Exposure to electric or magnetic fields in the low and intermediate frequency range - Methods for calculating the current density and internal electric field induced in the human body -- Part 3-1: Exposure to electric fields - Analytical and 2D numerical models

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EESTI STANDARDI EESSÕNA **NATIONAL FOREWORD**

Käesolev Eesti standard EVS-EN 62226-3-1:2007 sisaldab Euroopa standardi EN 62226-3-1:2007 ingliskeelset teksti. Käesolev dokument on jõustatud 23.11.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 62226-3-1:2007 consists of the English text of the European standard EN 62226-3-1:2007. This document is endorsed on 23.11.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: This part of IEC 62226 applies to the frequency range for which exposure limits are based on the induction of voltages or currents in the human body when exposed to electric and magnetic fields. This part defines in detail the coupling factor K – introduced by the IEC 62226 series to enable exposure assessment for complex exposure situations, such as non-uniform magnetic field or perturbed electric field – for the case of simple models of the human body, exposed to uniform electric fields. The coupling factor K has different physical interpretations depending on whether it relates to electric or magnetic field exposure. It is the so called “shape factor for electric field”. This part of IEC 62226 can be used when the electric field can be considered to be uniform, for frequencies up to at least 100 kHz.	**Scope:** This part of IEC 62226 applies to the frequency range for which exposure limits are based on the induction of voltages or currents in the human body when exposed to electric and magnetic fields. This part defines in detail the coupling factor K – introduced by the IEC 62226 series to enable exposure assessment for complex exposure situations, such as non-uniform magnetic field or perturbed electric field – for the case of simple models of the human body, exposed to uniform electric fields. The coupling factor K has different physical interpretations depending on whether it relates to electric or magnetic field exposure. It is the so called “shape factor for electric field”. This part of IEC 62226 can be used when the electric field can be considered to be uniform, for frequencies up to at least 100 kHz.

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Exposure to electric or magnetic fields in the low and intermediate frequency range - Methods for calculating the current density and internal electric field induced in the human body - Part 3-1: Exposure to electric fields - Analytical and 2D numerical models

(IEC 62226-3-1:2007)

Exposition aux champs électriques ou magnétiques à basse et moyenne fréquence - Méthodes de calcul des densités de courant induit et des champs électriques induits dans le corps humain - Partie 3-1: Exposition à des champs électriques - Modèles analytiques et numériques 2D (CEI 62226-3-1:2007)

Sicherheit in elektrischen oder magnetischen Feldern im niedrigen und mittleren Frequenzbereich - Verfahren zur Berechnung der induzierten Körperstromdichte und des im menschlichen Körpers induzierten elektrischen Feldes - Teil 3-1: Exposition gegenüber elektrischen Feldern - Analytische Modelle und numerische 2D-Modelle (IEC 62226-3-1:2007)

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

Ref. No. EN 62226-3-1:2007 E

Foreword

The text of document 106/125/FDIS, future edition 1 of IEC 62226-3-1, prepared by IEC TC 106, Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62226-3-1 on 2007-09-01.

This European Standard is to be used in conjunction with EN 62226-1:2005.

The following dates were 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)	2008-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2010-09-01

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Endorsement notice

The text of the International Standard IEC 62226-3-1:2007 was approved by CENELEC as a European Standard without any modification.

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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62226-3-1

First edition
Première édition
2007-05

Exposure to electric or magnetic fields in the low and intermediate frequency range – Methods for calculating the current density and internal electric field induced in the human body –

Part 3-1: Exposure to electric fields – Analytical and 2D numerical models

Exposition aux champs électriques ou magnétiques à basse et moyenne fréquence – Méthodes de calcul des densités de courant induit et des champs électriques induits dans le corps humain –

Partie 3-1: Exposition à des champs électriques – Modèles analytiques et numériques 2D

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Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPOSURE TO ELECTRIC OR MAGNETIC FIELDS IN THE LOW AND INTERMEDIATE FREQUENCY RANGE – METHODS FOR CALCULATING THE CURRENT DENSITY AND INTERNAL ELECTRIC FIELD INDUCED IN THE HUMAN BODY –

Part 3-1: Exposure to electric fields – Analytical and 2D numerical models

FOREWORD

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International Standard IEC 62226-3-1 has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

This standard is to be used in conjunction with the first edition of IEC 62226-1:2004, *Exposure to electric or magnetic fields in the low and intermediate frequency range – Methods for calculating the current density and internal electric field induced in the human body – Part 1: General.*

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

FDIS	Report on voting
106/125/FDIS	106/128/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 2.

