

Rotating electrical machines - Part 18-32: Functional evaluation of insulation systems (Type II) - Electrical endurance qualification procedures for form-wound windings

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 60034-18-32:2022 sisaldab Euroopa standardi EN IEC 60034-18-32:2022 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 60034-18-32:2022 consists of the English text of the European standard EN IEC 60034-18-32:2022.
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 and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 04.03.2022.	Date of Availability of the European standard is 04.03.2022.
Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 29.160.01

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis- ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autoriõiguse kaitse kohta, võtke palun ühendust Eesti Standardimis- ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about standards copyright protection, please contact the Estonian Centre for Standardisation and Accreditation: Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Rotating electrical machines - Part 18-32: Functional evaluation
of insulation systems (Type II) - Electrical endurance
qualification procedures for form-wound windings
(IEC 60034-18-32:2022)

Machines électriques tournantes - Partie 18-32: Evaluation
fonctionnelle des systèmes d'isolation (Type II) -
Procédures de qualification de l'endurance électrique pour
enroulements préformés
(IEC 60034-18-32:2022)

Drehende elektrische Maschinen - Teil 18-32: Funktionelle
Bewertung von Isoliersystemen - Elektrische Lebensdauer
Qualifizierungsverfahren für Wicklungen mit vorgeformten
Elementen
(IEC 60034-18-32:2022)

This European Standard was approved by CENELEC on 2022-03-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

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

European foreword

The text of document 2/2068/FDIS, future edition 2 of IEC 60034-18-32, prepared by IEC/TC 2 "Rotating machinery" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60034-18-32:2022.

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) 2022-12-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-03-01

This document supersedes EN 60034-18-32:2010 and all of its amendments and corrigenda (if any).

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 60034-18-32:2022 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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60034-1	-	Rotating electrical machines - Part 1: Rating and performance	EN 60034-1 ¹	-
IEC 60034-15	2009	Rotating electrical machines - Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines	EN 60034-15	2009
IEC 60034-18-1	2010	Rotating electrical machines - Part 18-1: Functional evaluation of insulation systems - General guidelines	EN 60034-18-1	2010
IEC/TS 60034-18-33	2010	Rotating electrical machines - Part 18-33: Functional evaluation of insulation systems - Test procedures for form-wound windings - Multifactor evaluation by endurance under simultaneous thermal and electrical stresses	CLC/TS 60034-18-33	2011
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	EN 60034-18-41	-
IEC 60034-18-42	2017	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	2017
+ A1	2020		+ A1	2020
IEC 60034-27-1	-	Rotating electrical machines - Part 27-1: Off-line partial discharge measurements on the winding insulation	EN IEC 60034-27-1	-

¹ Under preparation. Stage at the time of publication: FprEN 60034-1 and FprEN 60034-1/prAA.

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 60216-4-1	-	Electrical insulating materials - Thermal endurance properties - Part 4-1: Ageing ovens - Single-chamber ovens	EN 60216-4-1	-
IEC 62539	-	Guide for the statistical analysis of electrical insulation breakdown data	-	-

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Rotating electrical machines –
Part 18-32: Functional evaluation of insulation systems (Type II) –
Electrical endurance qualification procedures for form-wound windings**

**Machines électriques tournantes –
Partie 18-32: Évaluation fonctionnelle des systèmes d'isolation (Type II) –
Procédures de qualification de l'endurance électrique pour enroulements
préformés**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2022 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Rotating electrical machines –
Part 18-32: Functional evaluation of insulation systems (Type II) –
Electrical endurance qualification procedures for form-wound windings**

**Machines électriques tournantes –
Partie 18-32: Évaluation fonctionnelle des systèmes d'isolation (Type II) –
Procédures de qualification de l'endurance électrique pour enroulements
préformés**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.160.01

