SLOVENSKI STANDARD
SIST EN 50445:2008

01-junij-2008

Standard za drugino proizvodov za prikaz skladnosti opreme za uporovno varjenje, obloļno varjenje in sorodne procese z osnovnimi mejnimi vrednostmi glede izpostavljenosti ljudi elektromagnetnim sevanjem (0 Hzï 300 GHz)

Product family standard to demonstrate compliance of equipment for resistance welding, arc welding and allied processes with the basic restrictions related to human exposure to electromagnetic fields (0 Hz - 300 GHz)

Produktfamiliennorm zur Konformitätsprüfung von Einrichtungen zum Widerstandsschweißen, Lichtbogenschweißen und artverwandten Prozessen in Bezug auf die bei der Exposition durch elektromagnetische Felder anzuwendenden Basisgrenzwerte (0 Hz - 300 GHz)

Norme de famille de produit pour démontrer la conformité d'un équipement pour le soudage par résistance, le soudage à l'arc et les techniques connexes avec les restrictions de base concernant l'exposition des personnes aux champs électromagnétiques (0 Hz - 300 GHz)

Ta slovenski standard je istoveten z: **EN 50445:2008**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50445

February 2008

ICS 17.220.01; 25.160.10

English version

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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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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 50445:2008 E

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 26A, Electric arc welding equipment.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50445 on 2008-02-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by p ublication of an identical national standard or by endorsement	(dop)	2008-02-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-02-01s

This European Standard is to be read in conjunction with EN 50444 and EN 50505. The latter was prepared by the Technical Committee CENELEC TC 26B, Electric resistance welding.

This European Standard has been prepared under mandates M/305 and M/351 given to CENELEC by the European Commission and the European Free Trade Association.

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1 Scope

This product family standard applies to equipment for resistance welding, arc welding and allied processes designed for use in industrial or domestic environments, including welding power sources, wire feeders and ancillary equipment, e.g. torches, liquid cooling systems and arc striking and stabilising devices.

NOTE 1 Allied processes are for example resistance hard and soft soldering, resistance heating by means comparable to resistance welding equipment, electric arc cutting and arc spraying.

The frequency range covered is 0 Hz to 300 GHz.

This product family standard may be used to demonstrate compliance with the requirements of Directive 2006/95/EC [1] (needed for placing electric welding equipment on the European market), with regard to the limitation of human exposure to electromagnetic fields (EMF). There are additional requirements in the Directive, which are not included in this product family standard.

NOTE 2 The Directive 2006/95/EC [1], Article 2, stipulates that the Member States take all appropriate measures to ensure that electrical equipment may be placed on the market only if, having been constructed in accordance with good engineering practice in safety matters in force in the Community.

This product family standard may also be used for assessment regarding the requirements of Directive 2004/40/EC [3] on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) or Recommendation 1999/519/EC [2] on the limitation of exposure of the general public to electromagnetic fields, provided that no other relevant field sources are present in close proximity. If other relevant field sources are present, additional assessment is necessary.

NOTE 3 It should be noted that the supplier of specific equipment might not know the overall exposure environment in which the equipment is being used. This product family standard can only be used to assess human exposure from the specific equipment under evaluation when being used in accordance with the suppliers guidelines.

NOTE 4 Assessment procedures for workplaces with multiple field-sources may be found in EN 50499 [7].

Other standards may apply to products covered by this product family standard. In particular this standard can not be used to demonstrate electromagnetic compatibility with other equipment; nor does it specify any product safety requirements other than those specifically related to human exposure to electromagnetic fields.

