Australian Standard™

Wind turbines

Part 21: Measurement and assessment of power quality characteristics of grid connected wind turbines

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Australian Business Council for Sustainable Energy
Australian Electrical and Electronic Manfacturers Association
Australian Greenhouse Office, Department of the Environment and Heritage
Australian Wind Energy Association
Electrical Regulatory Authorities Council
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PREFACE

This Standard was prepared by the Standards Australia Committee EL-048, Wind Turbine Systems.

The objective of this Standard is to provide owners and operators of wind turbine systems and electricity distributors with a uniform methodology for consistency and accuracy in the measurement and assessment of the power quality characteristics of grid connected wind turbines.

This Standard has been reproduced from IEC 61400-21 Ed.1.0 (2001), *Wind turbine generator systems,* Part *21: Measurement and assessment of power quality characteristics of grid connected wind turbines*. An informative annex, ZA, has been added to assist users understand the effects of wind turbines on power quality.

As this Standard is reproduced from an International Standard, the following applies:

(a) Its number does not appear on each page of text and its identity is shown only on the cover and title page.

(b) In the source text 'this part of IEC 61400' should read 'this part of AS 61400'.

(c) A full point should be substituted for a comma when referring to a decimal marker.

(d) The term 'rated active power P_n' should be substituted for 'rated power P_n'.

To assist users of this Standard, the following explanations of some terms used in the Standard are provided:

Flicker: Impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time as a result of short duration fluctuations in the voltage of the electrical supply to the light source.

Power quality: A term used to describe the performance of a power supply at a given point in the electricity supply system. The term covers the variability of the system characteristics, mainly in regard to voltage, current and voltage waveform and frequency.

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

CONTENTS

INTRODUCTION

The purpose of this part of IEC 61400 is to provide a uniform methodology that will ensure consistency and accuracy in the measurement and assessment of power quality characteristics of grid connected wind turbines (WTs). In this respect the term power quality includes those electric characteristics of the WT that influence the voltage quality of the grid to which the WT is connected. The standard has been prepared with the anticipation that it would be applied by:

- the WT manufacturer striving to meet well-defined power quality characteristics;
- the WT purchaser in specifying such power quality characteristics;
- the WT operator who may be required to verify that stated, or required power quality characteristics are met;
- the WT planner or regulator who must be able to accurately and fairly determine the impact of a WT on the voltage quality to ensure that the installation is designed so that voltage quality requirements are respected;
- the WT certification authority or component testing organization in evaluating the power quality characteristics of the wind turbine type;
- the planner or regulator of the electric network who must be able to determine the grid connection required for a WT.

This standard provides recommendations for preparing the measurements and assessment of power quality characteristics of grid connected WTs. The standard will benefit those parties involved in the manufacture, installation planning, obtaining of permission, operation, utilization, testing and regulation of WTs. The measurement and analysis techniques recommended in this standard should be applied by all parties to ensure that the continuing development and operation of WTs are carried out in an atmosphere of consistent and accurate communication.

This standard presents measurement and analysis procedures expected to provide consistent results that can be replicated by others.

NOTES

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Any table, figure or text of the international standard that is struck through is not part of this standard. Any Australian table, figure or text that is added is part of this standard and is identified by shading.

1 Scope

This part of IEC 61400 includes:

- definition and specification of the quantities to be determined for characterizing the power quality of a grid connected wind turbine;
- measurement procedures for quantifying the characteristics;
- procedures for assessing compliance with power quality requirements, including estimation of the power quality expected from the wind turbine type when deployed at a specific site, possibly in groups.

The measurement procedures are valid for single wind turbines with a three-phase grid connection, and as long as the wind turbine is not operated to actively control the frequency or voltage at any location in the network. The measurement procedures are valid for any size of wind turbine, though this standard only requires wind turbine types intended for PCC at MV or HV to be tested and characterized as specified in this standard.

The measured characteristics are valid for the specific configuration of the assessed wind turbine only. Other configurations, including altered control parameters that cause the wind turbine to behave differently with respect to power quality, require separate assessment.

The measurement procedures are designed to be as non-site-specific as possible, so that power quality characteristics measured at for example a test site can be considered valid also at other sites.

The procedures for assessing compliance with power quality requirements are valid for wind turbines with PCC at MV or HV in power systems with fixed frequency within ±1 Hz, and sufficient active and reactive power regulation capabilities and sufficient load to absorb the wind power production. In other cases, the principles for assessing compliance with power quality requirements may still be used as a guide.

NOTE 1 This standard uses the following terms for system voltage:

- low voltage (LV) refers to $U_n \leq 1$ kV;
- medium voltage (MV) refers to 1 kV < $U_n \leq 35$ kV;
- high voltage (HV) refers to $U_n > 35$ kV.

NOTE FOR AUSTRALIA: These definitions for voltage values are different from those in AS/NZS 3000:2000. AS/NZS 3000:2000 only has definitions for extra-low voltage, low voltage and high voltage. It is understood that the definition for medium voltage in this Standard is a common industry term used in some countries and organizations.

NOTE 2 The issue of interharmonics is not addressed in this standard, though it is under consideration awaiting proper measurement and assessment procedures to be established by the appropriate IEC committee.

