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**Električni rotacijski stroji - 27. del: Meritve delne izpraznitve na izolaciji statorskih navitij neaktivnih električnih rotacijskih strojev (IEC/TS 60034-27:2006)**

Rotating electrical machines - Part 27: Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines (IEC/TS 60034-27:2006)

Drehende elektrische Maschinen - Teil 27: Off-line-Teilentladungsmessungen an der Statorwicklungsisolierung drehender Maschinen (IEC/TS 60034-27:2006)

Machines électriques tournantes - Partie 27: Mesures à l'arrêt des décharges partielles effectuées sur le système d'isolation des enroulements statoriques des machines électriques tournantes (CEI/TS 60034-27:2006)

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**Ta slovenski standard je istoveten z: CLC/TS 60034-27:2011**

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TECHNICAL SPECIFICATION  
SPÉCIFICATION TECHNIQUE  
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**CLC/TS 60034-27**

February 2011

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English version

**Rotating electrical machines -  
Part 27: Off-line partial discharge measurements on the stator winding  
insulation of rotating electrical machines  
(IEC/TS 60034-27:2006)**

Machines électriques tournantes -  
Partie 27: Mesures à l'arrêt des décharges  
partielles effectuées sur le système  
d'isolation des enroulements statoriques  
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(CEI/TS 60034-27:2006)

Drehende elektrische Maschinen -  
Teil 27: Off-line-Teilentladungsmessungen  
an der Statorwicklungsisolation drehender  
Maschinen  
(IEC/TS 60034-27:2006)

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of the Technical Specification IEC/TS 60034-27:2007, prepared by IEC TC 2, Rotating machinery, was submitted to the formal vote and was approved by CENELEC as CLC/TS 60034-27 on 2011-01-25.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following date was fixed:

- latest date by which the existence of the CLC/TS  
has to be announced at national level (doa) 2011-07-25

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the Technical Specification IEC/TS 60034-27:2006 was approved by CENELEC as a Technical Specification without any modification.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| <u>Publication</u> | <u>Year</u> | <u>Title</u>   | <u>EN/HD</u> | <u>Year</u> |
|--------------------|-------------|--|--------------|-------------|
| IEC 60060-1        | -           | High-voltage test techniques -<br>Part 1: General definitions and test<br>requirements | EN 60060-1   | -           |
| IEC 60060-2        | -           | High-voltage test techniques -<br>Part 2: Measuring systems                            | EN 60060-2   | -           |
| IEC 60270          | 2000        | High-voltage test techniques - Partial<br>discharge measurements                       | EN 60270     | 2001        |

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**Machines électriques tournantes –**

**Partie 27:**

**Mesures à l'arrêt des décharges partielles effectuées sur le système d'isolation des enroulements statoriques des machines électriques tournantes**

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**Rotating electrical machines –**

**Part 27:**

**Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ROTATING ELECTRICAL MACHINES –

**Part 27: Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines**

## FOREWORD

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 60034-27, which is a technical specification, has been prepared by IEC technical committee 2: Rotating machinery.

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

|               |                  |
|---------------|------------------|
| Enquiry draft | Report on voting |
| 2/1384/DTS    | 2/1395A/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 60034 series, under the general title *Rotating electrical machines*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

For many years, the measurement of partial discharges (PD) has been employed as a sensitive means of assessing the quality of new insulation as well as a means of detecting localized sources of PD in used electrical winding insulation arising from operational stresses in service. Compared with other dielectric tests (i.e. the measurement of dissipation factor or insulation resistance) the differentiating character of partial discharge measurements allows localized weak points of the insulation system to be identified.

The PD testing of rotating machines is also used when inspecting the quality of new assembled and finished stator windings, new winding components (e.g. form-wound coils and bars, HV bushings, etc.) and fully impregnated stators.

In connection with the servicing and overhaul of rotating machines, the measurement of partial discharges can also provide information on:

- points of weakness in the insulation system;
- ageing processes;
- further measures and intervals between overhauls.

Although the PD testing of rotating machines has gained widespread acceptance, it has emerged from several studies that not only are there many different methods of measurement in existence but also the criteria and methods of analysing and finally assessing the measured data are often very different and not really comparable. Consequently, there is an urgent need to give some guidance to those users who are considering the use of PD measurements to assess the condition of their insulation systems.

Partial discharge testing of stator windings can be divided into two broad groups:

- a) off-line measurements, in which the stator winding is isolated from the power system and a separate power supply is employed to energize the winding;
- b) on-line measurements, in which the rotating machine is operating normally and connected to the power system.

