



Institut luxembourgeois de la normalisation
de l'accréditation, de la sécurité et qualité
des produits et services

ILNAS-EN IEC 60216-3:2021

Electrical insulating materials - Thermal endurance properties - Part 3: Instructions for calculating thermal endurance characteristics

Matériaux isolants électriques -
Propriétés d'endurance thermique -
Partie 3: Instructions pour le calcul des
caractéristiques d'endurance thermique

Elektroisolierstoffe – Eigenschaften
hinsichtlich des thermischen
Langzeitverhaltens – Teil 3: Anweisungen
zur Berechnung thermischer

04/2021



National Foreword

This European Standard EN IEC 60216-3:2021 was adopted as Luxembourgish Standard ILNAS-EN IEC 60216-3:2021.

Every interested party, which is member of an organization based in Luxembourg, can participate for FREE in the development of Luxembourgish (ILNAS), European (CEN, CENELEC) and International (ISO, IEC) standards:

- Participate in the design of standards
- Foresee future developments
- Participate in technical committee meetings

<https://portail-qualite.public.lu/fr/normes-normalisation/participer-normalisation.html>

THIS PUBLICATION IS COPYRIGHT PROTECTED

Nothing from this publication may be reproduced or utilized in any form or by any mean - electronic, mechanical, photocopying or any other data carries without prior permission!

ILNAS-EN IEC 60216-3:2021

EUROPEAN STANDARD **EN IEC 60216-3**

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2021

ICS 17.220.99; 19.020

Supersedes EN 60216-3:2006 and all of its amendments
and corrigenda (if any)

English Version

**Electrical insulating materials - Thermal endurance properties -
Part 3: Instructions for calculating thermal endurance
characteristics
(IEC 60216-3:2021)**

Matériaux isolants électriques - Propriétés d'endurance
thermique - Partie 3: Instructions pour le calcul des
caractéristiques d'endurance thermique
(IEC 60216-3:2021)

Elektroisolierstoffe - Eigenschaften hinsichtlich des
thermischen Langzeitverhaltens - Teil 3: Anweisungen zur
Berechnung thermischer Langzeitkennwerte
(IEC 60216-3:2021)

This European Standard was approved by CENELEC on 2021-04-20. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 112/475/CDV, future edition 3 of IEC 60216-3, prepared by IEC/TC 112 "Evaluation and qualification of electrical insulating materials and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60216-3:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-01-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2024-04-20

This document supersedes EN 60216-3:2006 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60216-3:2021 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60216-2	NOTE	Harmonized as EN 60216-2
IEC 60216-5	NOTE	Harmonized as EN 60216-5
IEC 60216-6	NOTE	Harmonized as EN 60216-6

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60216-1	2013	Electrical insulating materials - Thermal endurance properties - Part 1: Ageing procedures and evaluation of test results	EN 60216-1	2013



INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electrical insulating materials – Thermal endurance properties –
Part 3: Instructions for calculating thermal endurance characteristics**

**Matériaux isolants électriques – Propriétés d'endurance thermique –
Partie 3: Instructions pour le calcul des caractéristiques d'endurance thermique**

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms, definitions, symbols and abbreviated terms	6
3.1 Terms and definitions	6
3.2 Symbols and abbreviated terms	8
4 Principles of calculations	10
4.1 General principles	10
4.2 Preliminary calculations	10
4.2.1 General	10
4.2.2 Non-destructive tests	11
4.2.3 Proof tests	11
4.2.4 Destructive tests	11
4.3 Variance calculations	12
4.4 Statistical tests	12
4.5 Results	13
5 Requirements and recommendations for valid calculations	13
5.1 Requirements for experimental data	13
5.1.1 General	13
5.1.2 Non-destructive tests	13
5.1.3 Proof tests	13
5.1.4 Destructive tests	13
5.2 Precision of calculations	14
6 Calculation procedures	14
6.1 Preliminary calculations	14
6.1.1 Temperatures and x -values	14
6.1.2 Non-destructive tests	14
6.1.3 Proof tests	14
6.1.4 Destructive tests	14
6.1.5 Incomplete data	18
6.2 Main calculations	18
6.2.1 Calculation of group means and variances	18
6.2.2 General means and variances	19
6.2.3 Regression calculations	20
6.3 Statistical tests	21
6.3.1 Variance equality test	21
6.3.2 Linearity test (F -test)	21
6.3.3 Confidence limits of X and Y estimates	22
6.4 Thermal endurance graph	23
7 Calculation and requirements for results	23
7.1 Calculation of thermal endurance characteristics	23
7.2 Summary of statistical tests and reporting	24
7.3 Reporting of results	24
8 Test report	24
Annex A (normative) Decision flow chart	26

Annex B (normative) Decision table	27
Annex C (informative) Statistical tables	28
Annex D (informative) Worked examples	38
Annex E (informative) Computer program	46
E.1 General	46
E.1.1 Overview	46
E.1.2 Convenience program execution	47
E.2 Structure of data files used by the program	48
E.2.1 Text file formats	48
E.2.2 Office Open XML formats	50
E.3 Data files for computer program	51
E.4 Output files and graph	56
Bibliography	57
Figure 1 – Example of groups selection	15
Figure A.1 – Decision flow chart	26
Figure D.1 – Thermal endurance graph	42
Figure D.2 – Example 3: Property-time graph	44
Figure E.1 – Shortcut property dialog for program launch	47
Figure E.2 – Thermal endurance graph of example N3	56
Table B.1 – Decisions and actions according to tests	27
Table C.1 – Coefficients for censored data calculations	28
Table C.2 – Fractiles of the F -distribution, $F(0,95, f_n, f_d)$	34
Table C.3 – Fractiles of the F -distribution, $F(0,995, f_n, f_d)$	35
Table C.4 – Fractiles of the t -distribution, $t_{0,95}$	37
Table C.5 – Fractiles of the χ^2 -distribution	37
Table D.1 – Worked example 1 – Censored data (proof tests: file CENEX3.DTA)	38
Table D.2 – Worked example 2 – Complete data (non-destructive tests: file TEST2.DTA)	40
Table D.3 – Worked example 3 – Destructive tests	43
Table D.4 – Worked example 3 – Selection of groups	44
Table E.1 – Non-destructive test data	49
Table E.2 – Destructive test data	49
Table E.3 – Non-destructive test data	50
Table E.4 – Destructive test data	50