SVENSK STANDARD

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Roterande elektriska maskiner – Del 27-2: Kopplad mätning av partiella urladdningar på statorlindningens isolering

Rotating electrical machines – Part 27-2: On-line partial discharge measurements on the stator winding insulation of rotating electrical machines

Som svensk standard gäller europastandarden EN IEC 60034-27-2:2024. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60034-27-2:2024.

Nationellt förord

Europastandarden EN IEC 60034-27-2:2024

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– **IEC 60034-27-2, First edition, 2023 - Rotating electrical machines – Part 27-2: On-line partial discharge measurements on the stator winding insulation of rotating electrical machines**

utarbetad inom International Electrotechnical Commission, IEC.

ICS 29.160.01

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EUROPEAN STANDARD

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English Version

Rotating electrical machines - Part 27-2: On-line partial discharge measurements on the stator winding insulation (IEC 60034-27-2:2023)

Machines électriques tournantes - Partie 27-2: Mesurages en fonctionnement des décharges partielles effectués sur le système d'isolation
(IEC 60034-27-2:2023)

Drehende elektrische Maschinen - Teil 27-2: Online Teilentladungsmessungen an der Ständerwicklungsisolierung drehender elektrischer Maschinen
(IEC 60034-27-2:2023)

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

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European foreword

The text of document 2/2153/FDIS, future edition 1 of IEC 60034-27-2, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60034-27-2:2024.

The following dates are fixed:

•	latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop) 2024-10-11
•	latest date by which the national standards conflicting with the document have to be withdrawn	(dow) 2027-01-11

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

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60034-27-2:2023 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60034-27-1	2017	Rotating electrical machines - Part 27-1: Off-line partial discharge measurements on the winding insulation	EN IEC 60034-27-1	2018
IEC 60034-27-3	-	Rotating electrical machines - Part 27-3: Dielectric dissipation factor measurement on stator winding insulation of rotating electrical machines	EN 60034-27-3	-
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-27	-	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60112	-	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN IEC 60112	-
IEC 60270	2000	High-voltage test techniques - Partial discharge measurements	EN 60270	2001
IEC 62271-1	-	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear	EN 62271-1	-
IEC TS 62478	-	High voltage test techniques - Measurement of partial discharges by electromagnetic and acoustic methods	-	-
ISO 8528-9	-	Reciprocating internal combustion engine driven alternating current generating sets - Part 9: Measurement and evaluation of mechanical vibration	-	-

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INTERNATIONAL STANDARD

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Rotating electrical machines – Part 27-2: On-line partial discharge measurements on the stator winding insulation

Machines électriques tournantes – Partie 27-2: Mesurages en fonctionnement des décharges partielles effectués sur le système d'isolation

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ROTATING ELECTRICAL MACHINES –

Part 27-2: On-line partial discharge measurements on the stator winding insulation

FOREWORD

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IEC 60034-27-2 has been prepared by IEC technical committee 2: Rotating machinery. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
2/2153/FDIS	2/2166/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60034 series, published under the general title *Rotating electrical machines*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

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INTRODUCTION

Partial Discharge (PD) on-line measurement of rotating electrical machines has gained widespread acceptance as it could reveal the presence of localized weak points of the stator insulation system and also various arcing and sparking phenomena. Nevertheless, 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 a need to have an International Standard (IS) to give defined guidelines to the users of on-line PD measurements to assess the condition of their insulation systems.

On-line PD measurements are recorded with the rotating electrical machine experiencing all of the operating stresses; thermal, electrical, environmental and mechanical. Due to the realistic stress impact on the winding during measurement and due to the fact that the measurement is performed during all kinds of normal operation like base load and peak load, PD on-line testing could identify changes of the winding insulation system at a premature stage and enables real-time condition assessment as part of predictive maintenance strategies.

PD trend evaluation and comparisons with machines of similar design and similar insulation system measured under similar conditions, using the same measuring equipment, are recommended to ensure reliable assessment of the condition of the stator winding insulation. The trending information provides a good measure for early indication of a change in insulation condition. This gives time for planning further standstill examination in terms of visual inspection and off-line testing during next inspection outage.

This document does not deal with on-line PD measurements on converter driven electrical machines because different measuring techniques are needed to distinguish between noise from the converter and PD from the winding.

Limitations:PD on-line tests on stator windings produce comparative, rather than absolute measurements. This creates a fundamental limitation for the interpretation of PD data. Therefore, acceptance criteria with simple limits for new or rewound stator windings cannot be established as the following reasons demonstrate:

– There are many types of PD sensors as well as recording and analysing instruments. Generally, they are incompatible and will produce different results for the same PD activity.
– Even with the same measuring system, the high frequency partial discharge pulses will interact with the winding capacitance and inductance on their way from point of origin to the measuring point, e.g. at the winding terminals. Thus, PD measurements taken at machines with different winding design and rating produce different PD results, even though the actual type of PD source is the same.
– Different types of winding defects produce different PD magnitudes and have different impact on insulation destruction. There is no strong correlation between high PD and high risk of insulation failure.
– PD activity may occur close or far from the PD sensor. In general, if the PD source is inside the winding coils far away from the PD sensor, it will produce a smaller response at the PD sensor at the terminals compared to a PD source at the phase connections nearby due to pulse attenuation.

Users should also be aware that there is no evidence that the time to failure of the stator winding insulation can be estimated using any PD quantity, alone or even in combination. In order to more comprehensively describe the condition of the stator insulation, PD measurements are required to be supplemented by other electrical tests. Also, determining the root cause of an insulation deterioration process using PD pattern recognition, especially if more than one process is occurring, is still somewhat subjective, although the digital analysing technology is evolving rapidly.

Noise and disturbance from electrical environment have a great impact to on-line PD measurement. Cross-coupling of PD and noise between different phases can make objective interpretation of the test results difficult. Therefore, different analogue and digital noise suppression techniques are used to improve PD measuring sensitivity and PD analysing tools.

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 on-line PD activity, e.g. insulation failures involving continuous leakage currents due to conductive paths between different electrical potential of the insulation system or fine main insulation cracks with too small PD activity compared to normal delamination PD or pulse-less discharge phenomena.

ROTATING ELECTRICAL MACHINES –

Part 27-2: On-line partial discharge measurements on the stator winding insulation

1 Scope

This part of IEC 60034-27 deals with on-line PD measurements and provides a common basis with standardized procedures if possible for:

– measuring techniques and instruments;
– the arrangement of the installation;
– normalization and sensitivity assessment;
– measuring procedures;
– noise reduction;
– the documentation of results;
– the interpretation of results;

with respect to partial discharge on-line measurements on the stator winding insulation of non-converter driven rotating electrical machines with rated voltage of 3 kV and up. This document covers PD measuring systems and methods detecting electrical PD signals. The same measuring devices and procedures can also be used to detect electrical sparking and arcing phenomena.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60034-27-1:2017, *Rotating electrical machines – Part 27-1: Off-line partial discharge measurements on the winding insulation*

IEC 60034-27-3, *Rotating electrical machines – Part 27-3: Dielectric dissipation factor measurement on stator winding insulation of rotating electrical machines*

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

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

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

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC TS 62478, *High voltage test techniques – Measurement of partial discharges by electromagnetic and acoustic methods*

ISO 8528-9: *Reciprocating internal combustion engine driven alternating current generating sets – Part 9: Measurement and evaluation of mechanical vibrations*