SVENSK STANDARD SS-EN 61400-12-1

Fastställd	Utgåva	Sida	Ansvarig kommitté
2017-10-18	2	1 (1+263)	SEK TK 88

Vindkraftverk –
Del 12-1: Bestämning av prestanda för anläggningar för elproduktion

Wind energy generation systems –
Part 12-1: Power performance measurements of electricity producing wind turbines

Som svensk standard gäller europastandarden EN 61400-12-1:2017. Den svenska standarden innehåller den officiella engelska språkversionen av EN 61400-12-1:2017.

Nationellt förord

Europastandarden EN 61400-12-1:2017

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 61400-12-1, Second edition, 2017 - Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 61400-12-1, utgåva 1, 2006, gäller ej fr o m 2020-04-07.

ICS 27.180.00

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Standarder underlättar utvecklingen och höjer elsäkerheten

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.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61400-12-1

June 2017

ICS 27.180

Supersedes EN 61400-12-1:2006

English Version

Wind power generation systems - Part 12-1: Power performance measurement of electricity producing wind turbines (IEC 61400-12-1:2017)

Systèmes de génération d'énergie éolienne - Partie 12-1: Mesures de performance de puissance des éoliennes de production d'électricité (IEC 61400-12-1:2017)

Windenergieanlagen - Teil 12-1: Messung des Leistungsverhaltens einer Windenergieanlage (IEC 61400-12-1:2017)

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 61400-12-1:2017 E

SEK Svensk Elstandard

European foreword

The text of document 88/610/FDIS, future edition 2 of IEC 61400-12-1, prepared by IEC TC 88 "Wind turbines" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61400-12-1:2017.

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)	2018-01-07
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-04-07

This document supersedes EN 61400-12-1:2006.

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 61400-12-1:2017 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 61400-1:2005	NOTE	Harmonized as EN 61400-1:2005.
IEC 61400-1:2005/AMD1:2010	NOTE	Harmonized as EN 61400-1:2005/A1:2010.
IEC 61400-2:2013	NOTE	Harmonized as EN 61400-2:2013.
IEC 61400-12-2	NOTE	Harmonized as EN 61400-12-2.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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 60688	2012	Electrical measuring transducers for converting A.C. and D.C. electrical quantities to analogue or digital signals	EN 60688	2013
IEC 61400-12-2	2013	Wind turbines -- Part 12-2: Power performance of electricity producing wind turbines based on nacelle anemometry	EN 61400-12-2	2013
IEC 61869-1 (mod)	2007	Instrument transformers -- Part 1: General requirements	EN 61869-1	2009
IEC 61869-2	2012	Instrument transformers -- Part 2: Additional requirements for current transformers	EN 61869-2	2012
IEC 61869-3	2011	Instrument transformers -- Part 3: Additional requirements for inductive voltage transformers	EN 61869-3	2011
ISO 2533	1975	Standard Atmosphere	-	-
ISO 3966	2008	Measurement of fluid flow in closed conduits_- Velocity area method using Pitot static tubes	-	-
ISO/IEC 17025	2005	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	2005
ISO/IEC 17043	2010	Conformity assessment - General requirements for proficiency testing	EN ISO/IEC 17043	2010
ISO/IEC Guide 98-3	2008	Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WIND ENERGY GENERATION SYSTEMS –

Part 12-1: Power performance measurements of electricity producing 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 61400-12-1 has been prepared by IEC technical committee 88: Wind energy generation systems.

This second edition cancels and replaces the first edition published in 2005. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

a) new definition of wind speed,
b) inclusion of wind shear and wind veer,
c) revision of air density correction,
d) revision of site calibration,
e) revision to definition of power curve,
f) interpolation to bin centre method,
g) revision of obstacle model,

h) clarification of topography requirements,
i) new annex on mast induced flow distortion,
j) revision to anemometer classifications,
k) inclusion of ultrasonic anemometers,
l) cold climate annex added,
m) database A changed to special database,
n) revision of uncertainty annex,
o) inclusion of remote sensing.

IEC 61400-12-2 is an addition to IEC 61400-12-1.

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

FDIS	Report on voting
88/610/FDIS	88/617/RVD

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

A list of all parts in the IEC 61400, 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.

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

The committee recognizes that this revision represents a significant increase in complexity and perhaps greater difficulty to implement. However, it represents the committee's best attempt to address issues introduced by larger wind turbines operating in significant wind shear and complex terrain. The committee recommends that the new techniques introduced be validated immediately by test laboratories through inter-lab proficiency testing. The committee recommends a Review Report be written within three years of the release of this document which includes recommendations, clarifications and simplifications that will improve the practical implementation of this standard. If necessary a revision should be proposed at the same time to incorporate these recommendations, clarifications and simplifications.

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.

