

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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**Wind energy generation systems –  
Part 12-5: Power performance – Assessment of obstacles and terrain**

**Systèmes de génération d'énergie éolienne –  
Partie 12-5: Performance de puissance – Évaluation des obstacles et du terrain**



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IEC 61400-12-5

Edition 1.0 2022-08

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ICS 27.180

ISBN 978-2-8322-5603-9

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## WIND ENERGY GENERATION SYSTEMS –

### Part 12-5: Power performance – Assessment of obstacles and terrain

#### FOREWORD

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IEC 61400-12-5 has been prepared by IEC technical committee 88: Wind energy generation systems. It is an International Standard.

This first edition of IEC 61400-12-5 is part of a structural revision that cancels and replaces the performance standards IEC 61400-12-1:2017 and IEC 61400-12-2:2013. The structural revision contains no technical changes with respect to IEC 61400-12-1:2017 and IEC 61400-12-2:2013, but the parts that relate to wind measurements, measurement of site calibration and assessment of obstacle and terrain have been extracted into separate standards.

The purpose of the re-structure was to allow the future management and revision of the power performance standards to be carried out more efficiently in terms of time and cost and to provide a more logical division of the wind measurement requirements into a series of separate standards which could be referred to by other use case standards in the IEC 61400 series and subsequently maintained and developed by appropriate experts.

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

Draft	Report on voting
88/825/CDV	88/870/RVC

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/standardsdev/publications](http://www.iec.ch/standardsdev/publications).

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 [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

The purpose of this part of IEC 61400 is to describe procedures to determine a measurement sector that is not influenced by turbines or other obstacles for a specific wind turbine. The measurement sector is used to assess the terrain and determine if a site calibration is required. This measurement sector can be used to evaluate wind turbine power performance.

Clause 6 describes a procedure to determine one or more sectors which are not usable for a power performance measurement because the flow at the wind turbine under test and/or the flow at the position of the wind measurement equipment (WME: a meteorological mast or a remote sensing device) might be affected by an operating wind turbine and/or by an obstacle.

Clause 7 describes a procedure for establishing the measurement sector during the determination of the nacelle transfer function.

Clause 8 describes a procedure for establishing the measurement sector during the determination of the nacelle power curve.

Clause 9 describes a procedure to assess the terrain surrounding the site and to determine if it is sufficiently complex to require site calibration. The purpose of site calibration is generally to measure the change in the boundary layer as it follows the orography, which is generally attached flow, whereas obstacles often generate more turbulent wakes associated with them, which are affected by sharp edges and vertical surfaces that can trigger flow separation.

Clause 10 describes a procedure to classify the terrain in order to apply the nacelle transfer function for a nacelle power curve measurement. The classification is used to estimate the uncertainty of the nacelle transfer function (NTF) and nacelle power curve (NPC) and also to determine under what terrain condition the NTF can be used for the NPC.

The creation of this new standard was mandated with the restriction that no technical changes to the content copied from the source documents (IEC 61400-12-1 and IEC 61400-12-2) would be allowed. Therefore, in this first edition of the new standard IEC 61400-12-5, there are some obvious areas of technical disagreement (e.g. assessment of terrain in Clauses 9 and 10) where a choice needs to be made depending on whether the intended use case is as an input to a IEC 61400-12-1 or to a IEC 61400-12-2 power curve evaluation. It is recommended that future revisions of this document aim to harmonise the technical content.

## WIND ENERGY GENERATION SYSTEMS –

### Part 12-5: Power performance – Assessment of obstacles and terrain

#### 1 Scope

This part of IEC 61400 specifies the procedures for assessing the significance of obstacles and terrain variations on a proposed power performance measurement site and applies to the performance testing of wind turbines of all types and sizes connected to the electrical power network as described in other parts of the IEC 61400 series. The procedure applies to the performance evaluation of specific wind turbines at specific locations.

#### 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 61400-12-1, *Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines*

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

IEC 61400-12-3, *Wind energy generation systems – Part 12-3: Power performance – Measurement based site calibration*

IEC 61400-12-6, *Wind energy generation systems – Part 12-6: Measurement based nacelle transfer function of electricity producing wind turbines*

#### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

##### 3.1

##### **complex terrain**

terrain surrounding the test site that features significant variations in topography and terrain obstacles (refer to 3.10) that may cause flow distortion

##### 3.2

##### **cut-in wind speed**

lowest wind speed at which a wind turbine will begin to produce power