

INTERNATIONAL STANDARD

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**Power transformers –
Part 16: Transformers for wind turbine applications**

**Transformateurs de puissance –
Partie 16: Transformateurs pour applications éoliennes**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER TRANSFORMERS –

Part 16: Transformers for wind turbine applications

FOREWORD

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International Standard IEC 60076-16 has been prepared by IEC technical committee 14: Power transformers.

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

FDIS	Report on voting
14/690/FDIS	14/698/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 of the IEC 60076 series can be found, under the general title *Power transformers*, 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- withdrawn,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
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INTRODUCTION

This part of IEC 60076 is intended to specify the additional requirements for the transformers for installation in wind turbine applications.

Wind turbines use generator step-up transformers to connect the turbines to a network. These transformers can be installed in the nacelle or in the tower or outside close to the wind turbine.

This standard covers transformers for wind turbine applications or wind farms where the constraints on transformers exceed the requirement of the present IEC 60076 series. The constraints are not often known or recognized by the transformer manufacturers, wind turbine manufacturers and operators and as a result the level of reliability of these transformers can be lower than those used for conventional applications.

The transformers for wind turbine applications are not included in the present list of IEC 60076 standard series.

The purpose of this standard is help to obtain the same level of reliability as transformers for more common applications.

This standard deals particularly with the effects of repeated high frequency transient over-voltages, electrical, environmental, thermal, loading, installation and maintenance conditions that are specific for wind turbines or wind farms.

On site measurements, investigations and observations on wind turbines have detected risks for some different kind of installations:

- repeated high frequency transient over or under voltages in the range of kHz;
- over and under frequency due to turbine control;
- values of over voltage;
- over voltage or under voltage coming from LV side;
- high level of transient over voltages due to switching;
- presence of partial discharge around the transformer;
- harmonic contents current and voltage;
- overloading under ambient conditions;
- fast transient overload;
- clearances not in compliance with the minimum prescribed;
- installation conditions and connections;
- restricted conditions of cooling;
- water droplets;
- humidity levels that exceed the maximum permissible values;
- salt and dust pollution and extreme climatic conditions;
- high levels of vibration;
- mechanical stresses.

Therefore it is necessary to take into account in the design of the transformer the constraints of this application, or to define some protective devices to protect the transformer. Additional or improved routine, type or special tests for these transformers have to be specified to be in compliance with the constraints on the network.

POWER TRANSFORMERS –

Part 16: Transformers for wind turbine applications

1 Scope

This part of IEC 60076 applies to dry-type and liquid-immersed transformers for rated power 100 kVA up to 10 000 kVA for wind turbine applications having a winding with highest voltage for equipment up to and including 36 kV and at least one winding operating at a voltage greater than 1,1 kV.

Transformers covered by this standard comply with the relevant requirements prescribed in the IEC 60076 standards.

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 60076-1:2011, *Power transformers – Part 1: General*

IEC 60076-2:2011, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

IEC 60076-3:2000, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*

IEC 60076-5:2006, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 60076-7:2005, *Power transformers – Part 7: Loading guide for oil-immersed power transformers*

IEC 60076-8:1997, *Power transformers – Application guide*

IEC 60076-11:2004, *Power transformers – Part 11: Dry-type transformers*

IEC 60076-12:2008, *Power transformers – Part 12: Loading guide for dry-type power transformers*

IEC 60076-13:2006, *Power transformers – Part 13: Self-protected liquid-filled transformers*

IEC 61100, *Classification of insulating liquids according to fire-point and net calorific value*

IEC 61378-1:2011, *Converter transformers – Part 1: Transformers for industrial applications*

IEC 61378-3:2006, *Converter transformers – Part 3: Application guide*

IEC 61400-1:2005, *Wind turbines – Part 1: Design requirements*