INTRODUCTION

The purpose of this part of IEC 61400 is to provide a uniform methodology that will ensure consistency, accuracy and reproducibility in the measurement and analysis of power performance by wind turbines. The standard has been prepared with the anticipation that it would be applied by:

a) a wind turbine manufacturer striving to meet well-defined power performance requirements and/or a possible declaration system;

b) a wind turbine purchaser in specifying such performance requirements;

c) a wind turbine operator who may be required to verify that stated, or required, power performance specifications are met for new or refurbished units;

d) a wind turbine planner or regulator who shall be able to accurately and fairly define power performance characteristics of wind turbines in response to regulations or permit requirements for new or modified installations.

This document provides guidance in the measurement, analysis, and reporting of power performance testing for wind turbines. The document will benefit those parties involved in the manufacture, installation planning and permitting, operation, utilization, and regulation of wind turbines. The technically accurate measurement and analysis techniques recommended in this standard should be applied by all parties to ensure that continuing development and operation of wind turbines is carried out in an atmosphere of consistent and accurate communication relative to wind turbine performance. This document presents measurement and reporting procedures expected to provide accurate results that can be replicated by others. Meanwhile, a user of the standard should be aware of differences that arise from large variations in wind shear and turbulence. Therefore, a user should consider the influence of these differences and the data selection criteria in relation to the purpose of the test before contracting the power performance measurements.

A key element of power performance testing is the measurement of wind speed. This document prescribes the use of cup or sonic anemometers or remote sensing devices (RSD) in conjunction with anemometers to measure wind. Even though suitable procedures for calibration/validation and classification are adhered to, the nature of the measurement principle of these devices may potentially cause them to perform differently. These instruments are robust and have been regarded as suitable for this kind of test with the limitation of some of them to certain classes of terrain.

Recognising that, as wind turbines become ever larger, a wind speed measured at a single height is increasingly unlikely to accurately represent the wind speed through the entire turbine rotor, this standard introduces an additional definition of wind speed. Whereas previously wind speed was defined as that measured at hub height only, this may now be supplemented with a so called Rotor Equivalent Wind Speed (REWS) defined by an arithmetic combination of simultaneous measurements of wind speed at a number of heights spanning the complete rotor diameter between lower tip and upper tip. The power curves defined by hub height wind speed and REWS are not the same and so the hub height wind speed power curve is always presented for comparison whenever a REWS power curve is measured. As a consequence of this difference in wind speed definition, the annual energy production (AEP) derived from the combination of a measured power curve with a wind speed distribution uses an identical definition of wind speed in both the power curve and the wind speed distribution.

Procedures to classify cup anemometers and ultrasonic anemometers are given in Annexes I and J. Procedures to classify remote sensing devices are given in Annex L. Special care should be taken in the selection of the instruments chosen to measure the wind speed because it can influence the result of the test.

WIND ENERGY GENERATION SYSTEMS –

Part 12-1: Power performance measurements of electricity producing wind turbines

1 Scope

This part of IEC 61400 specifies a procedure for measuring the power performance characteristics of a single wind turbine and applies to the testing of wind turbines of all types and sizes connected to the electrical power network. In addition, this standard describes a procedure to be used to determine the power performance characteristics of small wind turbines (as defined in IEC 61400-2) when connected to either the electric power network or a battery bank. The procedure can be used for performance evaluation of specific wind turbines at specific locations, but equally the methodology can be used to make generic comparisons between different wind turbine models or different wind turbine settings when site-specific conditions and data filtering influences are taken into account.

The wind turbine power performance characteristics are determined by the measured power curve and the estimated annual energy production (AEP). The measured power curve, defined as the relationship between the wind speed and the wind turbine power output, is determined by collecting simultaneous measurements of meteorological variables (including wind speed), as well as wind turbine signals (including power output) at the test site for a period that is long enough to establish a statistically significant database over a range of wind speeds and under varying wind and atmospheric conditions. The AEP is calculated by applying the measured power curve to reference wind speed frequency distributions, assuming 100 % availability.

This document describes a measurement methodology that requires the measured power curve and derived energy production figures to be supplemented by an assessment of uncertainty sources and their combined effects.

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 60688:2012, *Electrical measuring transducers for converting A.C. and D.C. electrical quantities to analogue or digital signals*

IEC 61400-12-2:2013, *Wind turbines – Part 12-2: Power performance of electricity-producing wind turbines based on nacelle anemometry*

IEC 61869-1:2007, *Instrument transformers – Part 1: General requirements*

IEC 61869-2:2012*, Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 61869-3:2011*, Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

ISO/IEC GUIDE 98-3:2008*, Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC 17043:2010, *Conformity assessment – General requirements for proficiency testing*

ISO 2533:1975, *Standard atmosphere*

ISO 3966:2008, *Measurement of fluid flow in closed conduits – Velocity area method using Pitot static tubes*