



Edition 1.0 2011-11

TECHNICAL SPECIFICATION





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IFC Central Office 3, rue de Varembé CH-1211 Geneva 20 Switzerland

Email: inmail@iec.ch Web: www.iec.ch

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

■ Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

■ IEC Just Published: www.iec.ch/online_news/justpub
Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

Customer Service Centre: https://www.ieo.ch/webstore/custserv
If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact os:

Email: csc@iec.ch Tel.: +41 22 919 02 11 Fax: +41 22 919 03 00

IEC/TS 61400-26-1

Edition 1.0 2011-11

TECHNICAL SPECIFICATION



INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE

ICS 27.180 ISBN 978-2-88912-780-1

CONTENTS

FOF	REWC	DRD	4
1	Scop	Scope7	
2	Norm	ative references	7
3	Terms, definitions and abbreviations		
	3.1	Terms and definitions	7
	3.2	Abbreviations	8
4	Inforr	nation model	9
	4.1	General	9
	4.2	Information categories	9
	4.3	Limitations	
	4.4	Information category priority	
5		RMATION AVAILABLE	
	5.1	OPERATIVE	_
		5.1.1 GENERATING	.13
	5.2	5.1.2 NON-GENERATING	.15 .20
	5.2	5 2 1 SCHEDULED MAINTENANCE	20
		5.2.1 SCHEDULED MAINTENANCE	22
		5.2.3 FORCED OUTAGE	23
		5.2.4 SUSPENDED	.24
	5.3	FORCE MAJEURE	24
6	INFO	RMATION UNAVAILABLE	25
Ann	ex A	(informative) Optional information categories – examples	27
		(informative) Time based availability indicators – examples	
		(informative) Verification scenarios – examples	
		phy	
	0 1		
Figi	ure 1 -	- Information category overview	. 10
		- Information category priority	
		- INFORMATION AVAILABLE category	
		- OPERATIVE category	
•		- GENERATING category	
_		- FULL PERFORMANCE category	
_		- PARTIAL PERFORMANCE category	
-		NON GENERATING category	
		- TECHNICAL STANDBY category	
Figu	ure 10	- OUT OF ENVIRONMENTAL SPECIFICATION category	.18
Figu	ure 11	- REQUESTED SHUTDOWN category	. 19
Figi	ure 12	- OUT OF ELECTRICAL SPECIFICATION category	20
_		– NON-OPERATIVE category	
_		- SCHEDULED MAINTENANCE category	
_		- PLANNED CORRECTIVE ACTION category	
_		- FORCED OUTAGE category	
٠. ح			

Figure 17 – SUSPENDED category	24
Figure 18 – FORCE MAJEURE category	25
Figure 19 – INFORMATION UNAVAILABLE category	26
Figure A.1 – Information category overview – mandatory and optional	28
Figure A.2 – Optional categories for PARTIAL PERFORMANCE	29
Figure A.3 – Derated category	30
Figure A.4 – Degraded category	30
Figure A.5 – Optional categories for OUT OF ENVIRONMENTAL SPECIFICATION	31
Figure A.6 – Calm winds category	32
Figure A.7 – Other environmental category	33
Figure A.8 – Optional categories for NON-OPERATIVE	34
Figure A.9 – Optional categories for forced outage	35
Figure A.10 – Workflow breakdown structure	36
Figure A.11 – Optional categories for SUSPENDED	38
Figure C.1 – Verification scenarios – time allocation to information categories	44
Figure C.2 – Verification scenarios – communication aspects	45
Figure C.3 – Verification scenarios – partial operational aspects	46
Figure C.4 – Verification scenarios – maintenance aspects	47
Figure C.5 – Verification scenarios – operational aspects	49
Figure C.6 – Verification scenarios – grid / electrical network aspects	50
Figure C.7 – Verification scenarios – environmental aspects	52
IEC \$1400-2\(\)12011	
https://standards.iteh.a/cx/a/b/stan/a/ts/six/756-be5-1c58-43c2-86f1-0329bc01c0f6/i	
61400 6-1-2011	

INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND TURBINES -

Part 26-1: Time-based availability for wind turbine generating 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 veterred 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.

The main task of JEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- The subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61400-26-1, which is a technical specification, has been prepared by IEC technical committee 88: Wind turbines.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
88/387/DTS	88/415/RVC

Full information on the voting for the approval of this technical specification 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 turbines*, can be found on the IEC website.

The committee has decided that the contents of this 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

- · transformed into an International standard,
- · reconfirmed,
- · withdrawn,
- · replaced by a revised edition, or
- amended.

A bilingual edition of this document may be issued at a later date.

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.

