Rotating electrical machines - Part 18-1: Functional evaluation of insulation systems - General guidelines

EESTI STANDARDIKESKUS
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NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 60034-18-1:2010 sisaldab Euroopa standardi EN 60034-18-1:2010 ingliskeelset teksti.	This Estonian standard EVS-EN 60034-18-1:2010 consists of the English text of the European standard EN 60034-18-1:2010.
Standard on kinnitatud Eesti Standardikeskuse 31.05.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.	This standard is ratified with the order of Estonian Centre for Standardisation dated 31.05.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.
Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 22.01.2010.	Date of Availability of the European standard text 22.01.2010.
Standard on kättesaadav Eesti standardiorganisatsioonist.	The standard is available from Estonian standardisation organisation.

ICS 29.160

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60034-18-1

May 2010

ICS 29.160

Supersedes EN 60034-18-1:1994 + A1:1996

English version

Rotating electrical machines - Part 18-1: Functional evaluation of insulation systems - General guidelines

(IEC 60034-18-1:2010)

Machines électriques tournantes - Partie 18-1: Evaluation fonctionnelle des systèmes d'isolation - Principes directeurs généraux (CEI 60034-18-1:2010)

Drehende elektrische Maschinen - Teil 18-1: Funktionelle Bewertung von Isoliersystemen - Allgemeine Richtlinien (IEC 60034-18-1:2010)

This European Standard was approved by CENELEC on 2010-05-01. 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 Central Secretariat or to any CENELEC member.

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60034-18-1:2010 E

Foreword

The text of document 2/1583/FDIS, future edition 2 of IEC 60034-18-1, prepared by IEC TC 2, Rotating machinery, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60034-18-1 on 2010-05-01.

This European Standard supersedes EN 60034-18-1:1994 + A1:1996.

This EN 60034-18-1:2010 includes the following significant technical changes with respect to EN 60034-18-1:1994 + A1:1996:

– provides general guidelines for functional evaluation of different types of windings as before but beyond that for electrical evaluation of windings which are electrically stressed by converter-supply;

– is now focused on general guidelines with all technical details of procedures and qualification principles moved to the subsequent parts;

– details additional general aspects of functional evaluation, particularly the statistical procedure for comparison between reference and candidate insulation systems and the evaluation of minor component or manufacturing changes;

– contains a new acceptance test for verifying the expected production quality level of the insulation systems;

– restricts the classification of insulation systems as a result of the functional evaluation to thermal classification. Other kinds of classifications (classes) of insulation systems no longer exist.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2011-02-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-05-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60034-18-1:2010 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 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60034-1	-	Rotating electrical machines - Part 1: Rating and performance	EN 60034-1	-
IEC 60034-18-21	-	Rotating electrical machines - Part 18: Functional evaluation of insulation systems - Section 21: Test procedures for wire-wound windings - Thermal evaluation and classification	EN 60034-18-21	-
IEC 60034-18-22	-	Rotating electrical machines - Part 18-22: Functional evaluation of insulation systems - Test procedures for wire-wound windings - Classification of changes and insulation component substitutions	EN 60034-18-22	-
IEC 60034-18-31	-	Rotating electrical machines - Part 18: Functional evaluation of insulation systems - Section 31: Test procedures for form-wound windings - Thermal evaluation and classification of insulation systems used in machines up to and including 50 MVA and 15 kV	EN 60034-18-31	-
IEC/TR 60034-18-32	-	Rotating electrical machines - Part 18-32: Functional evaluation of insulation systems - Test procedures for form-wound windings - Electrical evaluation of insulation systems used in machines up to and including 50 MVA and 15 kV	CLC/TR 60034-18-32	-
IEC/TR 60034-18-33	-	Rotating electrical machines - Part 18-33: Functional evaluation of insulation systems - Test procedures for form-wound windings - Multifactor functional evaluation - Endurance under combined thermal and electrical stresses of insulation systems used in machines up to and including 50 MVA and 15 kV	CLC/TR 60034-18-33	-

Publication	Year	Title	EN/HD	Year
IEC/TS 60034-18-34	-	Rotating electrical machines - Part 18-34: Functional evaluation of insulation systems - Test procedures for form-wound windings - Evaluation of thermomechanical endurance of insulation systems	CLC/TS 60034-18-34	-
IEC/TS 60034-18-41	-	Rotating electrical machines - Part 18-41: Qualification and type tests for Type I electrical insulation systems used in rotating electrical machines fed from voltage converters	-	-
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	-	-
IEC 60085	-	Electrical insulation - Thermal evaluation and designation	EN 60085	-
IEC 60216	Series	Electrical insulating materials - Properties of thermal endurance	EN 60216	Series
IEC 60493-1	-	Guide for the statistical analysis of ageing test data - Part 1: Methods based on mean values of normally distributed test results	-	-
IEC 60505	2004	Evaluation and qualification of electrical insulation systems	EN 60505	2004
IEC 62539	-	Guide for the statistical analysis of electrical insulation breakdown data	-	-

CONTENTS

INTRODUCTION

IEC 60034-18 comprises several parts, dealing with different types of functional evaluation and special kinds of test procedures for insulation systems of rotating electrial machines. IEC 60034-18-1 provides general guidelines for such procedures and qualification principles, whereas the subsequent parts IEC 60034-18-21, IEC 60034-18-22, IEC 60034-18-31, IEC 60034-18-32, IEC 60034-18-33, IEC 60034-18-34, IEC 60034-18-41 and IEC 60034-18-42 give detailed procedures for the various types of windings. Beyond that, part IEC 60034-18-41 and IEC 60034-18-42 contain special test procedures for electrical evaluation of windings electrically stressed by converter-supply.