ISBN 978-2-8322-1047-8

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 General considerations.....	9
4.1 Relationship to IEC 60034-18-1	9
4.2 Selection and designation of test procedures	9
4.3 Reference insulation system	9
4.4 Test procedures.....	9
4.4.1 General	9
4.4.2 Electrical ageing of the mainwall insulation.....	9
4.4.3 Electrical ageing of the stress control system	10
4.4.4 Electrical ageing of the turn insulation	10
4.5 Extent of tests.....	10
4.5.1 Full evaluation of the mainwall insulation.....	10
4.5.2 Reduced evaluation of the mainwall insulation.....	10
4.5.3 Evaluation of the stress control system.....	10
5 Test objects.....	10
5.1 Construction of test objects.....	10
5.2 Number of test specimens.....	11
5.3 Initial quality control tests	11
6 Electrical ageing.....	11
6.1 General.....	11
6.2 Voltage levels and intended test lives of the mainwall insulation	11
6.3 Test temperatures during electrical endurance testing of the mainwall insulation	11
6.3.1 Electrical ageing at room temperature	11
6.3.2 Electrical ageing at elevated temperature	12
6.3.3 Ageing procedure for the mainwall insulation	12
6.4 Maintenance of stress control coatings	12
7 Diagnostic sub-cycle.....	12
7.1 General.....	12
7.2 Voltage test of the mainwall insulation	12
7.3 Other diagnostic tests	13
8 Failures of the mainwall insulation	13
8.1 Failure location and verification.....	13
8.2 Failed specimen observations	13
9 Functional evaluation of the mainwall data	13
9.1 General.....	13
9.2 Full evaluation (same voltage level and same expected service life)	13
9.3 Reduced evaluation (same voltage level and same expected service life)	15
9.4 Recommended data to be recorded	16
9.5 Determining qualification for performances different to the reference system	17
9.5.1 Overview	17

9.5.2	Case B: Qualification for the same phase to phase voltage and a different expected service life	17
9.5.3	Case C: Qualification for different voltage level and same expected service life	18
9.5.4	Case D: Qualification for different voltage level and different expected service life	19
9.5.5	Non-linearity of regression lines.....	20
Annex A (normative) Reference life line for mainwall insulation in the absence of a manufacturer's reference life line		21
Annex B (informative)		22
B.1	Electrical ageing of the conductive slot coating	22
B.2	Electrical ageing of the stress control coating	22
B.3	Test objects	22
B.4	Evaluation of the stress control system	22
B.5	Ageing procedure for the conductive slot and stress control coating.....	23
B.5.1	General	23
B.5.2	Arrangement of temperature control by heater plates.....	23
B.5.3	Heating by means of an oven	23
B.5.4	Test parameter	23
B.6	Qualification of the stress control system	24
B.6.1	General	24
B.6.2	Test procedure	24
B.6.3	Test pass criteria	24
B.7	Examples of deterioration marks at the stress control system	25
Figure 1 – Comparison of ageing data from candidate (C) and reference (R) insulation systems showing qualification		14
Figure 2 – Comparison of ageing data from candidate and reference insulation systems showing failure to qualify		15
Figure 3 – Comparison of reduced evaluation test data from four separate candidate systems with that from the reference system.....		16
Figure 4 – Candidate system qualified for the same voltage level and different expected service life		18
Figure 5 – Candidate system qualified for a higher voltage level and the same expected service life		19
Figure 6 – Candidate system qualified for a different service life and different voltage level from the reference		20
Figure A.1 – Reference lifeline for mainwall insulation		21
Figure B.1 – Application of heater elements to a stator bar		23
Figure B.2 – Typical deterioration mark at the conductive slot coating		25
Table 1 – Conditions for qualification of candidate system		17
Table B.1 – Phase to ground test voltages and test temperatures		24

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

**Part 18-32: Functional evaluation of insulation systems (Type II) –
Electrical endurance qualification procedures for form-wound windings**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60034-18-32 has been prepared by IEC technical committee 2: Rotating machinery. It is an International Standard.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Title modified.
- b) Simplification of clauses.
- c) Reduction in the number of test procedures.
- d) Inclusion of full bars and coils as test objects.
- e) A new clause dealing with failures and failure criteria.

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

Draft	Report on voting
2/2068/FDIS	2/2075/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.

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.

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/standardsdev/publications.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 60034-18-1 presents general principles for the evaluation of insulation systems used in rotating electrical machines.

This document deals exclusively with insulation systems for form-wound windings (Type II) and concentrates on electrical functional evaluation.

In IEC 60034-18-42, tests are described for qualification of Type II insulation systems in voltage-source converter operation. These insulation systems are generally used in rotating machines which have form-wound windings, mostly rated above 700 V r.m.s. The two standards IEC 60034-18-41 and IEC 60034-18-42 separate 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 experience and withstand partial discharge activity in any part of the insulation system throughout their service lives (Type II).

This document is a preview generated by EVS