SLOVENSKI STANDARD
SIST EN 60034-18-21:1999/A2:1999

01-april-1999

Rotating electrical machines - Part 18: Functional evaluation of insulation systems - Section 21: Test procedures for wire-wound windings - Thermal evaluation and classification (IEC 60034-18-21:1992/A2:1996)

Rotating electrical machines -- Part 18: Functional evaluation of insulation systems -- Section 21: Test procedures for wire-wound windings - Thermal evaluation and classification

Drehende elektrische Maschinen -- Teil 18: Funktionelle Bewertung von Isoliersystemen -- Hauptabschnitt 21: Prüfverfahren für Runddraht-Wicklungen - Thermische Bewertung und Klassifizierung

Machines électriques tournantes -- Partie 18: Evaluation fonctionnelle des systèmes d'isolation -- Section 21: Procédures d'essai pour enroulements à fils - Evaluation thermique et classification

Ta slovenski standard je istoveten z: **EN 60034-18-21:1994/A2:1996**

ICS:

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

SIST EN 60034-18-21:1999/A2:1999 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60034-18-21/A2

December 1996

UDC 621.313:621.315.6:620.1:621.317.08
ICS 29.080.00; 29.160.00

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

English version

Rotating electrical machines
Part 18: Functional evaluation of insulation systems
Section 21: Test procedures for wire-wound windings
Thermal evaluation and classification
(IEC 34-18-21:1992/A2:1996)

Machines électriques tournantes
Partie 18: Evaluation fonctionnelle des systèmes d'isolation
Section 21: Procédures d'essai pour enroulements à fils
Evaluation thermique et classification
(CEI 34-18-21:1992/A2:1996)

Drehende elektrische Maschinen
Teil 18: Funktionelle Bewertung von Isoliersystemen für drehende elektrische Maschinen
Hauptabschnitt 21: Prüfverfahren für Runddraht-Wicklungen - Thermische Bewertung und Klassifizierung
(IEC 34-18-21:1992/A2:1996)

This amendment A2 modifies the European Standard EN 60034-18-21:1994; it was approved by CENELEC on 1996-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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 text of document 2J/51/FDIS, future amendment 2 to IEC 34-18-21:1992, prepared by SC 2J, Classification of insulation systems for rotating machinery, of IEC TC 2, Rotating machinery, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60034-18-21:1994 on 1996-10-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-09-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-09-01

For products which have complied with EN 60034-18-21:1994 and its amendment A1:1996 before 1997-09-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-09-01.

Endorsement notice

The text of amendment 2:1996 to the International Standard IEC 34-18-21:1992 was approved by CENELEC as an amendment to the European Standard without any modification.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
IEC

34-18-21

1992

AMENDEMENT 2
AMENDMENT 2

1996-11

Amendement 2

Machines électriques tournantes –

Partie 18:
Evaluation fonctionnelle des systèmes d'isolation –
Section 21: Procédures d'essai pour enroulements à fils – Evaluation thermique et classification

Amendment 2

Rotating electrical machines –

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

Bureau central de la Commission Electrotechnique Internationale 3, rue de Varembé Genève Suisse

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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FOREWORD

This amendment has been prepared by subcommittee 2J: Classification of insulation systems for rotating machinery, of IEC technical committee 2: Rotating machinery.

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

FDIS	Report on voting
2J/51/FDIS	2J/58/RVD

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

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Page 13

3.4.1 *Construction of test objects*

Replace the text of the note by the following:

NOTE – It is recognized that markedly different values of test life can be obtained for the same insulating materials, depending on insulation thicknesses and creepage distances.

Page 15

3.7 *Ageing temperature and subcycle lengths*

Replace the fourth paragraph by the following:

Ageing temperatures and lengths of ageing subcycles should be selected from table 2 of Section 1.

Replace, on page 17, the seventh paragraph by the following:

In addition, at least two higher ageing temperatures should be selected, separated by intervals of 20 K or more. Intervals of 10 K may be used when tests are made at more than three ageing temperatures.

Page 17

4.1.1 *Procedure 1*

Replace the existing text by the following:

This procedure, using "motorette" type models as test objects, shall be referred to as IEC 34-18-21, Procedure 1.

Page 23

5.1.1 *Procedure 2*

Replace the existing text by the following:

This procedure, using actual motors as test objects, shall be referred to as IEC 34-18-21, Procedure 2.

5.1.2 *General features*

Replace the fourth paragraph by the following:

Even though actual motors are tested, the results may not be used to determine endurance time in actual service in an absolute sense. The tests may be used as a means of classification only by comparing insulation systems.

Page 25

5.3.2 *Means of heating*

Replace the first paragraph by the following:

The mode of heat generation is dictated by the type of motor being used in the test and the laboratory equipment available. Higher than normal winding temperatures can be obtained by increasing motor losses by such means as enlarging the air gap, starting and reversing each motor, superimposition of direct current on the normal alternating current, or by increasing the temperature of the air surrounding the motor. For temperature regulation during the heat ageing portion of the cycle, the motors may be run at normal voltage and frequency with an electrical control which automatically starts and stops or reverses the direction of rotation of the motors at intervals. Other acceptable means of temperature control include automatic voltage variation, adjustment of the surrounding air temperature, or combinations thereof.

