

**01-junij-1999**

---

**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 (IEC 60034-18-31:1992)**

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 (IEC 60034-18-31:1992)

**(standards.iteh.ai)**

Drehende elektrische Maschinen -- Teil 18: Funktionelle Bewertung von Isoliersystemen -- Hauptabschnitt 31: Prüfverfahren für Wicklungen mit vorgeformten Elementen - Thermische Bewertung und Klassifizierung von Isoliersystemen für Maschinen bis einschließlich 50 MVA und 15 kV

Machines électriques tournantes -- Partie 18: Evaluation fonctionnelle des systèmes d'isolation -- Section 31: Procédures d'essai pour enroulements préformés - Evaluation thermique et classification des systèmes d'isolation utilisés dans les machines jusqu'à et y compris 50 MVA et 15 kV

**Ta slovenski standard je istoveten z: EN 60034-18-31:1994**

---

**ICS:**

|           |                              |                               |
|-----------|------------------------------|-------------------------------|
| 29.080.30 | Izolacijski sistemi          | Insulation systems            |
| 29.160.01 | Rotacijski stroji na splošno | Rotating machinery in general |

**SIST EN 60034-18-31:1999**

**en**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 60034-18-31:1999](#)

<https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-b1a9e37fd4d/sist-en-60034-18-31-1999>

UDC 621.313:621.315.6:620.1:621.317.08

Descriptors: Rotating electrical machine, electrical insulation, winding, test, thermal endurance test, operate characteristic, classification

### ENGLISH VERSION

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 15kV  
(IEC 34-18-31:1992)

Machines électriques tournantes  
Partie 18: Evaluation fonctionnelle des systèmes d'isolation  
Section 31: Procédures d'essai pour enroulements préformés  
Evaluation thermique et classification des systèmes d'isolation utilisés dans les machines jusqu'à et y compris 50 MVA et 15 kV  
(CEI 34-18-31:1992)

Drehende elektrische Maschinen  
Teil 18: Funktionelle Bewertung von Isoliersystemen für drehende elektrische Maschinen  
Hauptabschnitt 31:  
Prüfverfahren für Wicklungen mit vorgeformten Elementen  
Thermische Bewertung und Klassifizierung von Isoliersystemen für Maschinen bis einschließlich 50 MVA und 15 kV  
(IEC 34-18-31:1992)

<https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-b1a9e37fd4d/sist-en-60034-18-31-1999>

This European Standard was approved by CENELEC on 1993-12-08. 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.

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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

### CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

#### FOREWORD

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 34-18-31:1992 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 60034-18-31 on 8 December 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-03-15
- latest date of withdrawal of conflicting national standards (dow) 1995-03-15

For products which have complied with the relevant national standard before 1995-03-15, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-03-15.

Annexes designated "informative" are given only for information. In this standard, annex A is informative.

<https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-b1a9e37fd4d/sist-en-60034-18-31-1999>

#### ENDORSEMENT NOTICE

The text of the International Standard IEC 34-18-31:1992 was approved by CENELEC as a European Standard without any modification.

-----

**NORME  
INTERNATIONALE  
INTERNATIONAL  
STANDARD**

**CEI  
IEC  
34-18-31**

Première édition  
First edition  
1992-07

---



---

**Machines électriques tournantes**

**Partie 18:**

Evaluation fonctionnelle des systèmes d'isolation  
Section 31: Procédures d'essai pour enroulements  
préformés – Evaluation thermique et classification  
des systèmes d'isolation utilisés dans les machines

**jusqu'à et y compris 50 MVA et 15 kV  
(standards.iteh.ai)**

**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

© CEI 1992 Droits de reproduction réservés — Copyright — all rights reserved

Aucune partie de cette publication ne peut être reproduite ni  
utilisée sous quelque forme que ce soit et par aucun pro-  
cédé, électronique ou mécanique, y compris la photocopie et  
les microfilms, sans l'accord écrit de l'éditeur.

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 the publisher.

