7.6.2 Ultimate strength analysis

Replace equation (31) by the following new equation:

$$\gamma_f F_k \leq \frac{1}{\gamma_n} \cdot \frac{1}{\gamma_m} f_k \qquad (31)$$

Add the following new paragraph after equation (31):

Note that γ_n is a consequence of failure factor and shall not be treated as a safety factor on materials.

Delete the last sentence in 5th paragraph ("For guidance see Annex F") and insert, after the 5th paragraph, the following two paragraphs:

Data used in extrapolation methods shall be extracted from time series of turbine simulations of at least 10 min in length over the operating range of the turbine for DLC 1.1. A minimum of 15 simulations is required for each wind speed from (V_{rated} – 2 m/s) to cut-out and six simulations are required for each wind speed below (V_{rated} – 2 m/s). When extracting data, the designer must consider the effect of independence between peaks on the extrapolation and minimize dependence when possible. The designer shall aggregate data and probability distributions to form a consistent long-term distribution. To ensure stable estimation of long-term loads, a convergence criterion shall be applied to a probability fractile less than the mode of the data for either the short-term or long-term exceedance distributions. For guidance, see Annex F.

The characteristic value for blade root in-plane and out-of-plane moments and tip deflection may be determined by a simplified procedure[2]. The characteristic value may then be determined by calculating the mean of the extremes for each 10-min bin and using the largest value, multiplied by an extrapolation factor of 1,5, while maintaining the partial load factor for statistical load extrapolation, see Table 3.

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2 This approach is considered conservative for 3-bladed upwind wind turbines. Caution should be exercised for other wind turbine concepts.