IEC 61400-25-6

Edition 1.0 2010-11

INTERNATIONAL STANDARD

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Wind turbines –
Part 25-6: Communications for monitoring and control of wind power plants – Logical node classes and data classes for condition monitoring

IEC 61400-25-6:2010(E)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE V

ICS 27.180

ISBN 978-2-88912-230-1

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FOREWORD

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International Standard IEC 61400-25-6 has been prepared by IEC technical committee 88: Wind turbines.

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

FDIS	Report on voting
88/377A/FDIS	88/380/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.

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

A list of all parts in the IEC 61400 series, published 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication 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 IEC 61400-25 series defines information models and information exchange models for monitoring and control of wind power plants. The modelling approach (for information models and information exchange models) of IEC 61400-25-2 and IEC 61400-25-3 uses abstract definitions of classes and services such that the specifications are independent of specific communication protocol stacks, implementations, and operating systems. The mapping of these abstract definitions to specific communication profiles is defined in IEC 61400-25-4.

Conformance to IEC 61400-25-6 requires in principle conformance to IEC 61400-25-2, IEC 61400-25-3 and IEC 61400-25-4.

The definitions in parts IEC 61400-25-1 to IEC 61400-25-5 apply also for this part 6 of the standard series.

The purpose of this part of IEC 61400 is to define an information model for condition monitoring information and to define how to use the existing definitions of IEC 61400-25-2 and to define the required extensions in order to describe and exchange information related to condition monitoring of wind turbines. The models of condition monitoring information defined in this standard may represent information provided by sensors or by calculation.

In the context of this standard, condition monitoring means a process with the purpose of observing components or structures of a wind turbine or wind power plant for a period of time in order to evaluate the state of the components or structures and any changes to it, in order to detect early indications of impending failures. With the objective to be able to monitor components and structures in approximately the same conditions, this standard introduces a concept of sorting production or power levels of a wind turbine into power bins. The power bins concept is multidimensional in order to fit the purpose of sorting complex operational conditions into comparable circumstances.

Condition monitoring is most frequently used as a predictive or condition-based maintenance technique (CBM). However, there are other predictive maintenance techniques that can also be used, including the use of the human senses (look, listen, feel, smell) or machine performance monitoring techniques. These could be considered to be part of the condition monitoring.

Condition monitoring techniques

Condition monitoring techniques that generate information to be modelled include, but are not limited to, measured or processed values such as:

- vibration measurements and analysis;
- oil debris measurement and analysis;
- temperature measurement and analysis;
- strain gauge measurement and analysis;
- acoustic measurement and analysis.

Components and structures can be monitored by using automatic measurement retrieval or via a manual process.

Condition monitoring devices

The condition monitoring functions may be located in different physical devices. Some information may be exposed by a turbine controller device (TCD) while other information may be exposed by an additional condition monitoring device (CMD). Various actors may request to exchange data values located in the TCD and/or CMD. A SCADA device may request data values from a TCD and/or CMD; a CMD may request data values from a TCD. The information

exchange between an actor and a device in a wind power plant requires the use of information exchange services as defined in IEC 61400-25-3 and the additional required exchange services specified in this part 6. A summary of the above is depicted in Figure 1.