This International Standard constitutes Part 3-1 of IEC 62226 series, which will regroup several international standards and technical reports within the framework of the calculation of induced current densities and internal electric fields.

A list of all parts of the IEC 62226 series, published under the general title *Exposure to electric or magnetic fields in the low and intermediate frequency range – Methods for calculating the current density and internal electric field induced in the human body,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

INTRODUCTION

Public interest concerning human exposure to electric and magnetic fields has led international and national organisations to propose limits based on recognised adverse effects.

This standard applies to the frequency range for which the exposure limits are based on the induction of voltages or currents in the human body, when exposed to electric and magnetic fields. This frequency range covers the low and intermediate frequencies, up to 100 kHz. Some methods described in this standard can be used at higher frequencies under specific conditions.

The exposure limits based on biological and medical experimentation about these fundamental induction phenomena are usually called “basic restrictions”. They include safety factors.

The induced electrical quantities are not directly measurable, so simplified derived limits are also proposed. These limits, called “reference levels” are given in terms of external electric and magnetic fields. They are based on very simple models of coupling between external fields and the body. These derived limits are conservative.

Sophisticated models for calculating induced currents in the body have been used and are the subject of a number of scientific publications. These models use numerical 3D electromagnetic field computation codes and detailed models of the internal structure with specific electrical characteristics of each tissue within the body. However such models are still developing; the electrical conductivity data available at present has considerable shortcomings; and the spatial resolution of models is still progressing. Such models are therefore still considered to be in the field of scientific research and at present it is not considered that the results obtained from such models should be fixed indefinitely within standards. However it is recognised that such models can and do make a useful contribution to the standardisation process, specially for product standards where particular cases of exposure are considered. When results from such models are used in standards, the results should be reviewed from time to time to ensure they continue to reflect the current status of the science.

EXPOSURE TO ELECTRIC OR MAGNETIC FIELDS IN THE LOW AND INTERMEDIATE FREQUENCY RANGE – METHODS FOR CALCULATING THE CURRENT DENSITY AND INTERNAL ELECTRIC FIELD INDUCED IN THE HUMAN BODY –

Part 3-1: Exposure to electric fields – Analytical and 2D numerical models

1 Scope

This part of IEC 62226 applies to the frequency range for which exposure limits are based on the induction of voltages or currents in the human body when exposed to electric fields.

This part defines in detail the coupling factor K – introduced by the IEC 62226 series to enable exposure assessment for complex exposure situations, such as non-uniform magnetic field or perturbed electric field – for the case of simple models of the human body, exposed to uniform electric fields. The coupling factor K has different physical interpretations depending on whether it relates to electric or magnetic field exposure. It is the so called “shape factor for electric field”.

This part of IEC 62226 can be used when the electric field can be considered to be uniform, for frequencies up to at least 100 kHz.

This situation of exposure to a “uniform” electric field is mostly found in the vicinity of high voltage overhead power systems. For this reason, illustrations given in this part are given for power frequencies (50 Hz and 60 Hz).

2 Exposure to electric field

Alternating electric fields are generated by energised conductors (i.e. under voltage). In the immediate vicinity of domestic electrical equipment, such as lights, switches, food mixers and irons, local electric-field strengths about 100 V/m may be found. Such fields are non-uniform, but their strengths are far below the levels recommended in safety guidelines, so there is no need of calculation of induced currents in such exposure situations.

Higher electric-field strengths may be found in the vicinity of high voltage equipment such as electric power line. In the frequency range covered by this standard, it is considered that exposure from power lines is the only significant exposure source for public regarding safety guidelines limits.

Guidelines on human exposure to electric fields are generally expressed in terms of induced current density or internal electric field. These quantities cannot be measured directly and the purpose of this document is to give guidance on how to assess these quantities induced in the human body by external (environmental) electric fields E_0.