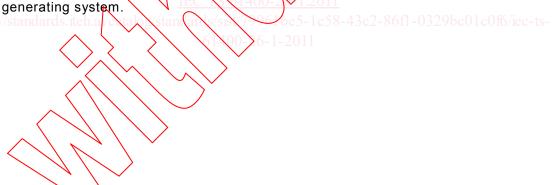
INTRODUCTION

The intention of this technical specification is to define a common basis for exchange of information on performance indicators between owners, utilities, lenders, operators, manufacturers, consultants, regulatory bodies, certification bodies, insurance companies and other stakeholders in the wind power generation business. This is achieved by providing an information model specifying how time designations shall be split into information categories. The information model forms the basis for allocation of time for reporting availability and reliability indicators.

The technical specification defines generic terms of wind turbine systems and environmental constraints in describing system and component availability, lifetime expectancy, repairs and criteria for determining overhaul intervals. The specification defines terminology and generic terms for reporting wind power based generating unit availability measurement. A generating unit includes all equipment up to the termination point defined in the distribution code (grid code) agreed between the generation party and the distribution variansmission party. Availability measurements are concerned with fractions of time a unit is capable of providing service, taking environmental aspects into account. Environmental aspects will be wind and other weather conditions, as well as grid and substation conditions. The specification furthermore defines terminology and terms for reporting performance indicators based on power production or capacity. Mandatory information categories defined in the technical specification are written in capital letters; optional information categories defined in the technical specification are written in bold letters.

The project scope is accomplished by separating the technical specification into two parts:

- IEC/TS 61400-26-1 specifies terms for time based availability of a wind turbine generating system;
- IEC/TS 61400-26-2 specifies terms for production based availability of a wind turbine generating system.



WIND TURBINES -

Part 26-1: Time-based availability for wind turbine generating systems

1 Scope

This part of IEC 61400 defines generic information categories to which fractions of time can be assigned for a wind turbine generating system (WTGS) considering internal and external conditions based on fraction of time and specifying the following:

- generic information categories of a WTGS considering availability and other performance indicators;
- information category priority in order to discriminate between concurrent categories;
- entry and exit point for each information category in order to allocate designation of time
- informative annexes including:
 - examples of optional information categories,
 - examples of algorithms for reporting availability and performance indicators,
 - examples of application scenarios.

2 Normative references

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.

IEC 60050-415:1999, International Electrotechnical Vocabulary – Part 415: Wind turbine generator systems. Available from: http://www.electropedia.org/

IEC 61400-1, Wind turbines - Design requirements

3 Terms, definitions and abbreviations

For the purposes of the present document, the following terms, definitions and abbreviations apply, as well as the relevant terms and definitions contained in IEC 60050-415.

3.1 Terms and definitions

3.1.1

availability

fraction of a given operating period in which a WTGS is performing its intended services within the design specification

3.1.2

design specifications

collection of precise and explicit information about requirements for a product design

It provides in-depth details about the functional and non-functional design requirements including assumptions, constraints, performance, dimensions, weights, reliability and standards. For example, specifications and design considerations given in IEC 61400-1 define the process for producing design specifications for WTGS.

3.1.3

external conditions

conditions outside of the WTGS that affect the operation of the WTGS, for example (i) out of environmental specification and (ii) out of electrical specification

3.1.4

permanent storage

type of computer storage that keeps the data or its contents regardless of whether the power is turned off or if the storage device is moved to another computer

The most commonly used permanent storage is the computer hard disk drive.

3.1.5

reliability

probability that a component part, equipment, or system will satisfactorily perform its intended function under given circumstances for a specified period of time

3.1.6

repair

activity whereby components of a system are restored to a safe operating condition following an unpredicted or unforeseen failure

3.1.7 retrofit

incorporation of new technology or new design parts resulting from an approved engineering change to an already supplied item

3.1.8 total time

the total calendar time of the period selected

3.2 Abbreviations

IA Information available category

IAO Information available operative category

IAOG Information available operative generating category

IAOGFP Information available operative generating with full performance category

IAOGPP Information available operative generating with partial performance category

IAONG Information available operative non generating category

IAONGTS Information available operative non generating technical standby category

IAONGEN Information available operative non generating out of environmental

specification category

IAONGENC Information available operative non generating out of environmental

specification optional category calm winds

IAONGENO Information available operative non generating out of environmental

specification optional category other environmental

IAONGEL Information available operative non generating out of electrical specification

category

IAONGRS Information available operative non generating requested shutdown category

IAN Information available non operative category

IANSM Information available non operative scheduled maintenance category
IANPCA Information available non operative planned corrective action category

IANFO Information available non operative forced outage category
IANS Information available non operative suspended category

IAFM Information available force majeure category

IU Information unavailable category

SCADA Supervisory control and data acquisition

WTGS Wind turbine generating system

TT Total time

4 Information model

4.1 General

The information model is comprised of different information categories. All calendar time shall be distributed into these information categories.

