

# TECHNICAL SPECIFICATION



**Wind turbines –  
Part 26-1: Time-based availability for wind turbine generating systems**

<https://standards.iteh.ai/catalog/standards/sis/959670e5-1c58-43c2-86f1-0329bc01c0f6/iec-ts-61400-26-1-2011>



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## WIND TURBINES –

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

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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- withdrawn,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
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## 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 / transmission 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.

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## 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
IAN	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.

Information categories					
Mandatory Level 1	Mandatory Level 2	Mandatory Level 3	Mandatory Level 4	Optional - description see Annex A Level 5	
INFORMATION AVAILABLE (IA)	OPERATIVE (IAO)	GENERATING (IAOG)	FULL PERFORMANCE (IAOGFP)		
			PARTIAL PERFORMANCE (IAOGPP)	Derated Degraded	
		NON-GENERATING (IAONG)	TECHNICAL STANDBY (IAONGTS)		
			OUT OF ENVIRONMENTAL SPECIFICATION (IAONGEN)	Calm winds Other environmental	
			REQUESTED SHUTDOWN (IAONGRS)		
			OUT OF ELECTRICAL SPECIFICATION (IAONGEL)		
		NON-OPERATIVE (IANO)	SCHEDULED MAINTENANCE (IANOSM)		
			PLANNED CORRECTIVE ACTION (IANOPCA)		Retrofit Upgrade Other corrective action
			FORCED OUTAGE (IANOFO)		Response Diagnostic Logistic Failure repair
			SUSPENDED (IANOS)		Scheduled maintenance Planned corrective action Forced outage
	FORCE MAJEURE (IAFM)				
	INFORMATION UNAVAILABLE (IU)				

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.

Information categories				
Mandatory Level 1	Mandatory Level 2	Mandatory Level 3	Mandatory Level 4	Mandatory Priority
INFORMATION AVAILABLE (IA)	OPERATIVE (IAO)	GENERATING (IAOG)	FULL PERFORMANCE (IAOGFP)	1
			PARTIAL PERFORMANCE (IAOGPP)	2
			TECHNICAL STANDBY (IAONGTS)	3
		NON-GENERATING (IAONG)	OUT OF ENVIRONMENTAL SPECIFICATION (IAONGEN)	4
			REQUESTED SHUTDOWN (IAONGRS)	5
			OUT OF ELECTRICAL SPECIFICATION (IAONGEL)	6
	NON-OPERATIVE (IANO)	SCHEDULED MAINTENANCE (IANOSM)		7
		PLANNED CORRECTIVE ACTION (IANOPCA)		8
		FORCED OUTAGE (IANOFO)		9
		SUSPENDED (IANOS)		10
	FORCE MAJEURE (IAFM)		11	
INFORMATION UNAVAILABLE (IU)				12

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.

Information categories				
Mandatory Level 1	Mandatory Level 2	Mandatory Level 3	Mandatory Level 4	Mandatory Priority
INFORMATION AVAILABLE (IA)	OPERATIVE (IAO)	GENERATING (IAOG)	FULL PERFORMANCE (IAOGFP)	1
			PARTIAL PERFORMANCE (IAOGPP)	2
			TECHNICAL STANDBY (IAONGTS)	3
		NON-GENERATING (IAONG)	OUT OF ENVIRONMENTAL SPECIFICATION (IAONGEN)	4
			REQUESTED SHUTDOWN (IAONGRS)	5
			OUT OF ELECTRICAL SPECIFICATION (IAONGEL)	6
	NON-OPERATIVE (IANO)	SCHEDULED MAINTENANCE (IANOSM)		7
		PLANNED CORRECTIVE ACTION (IANOPCA)		8
		FORCED OUTAGE (IANOFO)		9
		SUSPENDED (IANOS)		10
	FORCE MAJEURE (IAFM)		11	

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.

The OPERATIVE category is mandatory.

Information categories				
Mandatory Level 1	Mandatory Level 2	Mandatory Level 3	Mandatory Level 4	Mandatory Priority
INFORMATION AVAILABLE (IA)	OPERATIVE (IAO)	GENERATING (IAOG)	FULL PERFORMANCE (IAOGFP)	1
			PARTIAL PERFORMANCE (IAOGPP)	2
			TECHNICAL STANDBY (IAONGTS)	3
		NON-GENERATING (IAONG)	OUT OF ENVIRONMENTAL SPECIFICATION (IAONGEN)	4
			REQUESTED SHUTDOWN (IAONGRS)	5
			OUT OF ELECTRICAL SPECIFICATION (IAONGEL)	6

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.