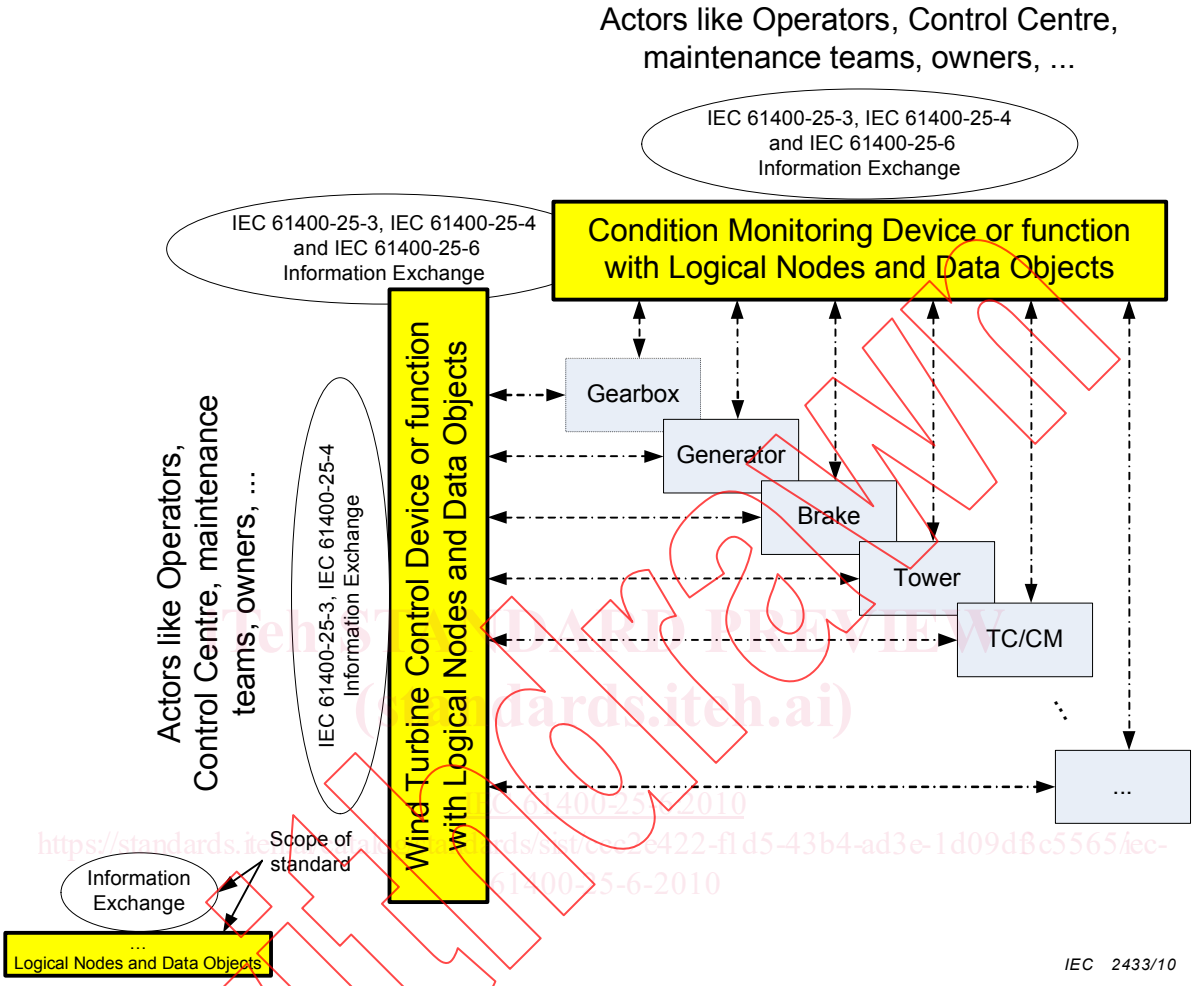

Figure 1 – Condition monitoring with separated TCD/CMD functions

The state of the art in the wind power industry is a topology with separated devices for control and condition monitoring applications. Based on this fact, the information and information exchange modelling in the present document is based on a topology with a TCD and a CMD.

IEC 61400-25-6 must be perceived as an extension of the IEC 61400-25 series of standards with the focus on condition monitoring.

WIND TURBINES –

Part 25-6: Communications for monitoring and control of wind power plants – Logical node classes and data classes for condition monitoring

1 Scope

This part of the IEC 61400-25 series specifies the information models related to condition monitoring for wind power plants and the information exchange of data values related to these models.

Figure 2 illustrates the information flow of a system using condition monitoring to perform condition based maintenance. The figure illustrates how data values are refined and concentrated through the information flow, ending up with the ultimate goal of condition based maintenance – actions to be performed via issuing work orders to maintenance teams in order to prevent the wind power plant device to stop providing its intended service.

