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Rotating electrical machines -
Part 27-6: On-line partial discharge measurements of rotating machine windings supplied from a converter

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Rotating electrical machines - Part 27-6: On-line partial discharge measurements of rotating machine windings supplied from a converter

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IEC TS 60034-27-6 has been prepared by subcommittee IEC technical committee 2: Rotating machines. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
2/2282/DTS	2/2308/RVDTS

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 Technical Specification 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 https://webstore.iec.ch/ in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

The on-line measurement of partial discharges (PD) is a well-established technology to help assess if deterioration has occurred in the electrical insulation of form-wound stator windings in motors and generators rated 3 kV and above that are directly connected to the 50/60 Hz power system. Such on-line testing helps machine owners determine when stator winding maintenance is required.

IEC 60034-27-2 provides methods for on-line PD detection, as well as advice on interpretation. However, the methods described in IEC 60034-27-2, in general, are not effective when applied to machines connected to most common types of AC frequency converters. This is because the AC fundamental frequency is not fixed, and since some types of drives (and the voltage source PWM converter in particular) produce high voltage impulses that in many respects have the same shape as PD pulses but are orders of magnitude higher than the PD pulses. The interference from the voltage impulses from operating converters can obscure the winding PD and make on-line measurement difficult if not impossible using the methods intended for machines fed from industrial sinusoidal AC voltage.

IEC TS 60034-27-5 is concerned with the off-line measurement of PD in windings caused by voltage impulses from specialized impulse test supplies. Usually, these voltage impulses are few in number per second, and the impulse waveform is well-behaved, reducing the risk of false indications. In contrast there are often thousands of impulses per second from converters, and a variety of impulse voltage waveforms occur, even from the same converter. Although some of the methods in IEC TS 60034-27-5 can produce good results when applied on-line, it is important to apply special provisions if they are used for on-line PD detection in windings supplied by converters.

On-line testing can be relevant for type I windings to confirm that frequent PD caused by converter switching is not occurring in service. On-line testing of type II windings can also be used for insulation condition monitoring to detect if aging processes are increasing the PD activity. Since some machine vendors are being asked to supply on-line PD systems for converter-fed machines, this document is intended to make users aware of the technical reasons why the methods in IEC 60034-27-2 are usually inadequate. It also provides guidance on methods that can be more effective.

Due to the high magnitude sparking that occurs with slip rings, at this time there are no on-line PD systems usable with converter-fed windings supplied via brushes/slip-rings.

This is a rapidly evolving technology with minimally proven systems available at the time of publication. Revisions to this document are expected in the near future as technology advances.

1 Scope

This part of the IEC 60034-27 deals with the on-line electrical detection and monitoring of partial discharges on both motors and generators whose rotor windings or stator windings, or both, are supplied from converters. The tests are applicable to both type I and type II insulation systems, encompassing AC windings rated 300 V and above.

Details of non-electrical methods such as optical or acoustic detection are not included. The on-line measurement of PD where the winding is supplied via slip rings are also not covered.

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

IEC 60034-18-41, *Rotating electrical machines - Part 18-41: Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters - Qualification and quality control tests*

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*

IEC TS 60034-25, *Rotating electrical machines - Part 25: AC electrical machines used in power drive systems - Application guide*

IEC TS 60034-27-5, *Rotating electrical machines - Part 27-5: Off-line measurement of partial discharge inception voltage on winding insulation under repetitive impulse voltage*

IEC 60270, *High-voltage test techniques - Charge-based measurement of partial discharges*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
type I insulation system
insulation systems, or parts of, that are not expected to experience PD activity under the specified rated conditions

3.2
type II insulation system
insulation systems, or parts of, that are expected to withstand PD activity under the specified rated conditions