Bureau Central de la Commission Electrotechnique Internationale 3, rue de Varembe Genève, Suisse



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

CODE PRIX  
PRICE CODE

**N**

Pour prix, voir catalogue en vigueur  
For price, see current catalogue

## CONTENTS

|   | Page |
|---|------|
| FOREWORD .....                                      | 5    |
| INTRODUCTION .....                                  | 7    |
| Clause  |      |
| 1 Scope .....                                       | 9    |
| 2 Normative references .....                        | 9    |
| 3 General considerations .....                      | 9    |
| 3.1 Relationship to Section 1 .....                 | 9    |
| 3.2 Designation of test procedures .....            | 9    |
| 3.3 Reference insulation system .....               | 11   |
| 3.4 Verification of diagnostic tests .....          | 11   |
| 4 Test objects and test specimens .....             | 13   |
| 4.1 Construction of test objects .....              | 13   |
| 4.2 Number of test specimens .....                  | 13   |
| 4.3 Quality assurance tests .....                   | 13   |
| 4.4 Initial diagnostic tests .....                  | 13   |
| 5 Thermal ageing sub-cycles .....                   | 13   |
| 5.1 Ageing temperatures and sub-cycle lengths ..... | 13   |
| 5.2 Means of heating .....                          | 15   |
| 5.3 Ageing procedure .....                          | 15   |
| 6 Diagnostic sub-cycle .....                        | 15   |
| 6.1 Mechanical test .....                           | 15   |
| 6.2 Moisture test .....                             | 17   |
| 6.3 Voltage test .....                              | 19   |
| 6.4 Other diagnostic tests .....                    | 21   |
| 7 Analyzing, reporting and classification .....     | 21   |
| Annex A - Formette construction (example) .....     | 23   |
| Figures .....                                       | 24   |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## 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**

## FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

INTERNATIONAL STANDARD PREVIEW  
 (standards.iteh.ai)

This section of International Standard IEC 34-18 has been prepared by Sub-Committee 2J: Classification of insulation systems for rotating machinery, of IEC Technical Committee No. 2: Rotating machinery.

<https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-b1a9e37fd4d/sist-en-60034-18-31-1999>

The text of this section is based on the following documents:

| Six Months' Rule | Report on Voting |
|------------------|------------------|
| 2J(CO)6          | 2J(CO)10         |

Full information on the voting for the approval of this section can be found in the Voting Report indicated in the above table.

This standard forms section 31 of a series of publications dealing with functional evaluation of insulation systems for rotating electrical machines, other parts being:

Section 1: General guidelines (IEC 34-18-1)

Section 21: Test procedures for wire-wound windings (IEC 34-18-21).

Annex A is for information only.

## INTRODUCTION

Section 1 of IEC 34-18 presents general guidelines for the evaluation and classification of insulation systems used in rotating electrical machines.

Section 31 deals exclusively with insulation systems for form-wound windings.

This section gives test procedures for thermal evaluation and classification.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 60034-18-31:1999

<https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-b1a9e37fd4d/sist-en-60034-18-31-1999>



## 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

#### 1 Scope

This section of IEC 34-18 gives test procedures for the thermal evaluation and classification of insulation systems used or proposed for use in a.c. or d.c. rotating electrical machines up to and including 50 MVA and 15 kV using form-wound windings. The test procedures are comparative in that the performance of a candidate insulation system is compared to that of a reference insulation system with proven service experience.

Section 31 shall be used in conjunction with Section 1.

#### NOTES

- 1 At the present time limited experience exists on insulation systems above 6,6 kV, using the test procedures given in this section.
- 2 Large machines, especially those using bars, may require special thermal evaluation test procedures which are not included in this section.

(standards.iteh.ai)

#### 2 Normative references

[SIST EN 60034-18-31:1999](https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-9e37fd4d/sist-en-60034-18-31-1999)

[https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-](https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-9e37fd4d/sist-en-60034-18-31-1999)

Clause 2 of Section 1 is applicable. [9e37fd4d/sist-en-60034-18-31-1999](https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-9e37fd4d/sist-en-60034-18-31-1999)

#### 3 General considerations

##### 3.1 Relationship to Section 1

Section 1 describes general testing principles applicable to thermal endurance testing of insulation systems in rotating electrical machines. Unless the procedures of this section indicate otherwise, the principles of Section 1 shall be followed.

