

**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  
(IEC/TS 60034-18-33:2010)**

Machines électriques tournantes -  
Partie 18-33: Évaluation fonctionnelle des  
systèmes d'isolation -  
Procédures d'essai pour enroulements  
préformés -  
Évaluation fonctionnelle à plusieurs  
facteurs par endurance sous contraintes  
thermiques et électriques simultanées des  
systèmes d'isolation utilisés dans les  
machines électriques tournantes  
(CEI/TS 60034-18-33:2010)

Drehende elektrische Maschinen -  
Teil 18-33: Funktionale Bewertung von  
Isoliersystemen -  
Prüfverfahren für die multifunktionelle  
Bewertung von Wicklungen mit  
vorgeformten Elementen bei gleichzeitiger  
thermischer und elektrischer  
Beanspruchung der Isoliersysteme von  
drehenden Maschinen  
(IEC/TS 60034-18-33:2010)

This Technical Specification was approved by CENELEC on 2011-02-21.

CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of the Technical Specification IEC/TS 60034-18-33:2010, prepared by IEC TC 2, Rotating machinery, was submitted to the formal vote and was approved by CENELEC as CLC/TS 60034-18-33 on 2011-02-21.

This European Standard supersedes CLC/TR 60034-18-33:2004.

The main changes with respect to CLC/TR 60034-18-33:2004 are as follows:

- a) the requirement to investigate the nature of interactions between thermal and electrical stresses has been abandoned;
- b) the use of single stress acceleration factors has been removed;
- c) the selection of stress levels has been adjusted and the temperatures are now related to the thermal class temperature of the insulation system;
- d) the introduction of end-point criteria;
- e) a simplified method to display results.

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 date was fixed:

- latest date by which the existence of the CLC/TS  
has to be announced at national level (doa) 2011-08-21

Annex ZA has been added by CENELEC.

---

## Endorsement notice

The text of the Technical Specification IEC/TS 60034-18-33:2010 was approved by CENELEC as a Technical Specification without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60034-18-32      NOTE Harmonized as EN 60034-18-33.

## 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60034-15	-	Rotating electrical machines - Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines	EN 60034-15	-
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 60034-18-42 -		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 60085	-	Electrical insulation - Thermal evaluation and designation	EN 60085	-
IEC 60505	-	Evaluation and qualification of electrical insulation systems	EN 60505	-
IEC 62539	-	Guide for the statistical analysis of electrical insulation breakdown data	-	-

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 General description of test procedures .....	8
3.1 Relationship to other standards .....	8
3.2 Test procedures .....	8
3.3 Reference insulation system.....	8
3.4 Characteristics of test procedures .....	8
3.4.1 General characteristics .....	8
3.4.2 Ageing sub-cycle .....	8
3.4.3 Conditioning and diagnostic sub-cycle .....	8
3.5 Means of heating and definition of thermal stress level.....	8
3.5.1 Methods of heating .....	8
3.5.2 Thermal stress level .....	9
3.5.3 Temperature measuring techniques .....	9
3.6 Means of electrical ageing.....	9
3.7 Definition of ageing sub-cycle duration .....	9
3.8 Reference operating conditions .....	10
3.8.1 General .....	10
3.8.2 Reference ageing factors.....	10
3.8.3 Reference conditioning factors .....	10
3.8.4 Reference diagnostic factors .....	10
4 Test objects.....	10
4.1 Construction of test objects .....	10
4.1.1 General aspects .....	10
4.1.2 Considerations on turns and strands in test objects .....	10
4.2 Number of test specimens .....	11
4.3 Initial quality control tests .....	11
4.4 Initial diagnostic tests.....	11
5 Ageing sub-cycle .....	11
5.1 Ageing stress levels .....	11
5.2 Acceleration factors.....	11
5.3 Duration and number of ageing sub-cycles .....	12
5.4 Full multifactor testing procedure .....	12
5.5 Single-point testing procedure .....	12
6 Conditioning and diagnostic sub-cycle .....	12
6.1 General.....	12
6.2 Mechanical tests .....	13
6.2.1 General mechanical test .....	13
6.2.2 Shake-table test .....	13
6.3 Moisture tests.....	13
6.3.1 General moisture test .....	13
6.3.2 Moisture test with water immersion .....	13
6.4 Voltage tests .....	13
6.5 Other diagnostic tests.....	14

7	End point criteria .....	14
8	Analyzing the data, reporting and evaluation .....	14
8.1	Analyzing the data.....	14
8.2	Reporting .....	14
8.3	Evaluation .....	14
	Bibliography.....	15
	Table 1 – Guidelines for the selection of stress levels.....	11

## INTRODUCTION

This document is being issued as a technical specification (according to the ISO/IEC Directives, Part 1, 3.1.1.1) for provisional application in the field of insulation systems for rotating electrical machines, because there is a need for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an International Standard. It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the IEC Central Office.

Part 18-1 of IEC 60034 presents general guidelines for the evaluation and classification of insulation systems used in rotating machines.

Part 18-33 deals exclusively with insulation systems for form-wound windings and concentrates on multifactor functional evaluation under simultaneous thermal and electrical ageing.

## 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**

#### **1 Scope**

This part of IEC 60034-18 describes procedures for evaluation of insulation systems by endurance testing where thermal and electrical stresses are applied simultaneously. The procedures are intended for insulation systems used, or proposed to be used, in a.c. electrical machines using form-wound windings. The test procedures provide a comparison of performance between reference and candidate systems at combinations of voltage and temperature which have been used separately to assess quality in the past and which are chosen to produce failures within a suitable timescale and at stresses within practical limits. The outcome of the test on the candidate insulation system will indicate whether it is better or worse than the reference system with proven service experience but will not enable a lifetime in service to be calculated. The evaluation described in this technical specification does not include stress grading.

The test procedures in this technical specification are not intended to establish the interaction between thermal and electrical stress in the ageing process nor endurance lines. If additional information is required on this interaction or in order to achieve endurance lines, it is necessary to undertake further tests in which electrical ageing is carried out at constant temperature and different voltages (IEC 60034-18-32) and thermal ageing is performed at different temperatures and constant voltage.

#### **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 60034-15, *Rotating electrical machines – Part 15: Impulse voltage withstand levels of form-wound stator coils for rotating a.c. machines*

IEC 60034-18-1:2010, *Rotating electrical machines – Part 18-1: Functional evaluation of insulation systems – General guidelines*

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*

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

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