NOTE 5 Procedures to demonstrate compliance are not specified for the whole frequency range.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 50392	Generic standard to demonstrate the compliance of electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (0 Hz – 300 GHz)
EN 50444	Basic standard for the evaluation of human exposure to electromagnetic fields from equipment for arc welding and allied processes
EN 50505	Basic standard for the evaluation of human exposure to electromagnetic fields from equipment for resistance welding and allied processes
EN 60974-1	Arc welding equipment – Part 1: Welding power sources (IEC 60974-1)
EN 60974-6	Arc welding equipment – Part 6: Limited duty manual metal arc welding power sources (IEC 60974-6)

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
action values
magnitude of directly measurable parameters at which one or more of the specified measures in Directive 2004/40/EC [3] must be undertaken

3.2
arc welding power source
equipment for supplying current and voltage and having the required characteristics suitable for arc welding and allied processes

NOTE 1 An arc welding power source may also supply services to other equipment and auxiliaries e.g. auxiliary power, cooling liquid, consumable arc welding electrode and gas to shield the arc and the welding area.

NOTE 2 In the following text, the term “welding power source” is used.

3.3
basic restrictions
exposure limit values
restrictions on exposure to electric, magnetic and electromagnetic fields that are based directly on established health effects and biological considerations

3.4
compliance boundary
spatial border outside which any point of investigation is deemed to be compliant

3.5
EMF
electric, magnetic or electromagnetic field

3.6
expert
competent person
skilled person
person who can judge the work assigned and recognize possible hazards on the basis of professional training, knowledge, experience and knowledge of the relevant equipment

NOTE Several years of practice in the relevant technical field may be taken into consideration in assessment of professional training.

3.7
induced current density (*J*)
electromagnetic field induced current per unit area inside the body

3.8
industrial and professional use
use intended only for experts or instructed persons

3.9
instructed person
person informed about the tasks assigned and about the possible hazards involved in neglectful behaviour

NOTE If necessary, the person has undergone some training.

3.10
magnetic flux density *(B)*
magnitude of a field vector that is equal to the magnetic field strength *H* multiplied by the permeability μ of the medium

$$B = \mu H$$

3.11
point of investigation (POI)
location in space at which the value of the *E*-field, *H*-field or power density is evaluated

NOTE This location is defined in cartesian, cylindrical or spherical co-ordinates relative to the reference point on the EUT.

3.12
reference levels
directly measurable quantities, derived from basic restrictions, provided for practical exposure assessment purposes

NOTE Respect of the reference levels will ensure respect of the relevant basic restriction. If the reference levels are exceeded, it does not necessarily follow that the basic restriction will be exceeded.

3.13
resistance welding equipment
equipment for supplying current and voltage and having the required characteristics suitable for resistance welding and allied processes

4 Compliance criteria and exposure limits

4.1 Background

Reference levels are provided for practical exposure assessment purposes to determine whether the basic restrictions are likely to be exceeded. If the measured value exceeds the reference level, it does not necessarily follow that the basic restriction will be exceeded.

In some situations, it may be necessary to show compliance with the basic restrictions directly, but it may also be possible to derive compliance criteria that allow a simple measurement or calculation to demonstrate compliance with the basic restriction. Often these compliance criteria can be derived using realistic assumptions about conditions under which exposures from a device may occur, rather than the conservative assumptions that underlie the reference levels.

NOTE 1 The limit is the basic restriction.

The exposure assessment results for the points of investigation specified in the basic standards EN 50444 and EN 50505 shall be below the relevant limits. For equipment designed exclusively for mechanized or robotic applications the points of investigation (reflecting the normal operator position for manual welding) defined in the basic standards EN 50444 and EN 50505 are not applicable. The manufacturer of this type of equipment shall define specific points of investigation.

As the highest exposure from equipment covered by the scope of this standard is to be expected in the inductive near-field, summation effects of maximum exposure levels of various pieces of equipment, e.g. in the same factory, are unlikely to be significant. However, in the presence of other strong magnetic fields (from large transformers, large electrolytic cells, etc.), in situ measurements to evaluate summation effects at medium distances (a few metres) might be appropriate. Such additional measurements are not a requirement of this standard, but may be required by other national or international regulations.

