

Rotating electrical machines - Part 27-1: Off-line partial
discharge measurements on the stator winding
insulation of rotating electrical machines

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 60034-27-1:2018 sisaldab Euroopa standardi EN IEC 60034-27-1:2018 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 60034-27-1:2018 consists of the English text of the European standard EN IEC 60034-27-1:2018.
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English Version

**Rotating electrical machines - Part 27-1: Off-line partial
discharge measurements on the stator winding insulation of
rotating electrical machines
(IEC 60034-27-1:2017)**

Machines électriques tournantes - Partie 27-1: Mesures à
l'arrêt des décharges partielles effectuées sur le système
d'isolation des enroulements statoriques des machines
électriques tournantes
(IEC 60034-27-1:2017)

Drehende elektrische Maschinen - Teil 27-1: Off-line
Teilentladungsmessungen an Ständerwicklungsisolierungen
drehender elektrischer Maschinen
(IEC 60034-27-1:2017)

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Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

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standards conflicting with the
document have to be withdrawn

This document supersedes CEN/TS 60034-27:2011.

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Endorsement notice

The text of the International Standard IEC 60034-27-1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60034-18-41 NOTE Harmonized as EN 60034-18-41 (not modified).

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 When 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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60034-18-32	-	Rotating electrical machines -- Part 18-32: Functional evaluation of insulation systems - Test procedures for form-wound windings - Evaluation of electrical endurance	EN 60034-18-32	-
IEC 60034-18-42	-	Rotating electrical machines - Part 18-42: Partial discharge resistant electrical insulation systems (Type II) used in rotating electrical machines fed from voltage converters - Qualification tests	EN 60034-18-42	-
IEC 60034-27-4	-	Rotating electrical machines - Part 27-4: Measurement of insulation resistance and polarization index of winding insulation of rotating electrical machines	EN IEC 60034-27-4	-
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60060-2	-	High-voltage test techniques - Part 2: Measuring systems	EN 60060-2	-
IEC 60270	2000	High-voltage test techniques - Partial discharge measurements	EN 60270	2001
+ A1	2015		+ A1	2016
IEC/TS 60034-27-2	-	Rotating electrical machines - Part 27-2: On-line partial discharge measurements on the stator winding insulation of rotating electrical machines	-	-

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	10
4 Nature of PD in rotating machines	12
4.1 Basics of PD	12
4.2 Types of PD in rotating machines.....	13
4.2.1 General	13
4.2.2 Internal discharges	13
4.2.3 Slot discharges.....	13
4.2.4 End-winding gap and surface discharges.....	14
4.2.5 Foreign conductive materials discharges	14
4.3 Pulse propagation in windings.....	14
5 Measuring technologies and instrumentation	15
5.1 General.....	15
5.2 Influence of frequency response of measuring system	15
5.3 Effects of PD coupling units	16
5.4 Effect of the measuring instrument.....	17
6 Visualization of measurements	17
6.1 General.....	17
6.2 Minimum scope of PD data presentation	17
6.3 Additional means of PD data representation.....	18
6.3.1 General	18
6.3.2 Partial discharge pattern.....	19
7 Test circuits.....	19
7.1 General.....	19
7.2 Individual winding components.....	20
7.3 Complete windings.....	21
7.3.1 General	21
7.3.2 Standard measurements (SX.X).....	22
7.3.3 Optional, extended measurements (EX.X)	23
7.3.4 Using integrated test equipment (IX.X)	24
8 Normalization of measurements.....	25
8.1 General.....	25
8.2 Individual winding components.....	26
8.3 Complete windings.....	26
9 Test procedures	28
9.1 Acquiring PD measurements on windings and winding components	28
9.1.1 General	28
9.1.2 Test equipment and safety requirements	28
9.1.3 Preparation of test objects	28
9.1.4 Conditioning	29
9.1.5 Test voltages	29
9.1.6 PD test procedure.....	30

