

# INTERNATIONAL STANDARD

# IEC 60034-18-22

Second edition  
2000-06

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## Rotating electrical machines –

### Part 18-22:

### Functional evaluation of insulation systems – Test procedures for wire-wound windings – Classification of changes and insulation component substitutions

### *Machines électriques tournantes –*

### *Partie 18-22:*

### *Évaluation fonctionnelle des systèmes d'isolation – Procédures d'essai pour enroulement à fils – Classification des modifications et des substitutions de composants d'isolations*



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## Numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series.

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## Terminology, graphical and letter symbols

For general terminology, readers are referred to IEC 60050: *International Electrotechnical Vocabulary (IEV)*.

For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

\* See web site address on title page.

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ROTATING ELECTRICAL MACHINES –

**Part 18-22: Functional evaluation of insulation systems –  
Test procedures for wire-wound windings – Classification of changes  
and insulation component substitutions**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60034-18-22 has been prepared by subcommittee 2J: Classification of insulation systems for rotating machinery, of IEC technical committee 2: Rotating electrical machines.

This second edition cancels and replaces the first edition published in 1996 of which it constitutes a technical revision.

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

FDIS	Report on voting
2/1088/FDIS	2/1096/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

It forms part of a series under the general title Rotating electrical machines:

Part 18-1:1992, Functional evaluation of insulation systems – General guidelines

Part 18-21:1992, Functional evaluation of insulation systems – Test procedures for wire-wound windings – Thermal evaluation and classification

Part 18-31:1992, 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

Part 18-32:1995, 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

Part 18-33:1995, 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 60034-18-22:2000](https://standards.iteh.ai/standards/iec/2e25b4de-6c0e-4636-84a0-c0ee5cf44ef3/iec-60034-18-22-2000)

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## INTRODUCTION

IEC 60034-18-1 presents general principles for evaluation and classification of insulation systems used in rotating electrical machines. Unless the procedures of this part indicate otherwise, the principles of IEC 60034-18-1 should be followed.

IEC 60034-18-21 deals with the thermal evaluation and classification of insulation systems for wire-wound windings in respect of normal procedures as referred to in 5.3.2.1 of IEC 60034-18-1.

This part of IEC 60034 is concerned with procedures of verification of the effects of changes in insulation systems for wire-wound windings covered by 5.3.2.2 of IEC 60034-18-1.

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## ROTATING ELECTRICAL MACHINES –

### Part 18-22: Functional evaluation of insulation systems – Test procedures for wire-wound windings – Classification of changes and insulation component substitutions

#### 1 Scope

This part of IEC 60034 gives test procedures for the thermal evaluation and classification of changes and insulation component substitution in insulation systems used or proposed for use in a proven insulation system used in wire-wound windings. The test procedures are comparative in that the performance of a candidate system is compared to that of a reference system which has previously been proved by experience or has been evaluated by one of the procedures given in 60034-18-21 and to which the change or substitution is intended.

#### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60034-18-21:1992, *Rotating electric machines – Part 18: Functional evaluation of insulation systems – Section 21: Test procedures for wire-wound windings – Thermal evaluation and classification*

<https://standards.iteh.ai/en/standards/iec/2ca5b4de-6cce-4636-84a0-c0ee5cf44ef3/iec-60034-18-22-2000>

IEC 60172:1987, *Test procedure for the determination of the temperature index of enamelled winding wires*

IEC 60216, *Guide for the determination of thermal endurance properties of electrical insulating materials*

IEC 60317, *Specifications for particular types of winding wires*

IEC 61033:1991, *Test methods for the determination of bond strength of impregnating agents to an enamelled wire substrate*

#### 3 General guidelines

##### 3.1 Category I insulation components

###### 3.1.1 Phase insulation and ground insulation

Insulation separating the windings from each other or from the magnetic core, for example slot liners, but not wedges, closures or top of slot packers all of which are considered as category II components (see 3.2).



### 3.1.2 Turn (conductor) insulation

The resinous (enamel) coating or wrapped insulation, fibrous or film, on winding wire.

### 3.1.3 Impregnating varnishes

These include both solvented and solventless varnishes.

### 3.1.4 Encapsulant

Moulded or cast insulation which completely encases the insulation system and which is the only barrier between the winding and the outer surface of the motor.

## 3.2 Category II insulation components

Category II components include any constituent of an insulation system not covered by 3.1, as listed below. If the testing organization wants to consider some of these components as category I insulation components, it may do so.

- a) Series/parallel winding insulation as used on multi-voltage windings
- b) Insulation between auxiliary and main winding as used on single-phase motors. This is not to be considered as phase insulation as described in 3.1.1.

NOTE If winding insulation according to item a) or b) above is, in normal operation, stressed like phase insulation, then it must be tested as a category I component.

- c) Layer insulation: insulation which is interleaved between successive layers of insulated wire in the same winding (same phase)
- d) Sleeving and tubing
- e) Slot wedges and closures

NOTE If, in normal operation, the closure is stressed like the slot liner, then it must be tested as a category I component.

- f) Securement tapes and tie-cords

- g) Lead wire insulation

## 3.3 Definition of generic identity

Generic identity embraces both chemical and physical identity. Chemical composition shall be established from analytical data which should, for instance, be based on appropriate spectroscopic analysis (IR, etc.) complemented with thermogravimetric, DTA and atomic absorption analysis.

Physical identity shall be established by mechanical and electrical tests appropriate to the component. DTA analysis can complement these tests.

For several properties, like  $\tan \delta$  and modulus, dependence on temperature can complement both the chemical and physical picture.

Where the insulation component is made from more than one material, for example an adhesive bonded laminate, a mineral filled encapsulant, or a dual coat winding wire, generic identity shall be established with respect to each material of the component separately. In the case of a filled component, the relative amounts of filler and polymeric material shall be the same in both candidate and reference material.

## 4 Documentation

The following information shall be obtained for any proposed substitution material:

- a) detailed chemical analysis;
- b) supplier and reference;
- c) thickness;
- d) thermal endurance, such as temperature index, and relevant standard or specification, for example:
  - 1) IEC 60317 type for winding wire,
  - 2) voltage rating, style or type for lead wire.

The same information is also required for the reference system.

## 5 General substitution procedures

The test procedures to be followed for any particular substitution depend on the specific substitution involved. These are in clause 6.

Any substitution to an insulation system shall be classified as a substitution procedure A, B, C or D. The action required in respect of validation for each procedure is listed below.

NOTE Procedures A, B, and C are considered minimum requirements. At the discretion of the testing organisation procedure D may be used in place of procedures A, B or C.

### – Procedure A

If the data enables the investigator to establish the generic identity according to 3.3, documentation data as described in clause 4 is sufficient to accept substitution without test.

### – Procedure B

Change requiring sealed tube test procedure (see clause 7).

### – Procedure C

Change requiring a single temperature ongoing programme using a procedure, for example motorette procedure, selected from IEC 60034-18-21.

### – Procedure D

Change requiring a full three-temperature test procedure as required by IEC 60034-18-21.

Specific component substitutions are assigned to one of the above categories in clause 6.

## 6 Component substitution category

### 6.1 Category I component substitution

#### 6.1.1 Phase insulation and ground insulation

##### 6.1.1.1 Generically identical, the same or increased thickness

Procedure A applies.

##### 6.1.1.2 Generically identical but thinner

Procedure C applies.