

TECHNICAL SPECIFICATION

IEC TS 61934

First edition
2006-04

**Electrical insulating materials and systems –
Electrical measurement of partial discharges (PD)
under short rise time and repetitive voltage
impulses**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL INSULATING MATERIALS AND SYSTEMS –
ELECTRICAL MEASUREMENT OF PARTIAL DISCHARGES (PD)
UNDER SHORT RISE TIME AND REPETITIVE VOLTAGE IMPULSES**

FOREWORD

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

IEC 61934, which is a technical specification, has been prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems¹.

¹ Provisional title.

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

Enquiry draft	Report on voting
112/13/DTS	112/25/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 bilingual version of this publication may be issued at a later date.

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- withdrawn;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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ELECTRICAL INSULATING MATERIALS AND SYSTEMS – ELECTRICAL MEASUREMENT OF PARTIAL DISCHARGES (PD) UNDER SHORT RISE TIME AND REPETITIVE VOLTAGE IMPULSES

1 Scope

This Technical Specification is applicable to the off-line electrical measurement of partial discharges (PD) that occur in electrical insulation systems (EIS) when stressed by repetitive voltage impulses having a rise time of 50 μ s or less.

Typical applications are EIS belonging to apparatus driven by power electronics, such as motors.

NOTE 1 Use of this document with specific products may require specification of additional procedures.

NOTE 2 Those described in the TS are emerging technologies, so that experience and cautions, as well as certain preconditions, are needed to apply this TS.

Excluded are

- methods based on optical or ultrasonic PD detection,
- fields of application for PD measurements when stressed by non-repetitive impulse voltages.

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

IEC 62068-1:2003, *Electrical insulation systems – Electrical stresses produced by repetitive impulses – Part 1: General method of evaluation of electrical endurance*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply, some of which are taken from IEC 60270 and IEC 62068-1.

3.1

repetitive voltage impulses

impulses that occur when switching of power electronic devices at a carrier or driven frequency

3.2

partial discharge

PD

electric discharge that only partially bridges the insulation between conductors

[IEC 60270:2000, Definition 3.1, modified]

3.3**partial discharge pulse
PD pulse**

current or voltage pulse at the terminal of the object under test that results from a partial discharge occurring within the object under test

NOTE The pulse is measured using suitable detector circuits, which have been introduced into the test circuit for the purpose of the test.

A detector in accordance with the provisions of this technical specification produces a current or a voltage signal at its output related to the PD pulse at its input.

[IEC 60270:2000, Definition 3.2, modified]

3.4**repetitive partial discharge inception voltage
RPDIV**

minimum peak-to-peak voltage at which partial discharges occur with a repetition rate of 1 or more PD pulses per every 2 voltage impulses

NOTE This is a mean value for the specified test time and a test arrangement where the voltage applied to the test object is gradually increased from a value at which no partial discharges can be detected.

3.5**repetitive partial discharge extinction voltage
RPDEV**

maximum peak-to-peak voltage at which partial discharges occur with a repetition rate of less than 1 PD pulse per 2 voltage impulses

NOTE This is a mean value for a specified test time and a test arrangement where the voltage applied to the test object gradually decreases from a voltage at which PD have been detected.

3.6**impulse voltage polarity**

polarity of the applied impulse voltage, with respect to earth

[IEC 62068-1:2003, Definition 3.10]

3.7**unipolar impulse**

repetitive voltage impulse, the polarity of which is either positive or negative

[IEC 62068-1:2003, Definition 3.8, modified]

NOTE The magnitude of the oscillation of the opposite polarity has to be less than 20 %.

3.8**bipolar impulse**

repetitive voltage impulse, the polarity of which changes

[IEC 62068-1:2003, Definition 3.9, modified]

3.9**impulse voltage repetition rate**

inverse of the average time between successive impulses of the same polarity, whether unipolar or bipolar

[IEC 62068-1:2003, Definition 3.11, modified]

3.10**PD pulse repetition rate**

inverse of the average time between successive PD pulses of the same polarity

[IEC 62068-1:2003, Definition 3.11, modified]

3.11**impulse rise time**

time for the voltage impulse to go from 0 % to 100 %

NOTE Unless otherwise stated, this is estimated as 1,25 times the time for the voltage to rise from 10 % to 90 %.
[IEC 62068-1:2003, Definition 3.12, modified]

3.12**rate of impulse voltage rise**

impulse voltage magnitude divided by the rise time, defined in 3.11

3.13**impulse decay time**

time interval between the instants at which the instantaneous value of an impulse decreases from a specified upper value to a specified lower value

NOTE Unless otherwise specified, the upper and lower values are fixed at 90 % and 10 % of the pulse magnitude.

3.14**impulse width**

interval of time between the first and last instants at which the instantaneous value of an impulse reaches a specified fraction of impulse magnitude or a specified threshold

3.15**impulse duty cycle**

ratio, for a given time interval, of the impulse width to the total time

3.16**peak partial discharge magnitude**

largest magnitude of any quantity related to PD pulses permitted in a test object at a specified voltage following a specified conditioning and test

[IEC 60270:2000, Definition 3.4 modified]

NOTE For impulse voltage tests, the peak magnitude of the PD pulse is the largest repeatedly occurring PD magnitude.

4 Measurement of partial discharge pulses during repetitive, short-rise time, voltage impulses and comparison with power frequency**4.1 Measurement frequency**

IEC 60270 describes the methods employed to measure the electrical pulses associated with PD in test objects excited by DC and alternating voltages up to 400 Hz. The methods used to measure PD pulses when the test object is subjected to supply voltage impulses should normally be modified from the standard narrow-band and wide-band frequency methods described in IEC 60270.

To measure the PD during repetitive short rise time voltage impulses, the detector circuit shall be of the ultra-wide band (UWB) type (see 4.6. of IEC 60270, i.e. >400 kHz), where the operating detection range is such that the exciting impulse voltage is strongly suppressed while the PD pulse is not significantly suppressed. IEC 60270 does not suggest specific ultra-wide band detection methods. For the purposes of this technical specification, specific detection methods are required. Types of couplers other than conventional capacitors are permitted in this document.