NOTE 2 Further guidance may be found in EN 50499 [7].

As there are different limits for general public or occupational exposure, the equipment documentation shall clearly state the intended use.

4.2 Equipment for use by the general public

The manufacturer shall specify if the equipment is intended to be used by the general public. Arc welding equipment built in accordance with to EN 60974-6 shall be assessed for such use. Any equipment assessed for general public use may also be used in an occupational environment.

If the environment in which the equipment is intended to be used is unknown, or not clear, the equipment shall be assessed for general public use.

The basis for assessment shall be the values of basic restrictions or reference levels from the Recommendation 1999/519/EC [2]. It must be noted that the tables of values referred to in the following sections are explained and rationalised in the text of the Recommendation 1999/519/EC [2] and the associated notes adjoining the tables. The basic restrictions on the current density only apply to central nervous system tissues in the head and trunk. These exposure limit values may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.

4.3 Equipment for occupational use

The manufacturer shall specify if the equipment is intended to be used only in an occupational environment (where the general public access is prohibited or regulated in such a way as to be similar to occupational use) by an expert or an instructed person. Arc welding equipment built in accordance with EN 60974-1 and resistance welding equipment can be assessed for such use.

The basis for assessment shall be the exposure limit values or action values from Directive 2004/40/EC [3]. It must be noted that the tables of values referred to in the following sections are explained and rationalised in the text of the Directive 2004/40/EC [3] and the associated notes adjoining the tables. The exposure limit values on the current density only apply to central nervous system tissues in the head and trunk. These exposure limit values may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.

If the limits specified above can not be complied with for some or all points of investigation, additional measures shall be defined which allow compliance (e.g. definition of a compliance boundary for occupational exposure, the use of protection devices, restrictions for manual use, etc.). If such special conditions are established, they shall be clearly stated in the instruction manual.

4.4 Equipment for occupational use in a public area

If equipment could be used under occupational conditions, but in an area where also the general public may be exposed, then the exposure shall additionally be assessed against the general public requirements under the conditions expected for that exposure situation (e.g. at usual safety distances) or, alternatively, the conditions necessary for compliance shall be established during assessment. If special conditions (such as the definition of a compliance boundary for the general public) are established, these shall be clearly stated in the instruction manual.

4.5 Exposure of persons wearing cardiac pacemakers or other medical implants

As the immunity of different types of pacemakers or other implants varies considerably, a risk assessment involving a responsible medical expert is necessary for every single case of user exposure. This risk assessment is not within the scope of this product family standard. A warning statement regarding this matter shall be included in the instruction manual.

4.6 Projectile risk

The projectile risk from ferromagnetic objects in static magnetic fields shall be considered in the instruction manual if there is a magnetic flux density greater than 3 mT.

4.7 Touch currents

The risk of touch currents generated by voltages induced in conducting structures at the workplace by electromagnetic fields due to the welding current is avoided by the application of general safety rules for electric welding, e.g. equipotential bonding and other measures, therefore no further evaluation is required.

5 Compliance assessment

5.1 General

5.1.1 Measurement and calculation

The measurements and/or calculations to demonstrate equipment compliance shall be made in accordance with the basic standards EN 50444 and EN 50505.

5.1.2 Time averaging

For occupational exposure the d.c. components of the magnetic flux density or field strength values should be averaged over a time interval of 8 h, taking into account the duty cycle of the equipment and the welding current sequence, as applicable [4].

For exposure to time-varying magnetic fields up to 10 MHz no averaging of induced current densities over time intervals is allowed.

At frequencies below 100 kHz no averaging is allowed for *H* and *B* values, at frequencies between 100 kHz and 10 GHz averaging over any six-minute period is permissible, provided that the peak restrictions given in the notes to Table 2 of Recommendation 1999/519/EC [2] and Table 2 of Directive 2004/40/EC [3] are not exceeded.