9.2	Identifying and locating the source of partial discharges	32
10	Interpretation of test results	32
10.1	General.....	32
10.2	Interpretation of PD magnitude, inception and extinction voltage.....	33
10.2.1	Basic interpretation.....	33
10.2.2	Trend in PD in a machine over time	34
10.2.3	Comparisons between winding components or between windings	34
10.3	PD pattern recognition	35
10.3.1	General	35
10.3.2	Basic interpretation.....	35
11	Test report.....	37
Annex A (informative)	Influence parameters of test frequency to testing procedure	39
Annex B (informative)	Alternative methods to determine discharge magnitudes	40
B.1	Q_m , according to definition 3.14.....	40
B.2	Cumulative repetitive PD magnitude Q_r	41
Annex C (informative)	Other off-line methods for PD detection and methods for localization	43
Annex D (informative)	External noise, disturbance and sensitivity	44
D.1	General.....	44
D.2	Sensitivity	44
D.3	Noise and signal-to-noise ratio.....	46
D.4	Disturbances.....	46
Annex E (informative)	Methods of disturbance suppression	47
E.1	Frequency range limiting.....	47
E.2	Phase window masking	47
E.3	Masking by noise signal triggering	47
E.4	Noise signal detection by measuring the propagation time	47
E.5	Two-channel signal difference method	48
E.6	Suppression of constant wave (CW) signals by digital filtering	49
E.7	Noise and disturbance rejection using signal processing techniques	49
Annex F (informative)	Interpretation of PD magnitude data and phase resolved PD patterns	52
F.1	Instructions for interpretation of PRPD patterns	52
F.1.1	Example of PRPD patterns	52
F.1.2	Relative severity of different PD mechanisms	54
F.1.3	Interpretation of the PD measurements from the line side and from the star point	55
F.1.4	Inductive discharges / Vibration sparking.....	55
Annex G (informative)	Test circuits for complete windings	57
G.1	General.....	57
G.2	Schemes and illustrations (see Figure G.1).....	57
Annex H (informative)	Wide-band and narrow-band measuring systems	62
H.1	General.....	62
H.2	Wide band systems.....	63
H.3	Narrow band systems	63
Bibliography.....		64

Figure 1 – Frequency response of a PD pulse and coupling units of various time constants	16
Figure 2 – PD magnitude as a function of the normalized test voltage $Q=f(U/U_{\max})$	18
Figure 3 – Example of a PRPD pattern.....	19
Figure 4 – Basic test circuits in accordance with IEC 60270.....	21
Figure 5 – Test circuit for PD measurement (S1.1) on complete windings	22
Figure 6 – Normalization of the test circuit for measurement S1.1	27
Figure 7 – Test voltage applied to the test object during PD measurement.....	30
Figure 8 – Example for identification and localization of PD sources	36
Figure B.1 – Example for the indication of polarity effect.....	40
Figure B.2 – Effect of A/D conversion accuracy and the calculation of Q_r , Example	42
Figure D.1 – Recharging of the test object by various current components.....	45
Figure E.1 – Without window masking.....	47
Figure E.2 – With window masking.....	47
Figure E.3 – Pulse currents through the measuring circuit	48
Figure E.4 – Example of noise rejection	50
Figure E.5 – Example of cross-talk rejection	51
Figure F.1 – Example of PRPD patterns.....	53
Figure G.1 – Illustrated diagrams for Y- and Δ -connections, according to 7.3	61
Figure H.1 – Typical pulse responses of wide band and narrow band PD systems	62
Table 1 – Connection configuration S1 for open star point	22
Table 2 – Connection configuration S2 for closed star point.....	23
Table 3 – Connection configuration E1 for open star point	23
Table 4 – Connection configuration E2 for closed star point.....	24
Table 5 – Connection configuration I1 for integrated equipment and open star point, measurement on high voltage side.....	24
Table 6 – Connection configuration I2 for integrated equipment and open star point, measurement on star point side	25
Table 7 – Connection configuration I3 for integrated equipment and closed star point.....	25
Table A.1 – Recommended minimum measurement time and maximum slew rates	39
Table F.1 – Severity associated with the main PD sources in rotating machines	54

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

**Part 27-1: Off-line partial discharge measurements
on the winding insulation**

FOREWORD

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International Standard IEC 60034-27-1 has been prepared by IEC technical committee 2: Rotating machinery.

This International Standard cancels and replaces IEC TS 60034-27 (2006). It constitutes a technical revision.