Each information category has an associated entry point and exit point. The entry point describes the criteria that have to be fulfilled to allocate time into a specific information category. The exit point describes the criteria to be fulfilled to end time allocation to a specific information category.

The information model is split into five levels and the hierarchy shall be understood from level one to level five i.e. all attributes of overlaying information categories are inherited by underlying information categories. The time designations are allocated at the lowest mandatory level. Overlaying information categories shall contain the sum of the related information categories on the underlying level. The information categories are introduced in 4.2.

In case entry conditions are fulfilled concurrently for two or more information categories, time shall be assigned into the information category with the highest priority only. Information category priorities are described in more details in 4.4.

4.2 Information categories

Information categories are counters for accumulation of time periods with specified attributes defined for a WTGS for the purpose of exchange of information on availability.

Figure 1 is an overview of the information categories defined in this technical specification. The information model includes four mandatory categories. The model also allows for additional optional levels of information categories to provide the user with more detailed data.

Compliance with this technical specification requires designation of time periods into the mandatory information categories defined in level 1 to level 4, as shown in Figure 1.

The optional information categories defined in level 5 are not required to be compliant with this specification; they are included to allow users to customize reporting details to meet their specific requirements. This specification imposes no limits on the number of optional information categories or levels added by the individual users. The optional information categories shown in Figure 1 are for illustrative purposes only and are described in Annex A. All optional information categories shall be located on level 5 or higher in order to be compliant with this technical specification.

Abbreviations for the various information categories are indicated in brackets with bold letters. The abbreviations are defined in Clause 3.

4.3 Limitations

It is not in the scope of this technical specification to determine the method of information acquisition.

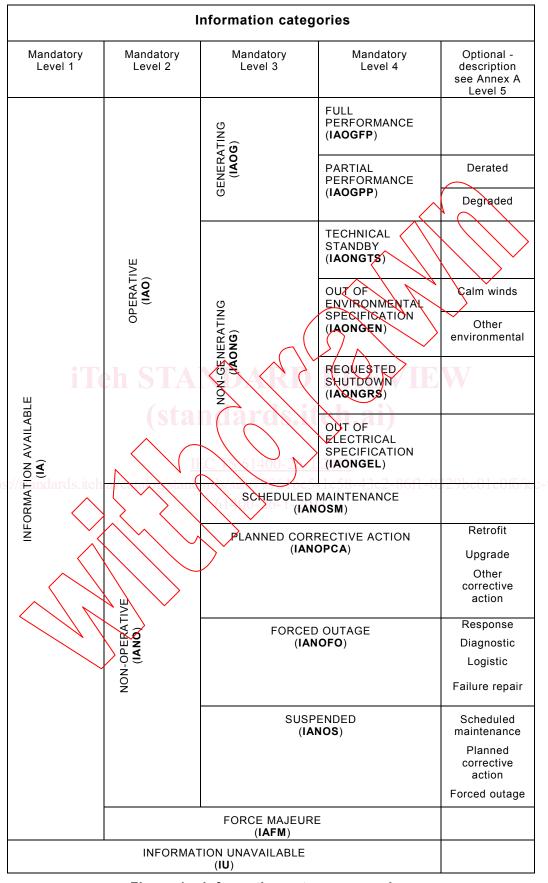


Figure 1 – Information category overview

The information categories are described in further details in Clause 5, Clause 6 and Annex A.

4.4 Information category priority

Time present in the information categories shall be exclusive and continuous. In case the conditions for allocating a time period to more than one information category are fulfilled at the same time, the information category priorities determine which category takes precedence for the allocation of the time period being considered. Assignment of priorities to the information categories provides a uniform and transparent method for designation of time.

The order of priorities as specified in Figure 2 is mandatory for compliance with this model. The priorities are ranked from one to twelve with one as the lowest and twelve as the highest priority. Priorities for optional information categories can be introduced for specific purposes. In such cases, the mandatory priorities can be extended with a priority for the optional information category.