5.1.3 Spatial averaging

Generally the reference levels are intended to be spatially averaged values over the entire body of the exposed individual, but with the important proviso that the basic restrictions on localized exposure are not exceeded.

This product family standard is used to assess mainly the exposure generated from the welding circuit, creating stimulation effects. The maximum exposure is localized on the part of the body nearest to the source. In this type of situation an approach based on the spatial averaging of non uniform field distributions underestimates the exposure and is not suitable to ensure that the localized exposure does not lead to exceeding the basic restrictions for induced current densities.

Therefore spatial averaging shall not be applied to reference level based exposure assessment of stimulation effects due to fields generated by the welding circuit.

For evaluation of exposure generated from sources other than the welding circuit (for example from microprocessors, radio communication systems, ancillary equipment) and assessment of thermal effects, spatial averaging of the field may be appropriate.

For homogeneous models, induced current density values shall be averaged over any area of 1 cm^2. In the case of induced current density values obtained by numerical simulation using high resolution anatomic body models this area shall be limited to central nervous system tissues and shall not include other types of tissue. Therefore the resulting averaging area for heterogeneous models shall be smaller than or equal to 1 cm^2. For all 3D models the averaging area shall be perpendicular to the induced current flow.

5.1.4 Assessment of equipment with pulsed or non-sinusoidal welding current

Assessment shall be made in accordance with the basic standards EN 50444 and EN 50505. If summation procedures are applied, the parameters given in Table 1 shall be used, as applicable.

Table 1 – Summation parameters

	φ_l below f_{coc} RAD		φ_l above f_{coc} RAD		f_{coc} Hz		f_{sco} kHz	*b*		*d*	
	for ***B*** & ***H***	for ***J***	for ***B*** & ***H***	for ***J***	for ***B*** & ***H***	for ***J***	for ***B*** & ***H***	for ***H*** A m^{-1}	for ***B*** µT	for ***H*** A m^{-1}	for ***B*** µT
General public exposure	pi/2	0	0	-pi/2	800	1 000	150	5,2	6,25	0,73/*f*	0,92/*f*
Occupational exposure	pi/2	0	0	-pi/2	820	1 000	65	24,4	30,7	–	–

where

φ_l is the phase angle of the weighting function;

f_{coc} is the cut off frequency of the modelled (e.g. by RC circuit) frequency response of nervous cells;

f_{sco} is the summation cut off frequency;

b is the value to relate frequency components above f_{sco} to for stimulation considerations;

d is the value to relate frequency components below f_{sco} to for thermal considerations;

f is the frequency of the spectral component to be summed, given in MHz.

NOTE These values are taken from the Recommendation 1999/519/EC [2] and ICNIRP documents [5] and [6].

Alternatively the limits, reference levels and phases of the weighting functions for summation of spectral components can be approximated by first order filters as specified in documents defining procedures to assess non-sinusoidal and pulsed signals [6]. Details and examples are given in the basic standards EN 50444 and EN 50505. The first order filter approach is applicable to both analytical and numerical methods as well as for field measurements.

5.1.5 Assessment of equipment with multiple welding current waveforms

This type of equipment shall be evaluated in all relevant operation modes, e.g. arc welding equipment such as a MIG standard / pulse power source with constant d.c. and pulsed output current or an a.c. / d.c. MMA power source with constant d.c. and a.c. output current. The selection of relevant operation modes, as far as applicable, and test parameters shall be made in accordance with the basic standards EN 50444 and EN 50505.

5.2 Assessment of EMF

5.2.1 General considerations

The EMF shall be assessed using one of the following methods. It is not necessary to demonstrate compliance using more than one method. However, if multiple operation modes have to be tested, different methods may be applied for these modes, e.g. measurements to show compliance with reference levels for d.c. mode and numerical simulation to show compliance with the basic restrictions for pulsed mode.

Selection criteria for appropriate application of assessment methods are given in the basic standards EN 50444 and EN 50505.