Replace the third paragraph by the following:

Single-phase motors shall have at least 250 start-stop operations each day of the heat ageing portion of the cycle. The starting winding of a single-phase motor normally operates at a much higher current density than the main winding during starting. During each start it can reach a temperature of 10 K to 30 K higher than the main winding. In order to ensure that the correct emphasis is placed on the main winding portion of the insulation system, a reasonable number of starts should be employed.

Replace, on page 27, the fourth paragraph by the following:

Polyphase motors shall have at least 1000 starts or reversals each day of the heat ageing portion of the cycle. Often the electrical loss during reversal is used to maintain the elevated temperatures, in which case the number of reversals may greatly exceed 1000 per day. At the highest temperature test the total time of exposure is relatively short which results in a relatively low number of reversals during the life of the test. At the lowest temperature, the time of exposure can be 16 to 20 times as long as that of the highest level. A wide variation in total number of starts would affect the slope of the time-temperature curve within a cycle. Thus, it is recommended that the number of reversals at the low temperature be no greater than twice those at the high temperature. Ideally, an equal number of reversals at each temperature should be sought.

5.3.4 *Mechanical stresses during the thermal ageing subcycle*

Replace the first paragraph by the following:

Mechanical stress is obtained in tests on actual motors by the normal vibration of the motor running and with starts or reversals, or both. There is mechanical shock from starting or reversing. The vibration amplitude at twice the line frequency can be increased by enlarging the air gap. Larger forces are present in the windings as a result of the high currents during starting and reversing of the motors. In a test, these mechanical forces occur at elevated temperatures.

5.4.1 *Moisture test*

Replace the first paragraph by the following:

A moisture test of at least 48 h shall be used, except that for totally enclosed machines (degrees of protection IP44 or more) and for d.c. machines a moisture test is not mandatory because it can be impracticable. Moisture shall be visible on the windings as droplets, without puddles, during the moisture test. To ensure visible condensation, the insulation system should be at a lower temperature than the dew point of the surrounding moisture-laden atmosphere at all times. The preferred method of meeting this requirement is by the use of a condensation test chamber with cooled test objects described in clause C.2 of annex C.

Replace, on page 29, the second paragraph by the following:

However, larger motors can be difficult to move and difficult to support in equipment for moisture test, or such equipment is not available. Other methods of applying moisture include: placing an enclosing hood around the motor, or using a conventional humidity cabinet or a fog chamber.

5.4.2 *Voltage test*

Replace the second paragraph by the following:

The motors should be started and run immediately after the moisture test while the windings are still wet. For machines that have to be reassembled prior to running, a power-frequency high potential test should be applied at the highest rated voltage from windings to frame for 10 min while wet before assembly. During at least part of the thermal ageing subcycle the motors are to be run at their highest rated nameplate voltage. A power source earthed through a current limiting impedance should be used and the motor frame should be earthed so that voltage stresses are present during the entire thermal ageing portion of the cycle. A detection circuit for current to frame should be used to detect when insulation to the frame has failed. The end point of the motor life in these tests is fixed by the electrical failure of its winding insulation, under a rated applied voltage. Indiscriminate starting in either direction of the rotation of a single-phase motor can indicate failure of the starting winding.

Page 35

7.2.1 *Construction of test objects*

Replace, on page 37, the second paragraph by the following:

An example of a model coil assembly for the purpose of testing random-wound stator field coil insulation is described in annex B. Actual pole pieces taken from production may be used if desired and can actually be necessary in some cases if the stresses developed in the coil-pole assembly produce deflections of the formed-shell pole. Such movement would introduce inappropriate variations from actual service conditions.

Page 41

8.2.1 *Construction of test objects*

Replace, on page 43, the third and fourth paragraphs by the following:

Commutator design and materials are important considerations for the test object. The objective of the test may be the evaluation of the armature winding insulation only and therefore it may be preferred to exclude the effects of the commutator. The rationale for doing so can be differences in the cooling arrangements and therefore in the temperature rises of the winding and of the commutator. The thermal capability of the materials selected for the winding and commutator can therefore be different. For this situation, a fixture may be used that replaces the commutator for the required coil terminations and measurements.

Should the test objective be an evaluation of the winding and commutator as an assembly, some modifications at the commutator will usually be required, particularly on small test objects, to ensure valid measurements and useful data. Exposure of bare copper and the short distances between segments, and from segments to connections or to frame, which are inherent in the commutator design and function, can result in flashover or undue burning of insulations during overvoltage testing. To alleviate this condition, excess moisture on the commutator from humidification may be removed by carefully directed forced air or wiping prior to application of voltage. Enclosure of the commutator surface and bare connections can also be required.

Page 43

8.2.2 *Number of test specimens*

Replace the existing text by the following:

At least 10 test specimens of each insulation system should be tested at each ageing temperature. A rotor may be wound to incorporate more than one insulation system, each adequately identified and isolated. Preferably, several rotors each containing a different insulation system should be wound for test at each ageing temperature.