SLOVENSKI STANDARD

SIST EN 62226-3-1:2008/A1:2017

01-april-2017

Izpostavljenost električnim in magnetnim poljem v nizkem in srednjem frekvenčnem obsegu - Metode za izračunavanje trenutne gostote in notranjega induciranega električnega polja v človeškem telesu - 3-1. del: Izpostavljenost električnim poljem - Analitični in numerični 2D modeli

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

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

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 analytique

Ta slovenski standard je istoveten z: **EN 62226-3-1:2007/A1:2017**

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities

SIST EN 62226-3-1:2008/A1:2017 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62226-3-1:2007/A1

January 2017

ICS 17.220.20

English Version

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/A1:2016)

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 (IEC 62226-3-1:2007/A1:2016)

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/A1:2016)

This amendment A1 modifies the European Standard EN 62226-3-1:2007; it was approved by CENELEC on 2016-11-11. 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 CEN-CENELEC Management Centre 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 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, Serbia, 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 62226-3-1:2007/A1:2017 E

European foreword

The text of document 106/376/FDIS, future IEC 62226-3-1:2007/A1, 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 approved by CENELEC as EN 62226-3-1:2007/A1:2017.

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)	2017-08-11
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2019-11-11

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 62226-3-1:2007/A1:2016 was approved by CENELEC as a European Standard without any modification.

IEC 62226-3-1

Edition 1.0 2016-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 17.220.20

ISBN 978-2-8322-3666-6

FOREWORD

This amendment has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

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

FDIS	Report on voting
106/376/FDIS	106/378/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.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website 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.

2 Exposure to electric field

Replace the fifth paragraph with the following new paragraph:

Although some guidelines on human exposure to electric fields adopt internal electric field as a limiting parameter, for reason of simplification, the content of this standard is presented mainly in terms of induced current densities J, from which values of internal electric field E_i can be easily derived using the previous formula.

3 General procedure

3.1 Shape factor

Add the following note at the end of this subclause:

NOTE The internal electric field E_i can be calculated from the current density J as $E_i = J/\sigma$, where σ is the conductivity of the human model (see equation (1)).

3.2 Procedure

Replace the third paragraph with the following new paragraph:

The third stage is to convert the current density averaged at a particular height to the local current density in the different tissues at that height. Health guidelines on exposure to EMF refer specifically to current density (or internal electric field) in the central nervous system, so

the particular area of interest within the body is the spinal cord in the neck, due to the small cross section of the neck, which concentrates the current (or internal electric field) in that region.

5.2.1 Analytical

Replace the paragraph immediately above Figure 8 with the following new paragraph and note:

Figure 9 gives the result of the analytical calculation of the local current density J_s, for a field magnitude of 1 kV/m at 50 Hz.

NOTE The internal electric field E_i can be calculated from the current density J as $E_i = J/\sigma$, where σ is the conductivity of the human model.

Replace the title of Figure 8 with the following new title:

Figure 8 – Calculation of the shape factor for electric field K_E for a spheroid exposed to an unperturbed electric field

5.3.1 Analytical

Replace Table 4 with the following new paragraph and table:

For the basic restrictions in terms of internal electric fields, i.e. E_{iBR}: 20 mV/m (public) and 100 mV/m (occupational), the external electric field E_{BR} required to produce an internal electric field equal to the basic restriction E_{iBR} is found by the following relation:

$$E_{BR} = \sigma E_{iBR} / J_A(\text{neck})$$

where σ is the conductivity of the human model.

Table 4 – Electric field E_{BR} required to produce basic restrictions J_{BR} or E_{iBR} in the neck at 50 Hz

	Reference man	Reference woman
J_A, current density in neck per kV/m, mA/m^2	0,244	0,286
Circumference at base of neck, m	0,425	0,368
E_{BR}, electric field for a 2 mA/m^2 basic restriction in the neck, kV/m	8,2	7,0
E_{BR}, electric field for a 10 mA/m^2 basic restriction in the neck, kV/m	41	35
E_{BR}, electric field for a 20 mV/m basic restriction in the neck, kV/m (σ = 0,2 S/m assumed)	16,4	14,0
E_{BR}, electric field for a 100 mV/m basic restriction in the neck, kV/m (σ = 0,2 S/m assumed)	82	70

5.4 Comparison of the analytical and numerical models

Replace Table 5 with the following new table:

Table 5 – Comparison of values of the shape factor for electric field K_E and corresponding current densities for an unperturbed 50 Hz electric field of 1 kV/m

	Reference man	Reference woman	Reference 10 year old child	5 kV (50 Hz) – 2 mA/m^2 [a]	5 kV (50 Hz) – 20 mV/m (σ = 0,2 S/m) [a]
K_{EZ} analytical A·s/V·m	4,88 × 10^{-9}	5,72 × 10^{-9}	5,16 × 10^{-9}	8 × 10^{-9}	1,6 × 10^{-8}
K_{EZ} numerical A·s/V·m	4,66 × 10^{-9}	5,94 × 10^{-9}	4,98 × 10^{-9}		
$J_{A\ max.}$ analytical mA/m^2	0,244	0,286	0,258	0,40	0,80
$J_{A\ max.}$ numerical mA/m^2	0,233	0,297	0,249		

[a] It is assumed that unperturbed electric field of 5 kV/m corresponds, at 50 Hz, to 2 mA/m^2 for induced current density, and 20 mV/m (σ = 0,2 S/m assumed) for internal electric field as conservative values. The corresponding value for K_E is calculated using equation (2).

6.3 Influence of conductivity

Add the following note to the end of the subclause:

NOTE The internal electric field E_i is dependent on the conductivity since it is calculated from the current density J as $E_i = J/\sigma$, where σ is the conductivity of the human model.

7.2 Current flowing to the ground

Replace the first sentence with the following new sentence:

The current flowing into the ground can be found from the product of the current density J_S and the cross sectional area of the spheroid at ground level.