##### 3.2 Designation of test procedures

Each thermal endurance test is performed in cycles, each cycle consisting of a thermal ageing sub-cycle and a diagnostic sub-cycle. The diagnostic tests may include a mechanical test, a moisture test, voltage tests and other diagnostic tests, performed in that order. Diagnostic tests shall be chosen from those listed in clause 6; not all of the tests need necessarily be applied in a particular evaluation procedure.

NOTE - The thermal classification of an insulation system may depend on the selected diagnostic procedure.

The following choices for a mechanical test are given in 6.1:

- A general mechanical test, with stresses comparable to service stresses;
- B shake-table test, with specified vibrational amplitude;
- S special mechanical test;
- N no mechanical test.

The following choices for a moisture test are given in 6.2:

- A general moisture test;
- B moisture test with water immersion;
- S special moisture test;
- N no moisture test.

The following choices for a voltage test are given in 6.3:

- A general voltage test;
- B voltage test of immersed test specimens;
- S special voltage test;
- N no voltage test.

The following choices for other diagnostic tests are given in 6.4:

- A informative diagnostic tests;
- S diagnostic tests used for end-point determination;
- N no other diagnostic test.

A test procedure shall be referred to as:

*IEC 34-18-31, Procedure MHED*

where

M is the mechanical test A, B, S, or N, according to 6.1;

H is the moisture test A, B, S, or N, according to 6.2;

E is the voltage test A, B, S, or N, according to 6.3;

D is the other diagnostic test A, S, or N, according to 6.4.

*Example:* Insulation system "Nec plus ultra" has been assigned thermal class F, according to IEC 34-18-31 Procedure BAAN.

### 3.3 Reference insulation system

A reference insulation system shall be tested using a test procedure equivalent to that for the candidate system (see Section 1).

### 3.4 Verification of diagnostic tests

Preliminary ageing tests according to 5.3.4 of Section 1 to check the feasibility of the diagnostic sub-cycle, may be performed, when appropriate.

## 4 Test objects and test specimens

### 4.1 Construction of test objects

Tests for the selection of materials according to 5.2.1 of Section 1 may be performed, as appropriate.

Test objects may be actual machines, machine components or models. The components and models should embody all the essential elements.

Insulation thickness, creepage distances, and discharge protection, where required, shall be appropriate for the intended maximum rated voltage and equipment standards or practices.

Test specimens simulating parts of a coil or winding may be used for evaluation, if stresses acting on these parts in service can be reliably reproduced in the test.

Particular types of models, known as formettes, have been used successfully in some countries and examples of these are illustrated in annex A.

### 4.2 Number of test specimens

An adequate number of test specimens should be used at each ageing temperature for each insulation system to obtain good statistical confidence. This number should be not less than five.

### 4.3 Quality assurance tests

SIST EN 60034-18-31:1999

<https://standards.iteh.ai/catalog/standards/sist/b62ce0dc-90c3-4592-828e-4194c0d04431/iec-60034-18-31-1999>

Before starting the first thermal ageing sub-cycle, the following quality assurance tests shall be performed:

- visual inspection of the test specimens;
- high-voltage tests according to IEC 34-1.

### 4.4 Initial diagnostic tests

Each completed test object shall be subjected to all the diagnostic tests selected for the test procedure before starting the first thermal ageing sub-cycle.

## 5 Thermal ageing sub-cycles

### 5.1 Ageing temperatures and sub-cycle lengths

#### 5.1.1 Normal procedure

In accordance with 5.3.2.1 of Section 1, the normal ageing procedure requires test specimens to be aged at not less than three temperatures.

Ageing temperatures and lengths of ageing sub-cycles may be selected from table 2 of Section 1.