Both of these approaches have advantages and disadvantages with respect to one another. A brief discussion of the merits of on-line testing, as well as the drawbacks, is provided in Annex A. However, while acknowledging the extensive world-wide use of on-line methods and their proven value to industry, this technical specification is confined to off-line techniques. This approach is considered necessary to render this specification sufficiently concise to be of use by non-specialists in the field of PD testing.

**Limitations:**

When stator windings are being tested different types of PD measuring instruments will inevitably produce different results and consequently PD measurements will only be comparable under certain conditions. Therefore, absolute limits for the windings of rotating machines, for example as acceptance criteria for production or operation, are difficult to define. This is mainly due to pulse propagation phenomena, specific difficulties with calibration and the individual frequency response characteristics of stator windings and PD measuring systems.

In addition, the degree of deterioration, and hence the risk of insulation system failure, depends on the specific type of PD source and its location within the stator winding insulation, both of which can influence the test results very significantly.

Empirical limits verified in practice can be used as a basis for evaluating test results. Furthermore, PD trend evaluation and comparisons with machines of similar design and similar insulation system measured under similar conditions, using the same measurement equipment, are recommended to ensure reliable assessment of the condition of the stator winding insulation.

Users of PD measurement should be aware that, due to the principles of the method, not all insulation-related problems in stator windings can be detected by measuring partial discharges (e.g. insulation failures involving continuous leakage currents due to conductive paths between different elements of the insulation or pulseless discharge phenomena).

For testing individual winding components, the limitations due to pulse propagation phenomena need not be considered when interpreting the results of measurements.

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## ROTATING ELECTRICAL MACHINES –

### Part 27: Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines

#### 1 Scope

This part of IEC 60034 which is a technical specification provides a common basis for

- measuring techniques and instruments,
- the arrangement of test circuits,
- normalization and testing procedures,
- noise reduction,
- the documentation of test results,
- the interpretation of test results

with respect to partial discharge off-line measurements on the stator winding insulation of rotating electrical machines when tested with alternating voltages up to 400 Hz. This technical specification applies to rotating machines having bars or form wound coils with conductive slot coating. This is usually valid for machines with voltage rating of 6 kV and higher. The measurement methods described in this specification may also be applied to machines without conductive slot coating. However, results may be different and are not covered by this specification.

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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 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2, *High-voltage test techniques – Part 2: Measuring systems*

IEC 60270:2000, *High-voltage test techniques – Partial discharge measurements*

#### 3 Terms and definitions

For the purposes of this document, the general terms and definitions for partial discharge measurements given in IEC 60270 apply, together with the following.

##### 3.1

##### **off-line measurement**

measurement taken with the rotating machine at standstill, the machine being disconnected from the power system

NOTE The necessary test voltage is applied to the winding from a separate voltage source.

**3.2****on-line measurement**

measurement taken with the rotating machine in normal operation

**3.3****stress control coating**

paint or tape on the surface of the groundwall insulation that extends beyond the conductive slot portion coating in high-voltage stator bars and coils

NOTE The stress control coating reduces the electric field stress along the winding overhang to below a critical value that would initiate PD on the surface. The stress control coating overlaps the conductive slot portion coating to provide electrical contact between them.

**3.4****conductive slot coating**

conductive paint or tape layer in intimate contact with the groundwall insulation in the slot portion of the coil side, often called semiconductive coating

NOTE This coating provides good electrical contact to the stator core.

**3.5****resistance temperature detector****RTD**

a temperature detector inserted into the stator winding, usually between the top and bottom bar or embedded coil sides in a given slot

**3.6****slot discharges**

discharges that occur between the outer surface of the slot portion of a coil or bar and the grounded core laminations

**3.7****internal discharges**

discharges that occur within the insulation system

**3.8****surface discharges**

discharges that occur on the surface of the insulation or on the surface of winding components in the winding overhang or the active part of the machine winding

**3.9****pulse height distribution**

the number of pulses within a series of equally-spaced windows of pulse magnitude during a predefined measuring time

**3.10****pulse phase distribution**

the number of pulses within a series of equally-spaced windows of phase during a predefined measuring time

**3.11****partial discharge pattern**

PD distribution map of PD magnitude vs a.c. cycle phase position, for visualization of the PD behaviour during a predefined measuring time, in which specific PD parameters are used for graphical representation

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