The following standards provide the basis and background for the development of the previous standards:

IEC 60505 establishes the basis for estimating the ageing of electrical insulation systems under conditions of either electrical, thermal, mechanical, environmental stresses or combinations of these (multifactor stresses). It specifies the general principles and procedures that should be followed defining functional test and evaluation procedures.

The IEC 60216 series deals with the determination of thermal endurance properties of single insulating materials. On the assumption, that the Arrhenius equations describe the rate of thermal ageing, test procedures and analyzing instructions for getting characteristic parameters like the “Temperature index” (TI), the “Halving interval” (HIC) and the “Relative thermal endurance index” (RTE) are given. For all these parameters selected properties and accepted end-point-criteria are specified. Consequently, a material may be assigned with more than one temperature index, derived from the measurement of different properties and the use of different end-point criteria.

IEC 60085 deals with thermal evaluation of insulation systems used in electrical equipment. In particular, thermal classes of insulation systems are defined and designations are given, such as 130 (B), 155 (F) and 180 (H) for use in rotating machines belonging to IEC 60034-1. In the past, materials for insulation systems were often selected solely on the basis of thermal endurance of individual materials performed according to the IEC 60216 series. However, IEC 60085 recognizes that such selection may be used only for screening materials prior to further functional evaluation of a new insulation system which is not service-proven. Evaluation is performed on the basis of a comparison with a service-proven reference insulation system. Service experience is the preferred basis for assessing the thermal endurance of an insulation system.

IEC 62539 defines statistical methods to analyse times to breakdown and breakdown voltage data obtained from electrical testing of solid insulation materials, for the purposes of characterization of the system and comparison with other insulation systems. The methods of analysis are described for the Weibull-distribution but other distributions are also presented.

ROTATING ELECTRICAL MACHINES –

Part 18-1: Functional evaluation of insulation systems – General guidelines

1 Scope

This part of IEC 60034 deals with the general guidelines for functional evaluation of electrical insulation systems, used or proposed to be used in rotating electrical machines within the scope of IEC 60034-1, in order to qualify them.

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 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

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*

IEC 60034-18-22, *Rotating electrical machines – Part 18-22: Functional evaluation of insulation systems – Test procedures for wire-wound windings – Classification of changes and insulation component substitutions*

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 machines up to and including 50 MVA and 15 kV*

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 of insulation systems used in machines up to and including 50 MVA and 15 kV*

IEC 60034-18-33, *Rotating electrical machines – Part 18-33: Functional evaluation of insulation systems – Test procedures for form-wound windings – Multifactor functional evaluation – Endurance under combined thermal and electrical stresses of insulation systems used in machines up to and including 50 MVA and 15 kV*

IEC 60034-18-34, *Rotating electrical machines – Part 18-34: Functional evaluation of insulation systems – Test procedures for form-wound windings – Evaluation of thermomechanical endurance of insulation systems*

IEC 60034-18-41, *Rotating electrical machines – Part 18-41: Qualification and type tests for Type I electrical insulation systems used in rotating electrical machines fed from voltage converters*

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*

IEC 60085, *Thermal evaluation and designation of electrical insulation*

IEC 60216 (all parts), *Electrical insulating materials – Properties of thermal endurance*

IEC 60493-1, *Guide for the statistical analysis of ageing test data – Part 1: Methods based on mean values of normally distributed test results*

IEC 60505:2004, *Evaluation and qualification of electrical insulation systems*

IEC 62539, *Guide for the statistical analysis of electrical insulation breakdown data*

3 Terms and definitions

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

3.1 General terms

3.1.1
class temperature
temperature for which the insulation system is suitable, as defined by the thermal class in IEC 60085 and as used in IEC 60505

3.1.2
insulation system
insulating structure containing one or more electrical insulating materials applied over conducting parts employed in rotating electrical machines

[IEC 60505:2004, 3.1.1, modified]

NOTE 1 There may be several insulation components within the windings, each being designed for different stresses in service, i.e. turn insulation, slot insulation and end-winding insulation. Different criteria may be applied to the various components within the overall system.

NOTE 2 There may be more than one insulation system in a particular type of machine. These insulation systems may have different thermal classes (e.g. stator and rotor windings).

3.1.3
candidate insulation system
insulation system being tested to determine its capability with respect to ageing factors

[IEC 60050-411, Amendment 1:2007, 411-39-26, modified]

3.1.4
reference insulation system
insulation system whose performance has been established by satisfactory service experience

[IEC 60050-411, Amendment 1:2007, 411-39-27]

3.1.5
coil
one or more turns of insulated conductors connected in series and surrounded by common insulation, arranged to link or produce magnetic flux

[IEC 60050-411:1996, 411-38-03, modified]

3.1.6
bar
either of two parts which, after placed in their slots and when connected together, will form the complete form-wound coil (see 3.1.8) and which comprise a coil side and an appropriate end winding