

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

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NATIONAL FOREWORD

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| See Eesti standard EVS-EN 60034-18-41:2014 sisaldab Euroopa standardi EN 60034-18-41:2014 inglisekeelset teksti. | This Estonian standard EVS-EN 60034-18-41:2014 consists of the English text of the European standard EN 60034-18-41:2014. |
| Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. | This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation. |
| Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 06.06.2014. | Date of Availability of the European standard is 06.06.2014. |
| Standard on kättesaadav Eesti Standardikeskusest. | The standard is available from the Estonian Centre for Standardisation. |

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ICS 29.160

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English Version

**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 60034-18-41:2014)**

Machines électriques tournantes - Partie 18-41: Systèmes
d'isolation électrique sans décharge partielle (Type I)
utilisés dans des machines électriques tournantes
alimentées par des convertisseurs de tension - Essais de
qualification et de contrôle qualité
(CEI 60034-18-41:2014)

Drehende elektrische Maschinen - Teil 18-41: Qualifizierung
und Qualitätsprüfungen für teilentladungsfreie elektrische
Isoliersysteme (Typ I) in drehenden elektrischen
Maschinen, die von Spannungsumrichtern gespeist werden
(IEC 60034-18-41:2014)

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Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 2/1728/FDIS, future edition 1 of IEC 60034-18-41, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60034-18-41:2014.

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) 2015-01-10
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-04-10

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 60034-18-1 | 2010 | Rotating electrical machines Part 18-1: Functional evaluation of insulation systems - General guidelines | EN 60034-18-1 | 2010 |
| IEC 60034-18-21 | - | Rotating electrical machines Part 18-21: Functional evaluation of insulation systems - Test procedures for wire-wound windings - Thermal evaluation and classification | EN 60034-18-21 | - |
| IEC 60034-18-31 | - | Rotating electrical machines Part 18-31: Functional evaluation of insulation systems - Test procedures for form-wound windings - Thermal evaluation and classification of insulation systems used in rotating machines | EN 60034-18-31 | - |
| IEC 60172 | - | Test procedure for the determination of the temperature index of enamelled winding wires | EN 60172 | - |
| IEC 60664-1 | - | Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests | EN 60664-1 | - |
| IEC/TS 60034-18-42 | - | Rotating electrical machines Part 18-42: Qualification and acceptance tests for partial discharge resistant electrical insulation systems (Type II) used in rotating electrical machines fed from voltage converters | CLC/TS 60034-18-42 | - |
| IEC/TS 60034-25 | 2007 | Rotating electrical machines Part 25: Guidance for the design and performance of a.c. motors specifically designed for converter supply | CLC/TS 60034-25 | 2008 |

| | | | | |
|-----------------|---|--|-----------------|---|
| IEC/TS 60034-27 | - | Rotating electrical machines Part 27: Off-line partial discharge measurements on the stator winding insulation of rotating electrical machines | CLC/TS 60034-27 | - |
| IEC/TS 61800-8 | - | Adjustable speed electrical power drive systems Part 8: Specification of voltage on the power interface | - | - |
| IEC/TS 61934 | - | Electrical insulating materials and systems - Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses | - | - |

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INTRODUCTION

The approval of electrical insulation systems for use in rotating electrical machines driven from voltage converters is set out in two IEC documents. They divide the systems into those which are not expected to experience partial discharge activity within specified conditions in their service lives (Type I) and those which are expected to withstand partial discharge activity in any part of the insulation system throughout their service lives (Type II). For both Type I and Type II insulation systems, the drive system integrator (the person responsible for co-ordinating the electrical performance of the entire drive system) shall inform the machine manufacturer what voltage will appear at the machine terminals in service. The machine manufacturer will then decide upon the severity of the tests appropriate for qualifying the insulation system. The severity is based on the impulse rise time, the peak to peak voltage and, in the case of Type II systems, the impulse repetition rate. After installation of the converter/machine system, it is recommended that the drive system integrator measures the phase/phase and phase/ground voltages between the machine terminals and ground to check for compliance.

IEC 60034-18-41

The Type I systems are dealt with in this standard. They are generally used in rotating machines rated at 700 V r.m.s. or less and tend to have random wound windings. The procedures described here are directed at:

- Qualification of the insulation system.
- Type and routine testing of the complete windings of service machines.

Before undertaking any testing, the machine manufacturer shall decide upon the level of severity that the system will be required to withstand. The severity is based on how large the voltage overshoot and how short the impulse rise time will be at the machine terminals. The machine designer then makes a choice from a table in which the range of expected overshoot voltage is divided into bands. Testing is performed at the extreme value of each band. A default value of 0,3 μ s is attributed to the impulse rise time. Other values of impulse rise time or voltage overshoot are dealt with as special cases.

In qualification testing, the insulation system is used to construct various representative test objects. These are subjected to the range of tests described in IEC 60034-18-21 or IEC 60034-18-31 with the addition of a high frequency voltage test and a partial discharge test. For the latter, it may be necessary to use impulse test equipment, as described in IEC/TS 61934. If the test object is partial discharge free under the specified test conditions at the end of the sequence of testing, the insulation system is qualified for the severity band that has been selected.

Type and optional routine tests are performed on complete windings to demonstrate that they are partial discharge free under sinewave or impulse voltage conditions (as appropriate) for the band of severity that the manufacturer has chosen. An impulse voltage insulation class is then assigned to the machine. A mechanism is described for dealing with special cases.

IEC/TS 60034-18-42

The tests for qualification and acceptance of electrical insulation systems chosen for Type II rotating electrical machines are described in this technical specification. These insulation systems are generally used in rotating machines and tend to have form-wound coils, mostly rated above 700 V r.m.s. The qualification procedure is completely different from that used for Type I insulation systems and involves destructive ageing of insulated test objects under accelerated conditions. The rotating machine manufacturer requires a life curve for the insulation system that can be interpreted to provide an estimate of life under the service conditions with converter drive. Great importance is attached to the qualification of any stress grading system that is used and testing here should be performed under repetitive impulse conditions. If the insulation system can be shown to provide an acceptable life under the

appropriate ageing conditions, it is qualified for use. Acceptance testing is performed on coils made using this insulation system when subjected to a voltage endurance test.