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Test procedure for the determination of the temperature index of enamelled winding wires

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Prüfverfahren zur Bestimmung des Temperaturindex von Lackdrähten

Méthode d'essai pour la détermination de l'indice de température des fils de bobinage émaillés

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Test procedure for the determination of the temperature index of enamelled winding wires
(IEC 172:1987)

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(CEI 172:1987)

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(IEC 172:1987)

This European Standard was approved by CENELEC on 1994-09-01. 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.

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.

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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 the International Standard IEC 172:1987, prepared by IEC TC 55, Winding wires, was approved by CENELEC as HD 41 S3 on 1989-08-01.

This Harmonization Document was submitted to the formal vote for conversion into a European Standard and was approved by CENELEC as EN 60172 on 1994-09-01.

The following date was 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) 1995-10-15

Annexes designated "normative" are part of the body of the standard. In this standard, annex ZA normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 172:1987 was approved by CENELEC as a European Standard without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT EUROPEAN PUBLICATIONS

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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

IEC Publication	Date	Title	EN/HD	Date
216-1	1987*	Guide for the determination of thermal endurance properties of electrical insulating materials Part 1: General guidelines for ageing procedures and evaluation of test results	-	-
216-3	1980*	Part 3: Statistical methods	-	-

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* IEC 216-1:1990 is harmonized as HD 611.1 S1:1992
IEC 216-3:1990 is harmonized as HD 611.3 S1:1992

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Méthode d'essai pour la détermination de l'indice de température des fils de bobinage émaillés

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CONTENTS

Page

FOREWORD 5

PREFACE 5

Clause

1. Scope 7
2. Object 7
3. Definition of terms 9
4. Summary of procedure 9
5. Test specimens 9
6. Temperature exposure 13
7. Test voltage and its application 15
8. Calculations 17
9. Report 21

FIGURES 22

APPENDIX A — Simplified method for calculation of the regression line 29

APPENDIX B — Correlation coefficient 39

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TEST PROCEDURE FOR THE DETERMINATION OF THE TEMPERATURE INDEX OF ENAMELLED WINDING WIRES

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.

PREFACE

This standard has been prepared by IEC Technical Committee No. 55: Winding wires.

This third edition of IEC Publication 172 replaces the second edition, which was issued in 1981.

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

Six Months' Rule	Report on Voting
55(CO)287	55(CO)330

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

The following IEC publications are quoted in this standard:

Publication Nos. 216-1 (1987): Guide for the determination of thermal endurance properties of electrical insulating materials, Part 1: General guidelines for ageing procedures and evaluation of test results.

216-3 (1980): Part 3: statistical methods.

TEST PROCEDURE FOR THE DETERMINATION OF THE TEMPERATURE INDEX OF ENAMELLED WINDING WIRES

1. Scope

This test procedure specifies, in accordance with the provisions of IEC Publication 216-1, a method for evaluating the temperature index of round enamelled winding wires. It is not applicable to rectangular winding wires or to fibre-insulated winding wires.

In order to avoid undue fragility of the test specimens, experience has shown that sizes from 0.8 mm to 1.5 mm are generally found convenient to handle and test.

2. Object

This test procedure is to determine the thermal endurance of enamelled round wires in air at atmospheric pressure. The thermal endurance, characterized by Temperature Index, is specified in most performance specifications for enamelled wires. The data obtained on the long-term characteristics of enamelled winding wires also provide the designer and development engineer with information for the selection of winding wire for further evaluation in insulation systems and equipment tests.

This test procedure covers only the evaluation of thermal endurance by changes in electric strength; to evaluate the changes of other properties, further test procedures are needed.

Exposure of some types of enamelled wire to heat in gaseous or liquid environments in the absence of air may give thermal endurance characteristics different from those obtained in air. This fact shall be considered when interpreting the results obtained by heating in air with respect to applications where the wire will not be exposed to air in service. Sizes other than those specified in Clause 15 of the relevant specification sheet dealing with thermal endurance may give different thermal endurance characteristics. The conductor material in contact with the enamel insulation may affect the thermal endurance characteristics.

The suitability or compatibility of an insulating varnish with enamel insulation can also be tested and temperature indices of combinations can be compared by using this method.

Electric stress applied for extended periods at a level exceeding or even approaching the discharge inception voltage may significantly change the thermal endurance of enamelled winding wires, varnished or unvarnished. Under such electric stress conditions, comparisons between materials may also differ from those developed using this method.

It should be made clear that the Temperature Index determined by this method is the number corresponding to the temperature in degrees Celsius at which the regression line

intersects the 20 000 h line. The temperature in degrees Celsius corresponding to the Temperature Index is not necessarily that at which the wire is recommended to be operated. This depends on many factors, including the type of equipment involved.

Environmental factors such as moisture, chemical contamination, and mechanical stresses or vibrations, are factors that may result in failure after the enamelled wire has been weakened by thermal deterioration and are more appropriately evaluated in insulation system tests.

3. Definition of terms

Temperature Index

The number corresponding to the temperature in degrees Celsius derived from the thermal endurance graph at 20 000 h as calculated by equation (6) of Appendix A.

Specimen failure time

The hours at the exposure temperature that have resulted in a specimen failing the proof test (see Sub-clause 8.1).

Time to failure

The hours to failure calculated from the specimen failure times for a set of specimens at one exposure temperature in accordance with Sub-clause 8.2.

4. Summary of procedure

A set of specimens in accordance with Clause 5 is subjected to a testing cycle. This cycle consists of a heat-storing period at a temperature given in Clause 6, followed by a proof voltage test at room temperature in accordance with Clause 7.

This cycle is repeated until a sufficient number of specimens has failed, and the time to failure is calculated in accordance with Clause 8. The test is carried out at three or more temperatures. A regression line is calculated in accordance with Sub-clause 8.4 and the time to failure values plotted on thermal endurance graph paper as a function of the exposure temperature.

The temperature, in degrees Celsius, corresponding to the point of intersection of the regression line with the ordinate of 20 000 h endurance represents the Temperature Index of the winding wire under test.

5. Test specimens

5.1 *Preparation*

a) A piece of wire approximately 400 mm in length shall be twisted together over a distance of 125 mm with a device as shown in Figure 1. The force (weight) applied to the wire pair while being twisted and the number of twists are given in Table I.