TECHNICAL REPORT

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Wind turbine generator systems –

Part 24: Lightning protection

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
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FOREWORD

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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example “state of the art”.

Technical reports do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful by the maintenance team.

IEC 61400-24, which is a technical report, has been prepared by IEC technical committee 88: Wind turbine systems.

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

Enquiry draft	Report on voting
88/128/CDV	88/142/RVC

Full information on the voting for the approval of this technical report 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 3.

This document, which is purely informative, is not to be regarded as an International Standard.

The committee has decided that the contents of this publication will remain unchanged until 2007. At this date, the publication will be either

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- withdrawn;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

INTRODUCTION

During the last few years damage to wind turbines due to lightning strokes has been recognized as an increasing problem. The increasing number and height of installed turbines have resulted in an incidence of lightning damage greater than anticipated with repair costs beyond acceptable levels. The influence of lightning faults on operational reliability becomes a concern as the capacity of individual wind turbines increases and turbines move offshore. This is particularly the case when several large wind turbines are operated together in wind farm installations since the potential loss of multiple large production units due to one lightning flash is unacceptable.

Unlike other electrical installations, such as overhead lines, substations and power plants, where protective conductors can be arranged around or above the installation in question, wind turbines pose a different lightning protection problem due to their physical size and nature. Wind turbines typically have two or three blades with a diameter up to 100 m or more rotating 100 m above the ground. In addition, there is extensive use of insulating composite materials, such as glass fibre reinforced plastic, as load-carrying parts. The lightning protection system has to be fully integrated into the different parts of the wind turbines to ensure that all parts likely to be lightning attachment points are able to withstand the impact of the lightning and that the lightning current may be conducted safely from the attachment points to the ground without unacceptable damage or disturbances to the systems.

To that end this report was developed to inform designers, purchasers, operators, certification agencies and installers of wind turbines on the state-of-the-art of lightning protection of wind turbines.

WIND TURBINE GENERATOR SYSTEMS –

Part 24: Lightning protection

1 Scope

During the last few years, all major wind turbine manufacturers have made dedicated efforts towards developing adequate lightning protection systems, and the first experiences with these new designs are beginning to be seen. It is therefore reasonable at this time to consider and prepare for a standardization effort that will give both manufacturers and operators a common framework for appropriate lightning protection of wind turbines.

On the above background the following elements of work have formed the scope of a new working group with the specific aim of preparing a technical report on the subject prior to considering development of a full standard:

– identify the generic problems involved in lightning protection of wind turbines;

– collect and systematize existing experience with both older and new designs of wind turbines;

– describe appropriate methods for evaluating the risk of lightning damage to wind turbines, thereby making reliable cost-benefit evaluations of lightning protection efforts possible;

– describe and outline appropriate methods for lightning protection of wind turbine components, considering the special nature of wind turbines and the extensive use of composite materials;

– compile a technical report outlining problems and solutions as seen today. The working group should identify and quantify areas where further research and proper standardization efforts are needed.

This technical report is structured as follows:

– clause 3 gives the background on the current understanding on lightning phenomenology and its impact on wind turbines;

– clause 4 presents the lightning damage experience as extracted from the various national wind turbine databases;

– clause 5 describes risk evaluation;

– clauses 6 through 10 discuss appropriate methods for protection against lightning damage;

– clause 11 identifies areas for further research.