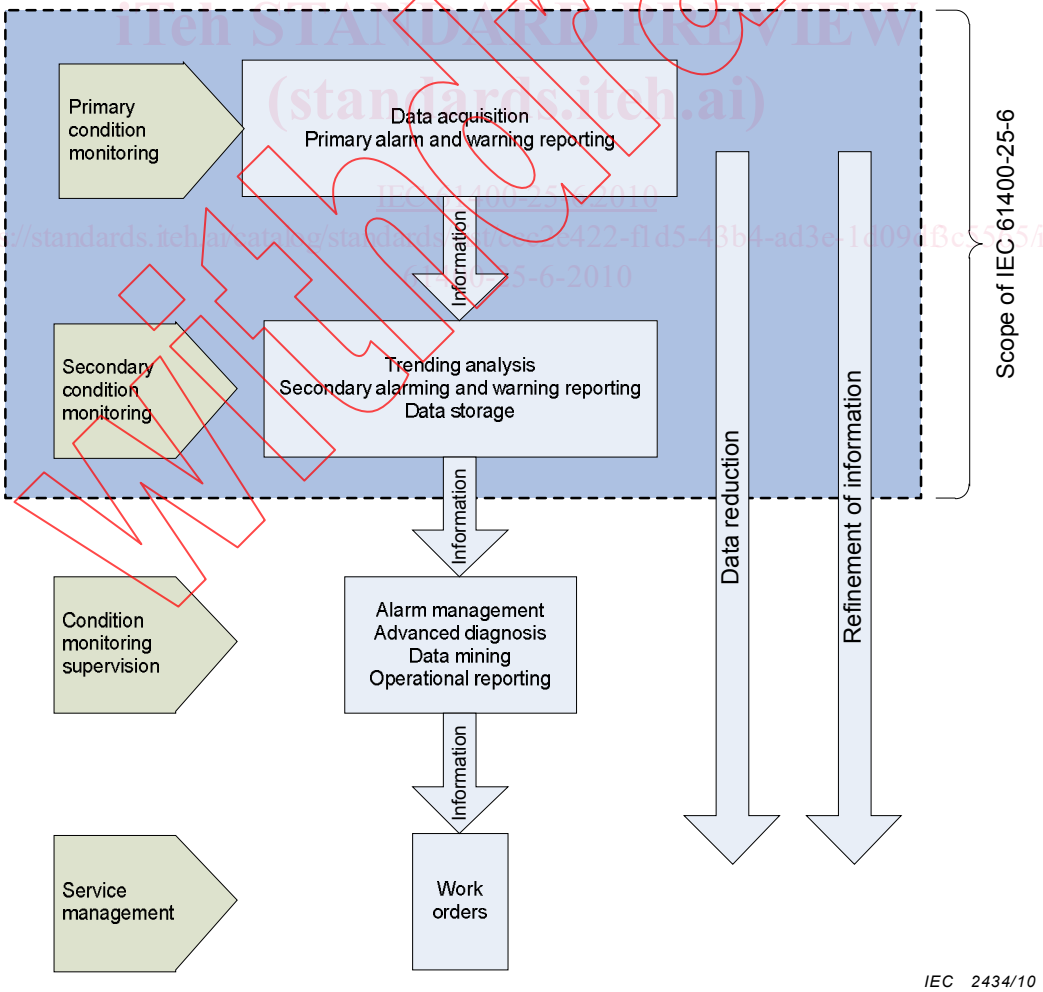

Figure 2 – Schematic flow of condition monitoring information

Condition monitoring is mainly based on the following kinds of information.

- Time waveform records (samples) of a specific time interval to be exchanged in real-time or by files for analysis (e.g. acceleration, position detection, speed, stress detection).
- Status information and measurements (synchronized with the waveform records) representing the turbine operation conditions.
- Results of time waveform record analysis of vibration data (scalar values, array values, statistical values, historical (statistical) values, counters and status information).
- Results of, for example, oil debris analysis.

It is the purpose of this standard to model condition monitoring information by using the information modelling approach as described in 6.2.2 of IEC 61400-25-1 and by extending the existing information model as specified in Clause 6 of IEC 61400-25-2, the information exchange models specified in Clause 9 of IEC 61400-25-3 and the mapping to communication profiles as specified in IEC 61400-25-4.

2 Normative references

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.

IEC 61400-25-1:2006, *Wind turbines – Communications for monitoring and control of wind power plants – Overall description of principles and models*

IEC 61400-25-2:2006, *Wind turbines – Communications for monitoring and control of wind power plants – Information models*

IEC 61400-25-3:2006, *Wind turbines – Communications for monitoring and control of wind power plants – Information exchange models*

IEC 61400-25-4, *Wind turbines – Communications for monitoring and control of wind power plants – Mapping to communication profile*

IEC 61400-25-5, *Communications for monitoring and control of wind power plants – Conformance testing*

IEC 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes*

ISO 10816 (all parts), *Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts*

ISO 13373-1:2002, *Condition monitoring and diagnostics of machines – Vibration condition monitoring – Part 1: General procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61400-25-1 and the following apply.

3.1
actor
any entity that receives (sends) data values from (to) another device

Examples of actors could be SCADA systems, maintenance systems, owner, etc.

3.2
mandatory
term applied where specific content must be provided in order to comply with this standard

3.3
optional
term applied where specific content might be provided in compliance to this standard

3.4
conditional
term applied where specific content defined must be provided depending on stated conditions in compliance to this standard

3.5
scalar value
data type representing a quantity which can be described by a single number, such as a temperature

3.6
data file
in a computer system, an entity of data available to system users (including the system itself and its application programs) that is capable of being manipulated as an entity (for example, a file can be moved from one file directory to another as a whole entity)

The file must have a unique name within its own directory. Some operating systems and applications describe files with given formats by giving them a particular file name suffix. (The file name suffix is also known as a file name extension.)

3.7
peak value
maximum excursion of a time wave form from its mean value within a specific time interval

3.8
peak-to-peak value
difference between the positive and negative extreme values of a time wave form within a specific time interval

3.9
crest factor
ratio of the peak value of a time waveform to the RMS value of the time waveform within a specific time interval

A crest factor is also named as a "peak-to-RMS-ratio".