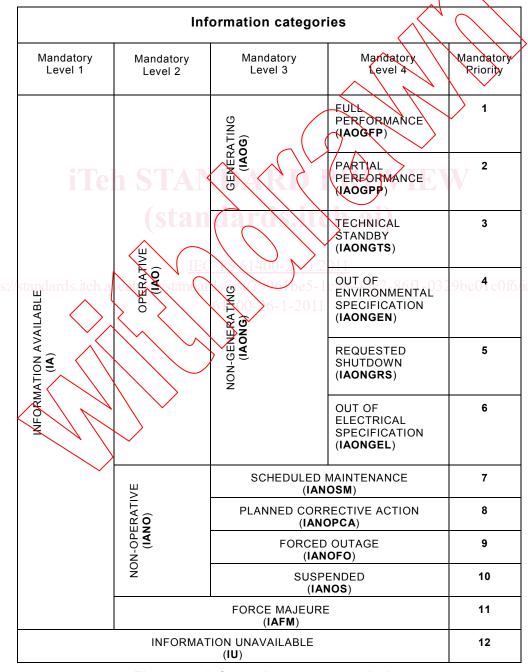


Figure 2 - Information category priority

5 INFORMATION AVAILABLE

Definition – The category INFORMATION AVAILABLE covers all time periods during which information on the WTGS and external conditions is retrieved, logged and stored manually or automatically.

It is recognised that there may be circumstances where information is partially available. Qualification for INFORMATION AVAILABLE category requires enough information to confirm if the exit and entry points for all mandatory categories are met.

This category covers all mandatory information categories as depicted in Figure 3.

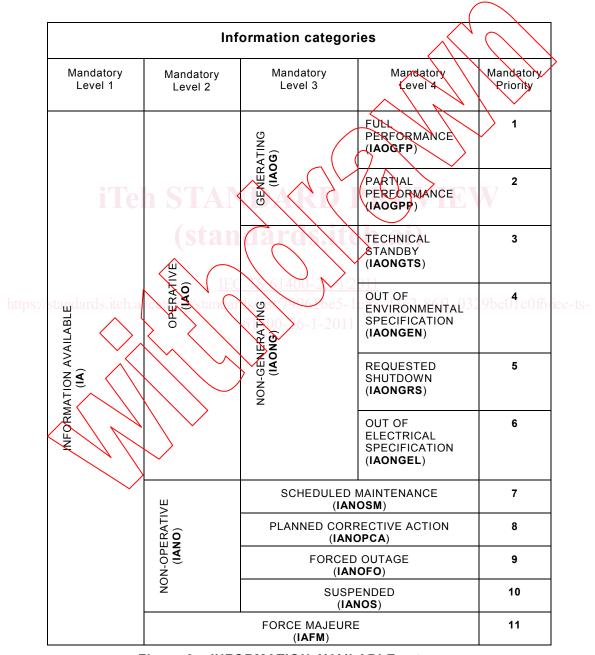


Figure 3 – INFORMATION AVAILABLE category

Entry point – The WTGS operating status data is available and can be logged and stored.

Exit point – The WTGS operating status data is not available and/or cannot be logged or stored.

5.1 OPERATIVE

Definition – The WTGS is in the category OPERATIVE when capable of performing generation function, regardless of whether it is actually generating and regardless of the capacity level that can be provided.

The OPERATIVE category is underlying the INFORMATION AVAILABLE category and has two underlying information categories as listed below and depicted in Figure 4.

- GENERATING as defined in 5.1.1;
- NON-GENERATING as defined in 5.1.2.

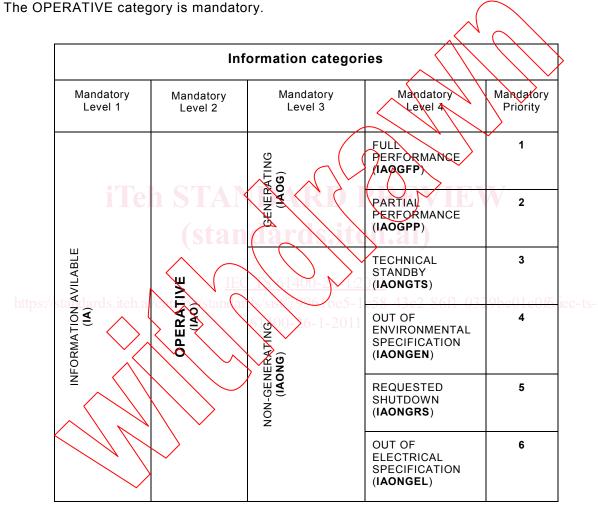


Figure 4 – OPERATIVE category

Entry point – The WTGS is able to perform the generation function, regardless of whether it is actually generating and regardless of the capacity level that can be provided. For example internal faults or alarms are resolved, maintenance is completed and other events such as force majeure are cleared.

Exit point – One or more turbine-internal faults, alarms or other constraints occur, preventing the turbine from providing its intended service.

5.1.1 GENERATING

Definition – The WTGS is converting wind energy into electrical energy and/or providing reactive compensation.