The main technical changes with regard to IEC TS 60034-27 (2006) are as follows:

- In 1st version the scope was not well defined, and open to a too wide range of measurement frequencies. That has been corrected.
- In 1st version pulse magnitude was defined in different ways. Now, 2 definitions are given, one for each method.
- In 1st version the types of PD were erroneous. Especially the definition of the most critical “slot discharges” has been improved.

- Adding one more common test arrangement to Clause 7.
- Adding Annex A.
- Adding Annex B.
- Adding Annex G.
- Moving part of the original text (valid for old fashioned instruments) to new Annex H.

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

FDIS	Report on voting
2/1877/FDIS	2/1887/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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.

NOTE A table of cross-references of all IEC TC 2 publications can be found in the IEC TC 2 dashboard 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 "<http://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

For many years, the measurement of partial discharges (PD) has been employed as a means of assessing the quality of new insulation systems and the condition of aged insulation systems. It is also considered 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 (e.g. the measurement of dissipation factor or insulation resistance) the differentiating character of partial discharge measurements allows PD sources within the insulation system to be detected.

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

- presence of ageing effects and potential defects in the insulating 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 different methods of measurement in existence but also the criteria and methods of analysing and finally assessing the measured data are often different and not comparable. Consequently, there is a 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 (IEC 60034-27-2).

Both of these approaches have advantages and disadvantages with respect to one another. While acknowledging the extensive world-wide use of on-line methods and their proven value to industry, this international standard is confined to off-line techniques. This approach is considered necessary to render this standard sufficiently concise to be of use by non-specialists in the field of PD testing.

Limitations:

When PD measurements are performed on stator windings, several external factors will inevitably affect the result. Consequently, PD measurements are only comparable under certain conditions.

In a factory or site environment, the PD measurement results will be influenced by noise, unless provisions have been made to reduce the influence of noise. Different hardware and software methods, affecting for example measurement frequency band or noise cancellation algorithms, are used in different equipment systems to separate relevant PD signals from noise. Recalculation of the measured PD signal to an equivalent charge is an additional step that will be dependent on the measurement and the calibration equipment that has been used for normalization, as well as the method used.

Measurement conditions including temperature and moisture as well as test object set-up will further affect the PD result. In case of a stator winding, the attenuation and dispersion of the PD pulse during propagation will be dependent on the actual winding design and the origin of the pulse.

Based on the above reasons, absolute PD magnitude limits for the windings of rotating machines, for example as acceptance criteria for production or operation are difficult to define.

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 significantly.

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 (for example insulation failure mechanisms, which are not accompanied by pulse signals due to conductive paths between different elements of the insulation). Pulse signals may further remain undetected in practice due to the impact of electrical noise and disturbance conditions, which limit the detection sensitivity.

For individual bars and coils, absolute limits for PD magnitude are also difficult to establish due to disparities between different test equipment and test setups. Therefore, no absolute limits are given in the current version of this document.

ROTATING ELECTRICAL MACHINES –

Part 27-1: Off-line partial discharge measurements on the winding insulation

1 Scope

This part of IEC 60034 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 winding insulation of rotating electrical machines.

The measurement methods described in this document are applicable to stator windings of machines with or without conductive slot coating and to the stator windings of machines made with form wound or random wound windings. In special cases like high voltage rotor field windings, this document is applicable as well. The measurement methods are applicable when testing with alternating sinusoidal voltages from 0,1 Hz up to 400 Hz.

Interpretation guidelines are given in this document and are applicable only if all the following requirements are fulfilled:

- Measurements performed with power frequency of 50 Hz or 60 Hz, or when testing with power supply within a frequency range of 45 Hz to 65 Hz.
- Form wound windings and winding components such as bars and coils.
- Winding with conductive slot coating. This is usually valid for machines with voltage rating of 6 kV and higher.

For machines with random wound windings, form-wound windings without conductive slot coating, and testing at frequencies differing from power frequencies, the interpretation guidelines are not applicable. The testing procedures for off-line PD-measurements of this document can be used for assessing the uniform quality of manufacturing or/and the trending of these kind of windings as well as converter driven machine windings.

NOTE Testing of low voltage machines with so called Type I insulation systems is defined in reference [10]¹. Testing procedures for qualification of converter driven high voltage machines with so called Type II insulation systems are dealt with in IEC 60034-18-42 (in addition to the optional electric tests described therein).

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.

¹ Numbers in square brackets refer to the Bibliography.