Electrical insulating materials - Determination of the effects of ionizing radiation -- Part 1: Radiation interaction and dosimetry

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 60544-1:2013 sisaldab Euroopa standardi EN 60544-1:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 60544-1:2013 consists of the English text of the European standard EN 60544-1:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 13.09.2013.	Date of Availability of the European standard is 13.09.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.240, 29.035.01

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60544-1

September 2013

ICS 17.240; 29.035.01

Supersedes EN 60544-1:1994

English version

Electrical insulating materials - Determination of the effects of ionizing radiation - Part 1: Radiation interaction and dosimetry

(IEC 60544-1:2013)

Matériaux isolants électriques - Détermination des effets des rayonnements ionisants - Partie 1: Interaction des rayonnements et dosimétrie
(CEI 60544-1:2013)

Elektroisolierstoffe - Bestimmung der Wirkung ionisierender Strahlung - Teil 1: Einfluss der Strahlenwirkung und Dosimetrie
(IEC 60544-1:2013)

This European Standard was approved by CENELEC on 2013-08-01. 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 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60544-1:2013 E

Foreword

The text of document 112/254/FDIS, future edition 3 of IEC 60544-1, 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 60544-1:2013.

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)	2014-05-01
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-08-01

This document supersedes EN 60544-1:1994.

EN 60544-1:2013 includes the following significant technical changes with respect to EN 60544-1:1994:

a) recent advances in simulation methods of radiation interaction with different matter enables the prediction of the energy-deposition profile in matter and design the irradiation procedure;

b) many new dosimetry systems have become available.

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

Endorsement notice

The text of the International Standard IEC 60544-1:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

ISO 11137 series NOTE Harmonised in EN ISO 11137 series.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

Publication	Year	Title	EN/HD	Year
IEC 60544-2	-	Electrical insulating materials - Determination of the effects of ionizing radiation on insulating materials - Part 2: Procedures for irradiation and test	EN 60544-2	-
IEC 60544-4	-	Electrical insulating materials - Determination of the effects of ionizing radiation - Part 4: Classification system for service in radiation environments	EN 60544-4	-

CONTENTS

INTRODUCTION

The establishment of suitable criteria for the evaluation of the radiation resistance of insulating materials is very complex, since such criteria depend upon the conditions under which the materials are used. For instance, if an insulated cable is flexed during a refuelling operation in a reactor, the service life will be that time during which the cable receives a radiation dose sufficient to reduce to a specified value one or more of the relevant mechanical properties. Temperature of operation, composition of the surrounding atmosphere and the time interval during which the total dose is received (dose rate or flux) are important factors which also determine the rate and mechanisms of chemical changes. In some applications, temporary changes may be the limiting factor.

Given this, it becomes necessary to define the radiation fields in which materials are exposed and the radiation dose subsequently absorbed by the material. It is also necessary to establish procedures for testing the mechanical and electrical properties of materials which will define the radiation degradation and link those properties with application requirements in order to provide an appropriate classification system.

ELECTRICAL INSULATING MATERIALS – DETERMINATION OF THE EFFECTS OF IONIZING RADIATION –

Part 1: Radiation interaction and dosimetry

1 Scope

This part of IEC 60544 deals broadly with the aspects to be considered in evaluating the effects of ionizing radiation on all types of organic insulating materials. It also provides, for X-rays, γ-rays, and electrons, a guide to

– dosimetry terminology,
– methods for dose measurements,
– testing carried out at irradiation facilities,
– evaluation and testing of material characteristics and properties,
– documenting the irradiation process.

Dosimetry that might be carried out at locations of use of the material is not described in this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60544-2, *Electrical insulating materials – Determination of the effects of ionizing radiation on insulating materials – Part 2: Procedures for irradiation and test*

IEC 60544-4, *Electrical insulating materials – Determination of the effects of ionizing radiation – Part 4: Classification system for service in radiation environments*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ICRU Report 33 [1][1]. as well as the following definitions apply.

3.1
exposure
X
measure of an electromagnetic radiation field (X- or γ-radiation) to which a material is exposed

Note 1 to entry: The exposure is the quotient obtained by dividing d*Q* by d*m*, where d*Q* is the absolute value of the total charge of the ions of one sign produced in the air when all of the electrons (and positrons) liberated by photons in air of mass d*m* are completely stopped in air:

1 References in square brackets refer to the Bibliography.