

**SLOVENSKI STANDARD**  
**SIST-TP CLC/TR 62271-208:2010**  
**01-junij-2010**

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**Metode za kvantifikacijo nizkofrekvenčnih elektromagnetnih polj v ustaljenem stanju, ki jih generirajo visokonapetostne (VN) omrežne stikalne naprave in VN/NN montažne postaje (IEC/TR 62271-208:2009)**

Methods to quantify the steady state, low frequency EMF generated by HV switchgear assemblies and HV/LV prefabricated substations (IEC/TR 62271-208:2009)

Bestimmung der stationären, betriebsfrequenten elektromagnetischen Felder von HS-Schaltanlagen und fabrikfertigen HS-/NS-Stationen (IEC/TR 62271-208:2009)

Méthodes de quantification des champs électromagnétiques à fréquence industrielle en régime établi générés par les ensembles d'appareillages HT et les postes préfabriqués HT/BT (CEI/TR 62271-208:2009)

**Ta slovenski standard je istoveten z: CLC/TR 62271-208:2010**

**ICS:**

29.130.10	Visokonapetostne stikalne in krmilne naprave	High voltage switchgear and controlgear
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**SIST-TP CLC/TR 62271-208:2010**      **en,fr**

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TECHNICAL REPORT

**CLC/TR 62271-208**

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

April 2010

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English version

**High-voltage switchgear and controlgear -  
Part 208: Methods to quantify the steady state, power-frequency  
electromagnetic fields generated by HV switchgear assemblies and HV/LV  
prefabricated substations**

(IEC/TR 62271-208:2009)

Appareillage à haute tension -  
Partie 208: Méthodes de quantification  
des champs électromagnétiques  
à fréquence industrielle en régime établi  
générés par les ensembles  
d'appareillages HT et les postes  
préfabriqués HT/BT

Hochspannungs-Schaltgeräte  
und -Schaltanlagen -  
Teil 208: Bestimmung der stationären,  
betriebsfrequenten elektromagnetischen  
Felder von HS-Schaltanlagen  
und fabrikfertigen HS-/NS-Stationen

(CEI/TR 62271-208:2009)

(IEC/TR 62271-208:2009)

This Technical Report was approved by CENELEC on 2010-03-05.

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, 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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

This Technical Report consists of the text of the International Technical Report IEC/TR 62271-208:2009 prepared by SC 17C, High-voltage switchgear and controlgear assemblies, of IEC TC 17, Switchgear and controlgear.

It was circulated for voting in accordance with the Internal Regulations, Part 2, Subclause 11.4.3.3 (simple majority) for acceptance as a CENELEC Technical Report.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61000-6-2	- 1)	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments	EN 61000-6-2	- 2)
IEC 61786	- 1)	Measurement of low-frequency magnetic and electric fields with regard to exposure of human beings – Special requirements for instruments and guidance for measurement	-	-
IEC 62271-200	- 1)	High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV	EN 62271-200	- 2)
IEC 62271-201	- 1)	High-voltage switchgear and controlgear – Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV	EN 62271-201	- 2)
IEC 62271-202	- 1)	High-voltage switchgear and controlgear – Part 202: High voltage/low voltage prefabricated substation	EN 62271-202	- 2)

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1) Undated reference.

2) Valid edition at date of issue.

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# TECHNICAL REPORT

# RAPPORT TECHNIQUE

**High-voltage switchgear and controlgear –  
Part 208: Methods to quantify the steady state, power-frequency electromagnetic  
fields generated by HV switchgear assemblies and HV/LV prefabricated  
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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 208: Methods to quantify the steady state,  
power-frequency electromagnetic fields  
generated by HV switchgear assemblies  
and HV/LV prefabricated substations**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62271-208, which is a technical report, has been prepared by subcommittee 17C: High-voltage switchgear and controlgear assemblies, of IEC technical committee 17: Switchgear and controlgear.

In this technical report the word "shall" is used as a conditional "shall", in the event that this technical report is applied.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
17C/450/DTR	17C/462/RVC

Full information on the voting for the approval of this technical report 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.

A list of all the parts in the IEC 62271 series, under the general title *High-voltage switchgear and controlgear*, 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.

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## INTRODUCTION

Manufacturers of electricity supply equipment may be asked to provide information about the electromagnetic field characteristics to enable the user to

- assess the electromagnetic field conditions to assist with planning, installation, operating instructions and service,
- take measures to meet requirements or regulations on electromagnetic fields,
- compare different products as far as their level of electromagnetic fields is concerned.

The purpose of this technical report is to describe a methodology for the evaluation (measurement or calculation) of generated electromagnetic fields.

The electromagnetic field characteristic of the equipment comprises the values of the electric and the magnetic fields around its accessible surfaces.

The electromagnetic field characteristic defined in this technical report refers to a single product as defined in the scope. In real installations, several field sources can superimpose, so the resulting electromagnetic fields on site may differ significantly from the single product characteristics.

This technical report does not define a mandatory test for the products mentioned in the scope.

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Neither the establishment of limits for the electromagnetic fields generated by equipment, nor the establishment of assessment methods for the human exposure to electromagnetic fields is within the content or intent of this technical report.

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## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 208: Methods to quantify the steady state, power-frequency electromagnetic fields generated by HV switchgear assemblies and HV/LV prefabricated substations

#### 1 Scope

This part of IEC 62271 gives practical guidance for the evaluation and documentation of the external electromagnetic fields which are generated by HV switchgear assemblies and HV/LV prefabricated substations. Basic requirements to measure or calculate the electric and magnetic fields are summarised for switchgear assemblies covered by IEC 62271-200 and IEC 62271-201, and for prefabricated substations covered by IEC 62271-202.

NOTE 1 The methods described in this technical report refer to three-phase equipment. However, the methodology may be used correspondingly for any single- or multi-phase equipment covered by this technical report.

This technical report applies to equipment rated for voltages up to and including 52 kV and power-frequencies from 15 Hz to 60 Hz. The electromagnetic fields which are generated by harmonics or transients are not considered in this technical report. However, the methods described are equally applicable to the harmonic fields of the power-frequency.

Detailed generic information on requirements and measurements of low-frequency electromagnetic fields is given in IEC 61786.

This technical report covers evaluation under factory or laboratory conditions before installation. The electric and the magnetic fields can be evaluated either by measurements or by calculations.

NOTE 2 Where practicable, the methods described in this technical report may also be used for installations on site.

It is not within the scope of this technical report to specify limit values of electromagnetic fields or methods for the assessment of human exposure.

#### 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.

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity for industrial environments*

IEC 61786, *Measurement of low-frequency magnetic and electric fields with regard to exposure of human beings – Special requirements for instruments and guidance for measurements*

IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-201, *High-voltage switchgear and controlgear – Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-202, *High-voltage switchgear and controlgear – Part 202: High-voltage/low-voltage prefabricated substation*

### 3 Terms and definitions

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

#### 3.1

##### **EMF**

abbreviation for the term “electromagnetic field(s)”

#### 3.2

##### **electric field characteristic**

values (r.m.s.) and spatial distribution of the electric field strength at rated voltage and frequency around all accessible surfaces of the equipment. The electric field characteristic is the resultant of the r.m.s. values of the three orthogonal vector components

#### 3.3

##### **magnetic field characteristic**

values (r.m.s.) and spatial distribution of the magnetic flux density at rated normal current and frequency around all accessible surfaces of the equipment. The magnetic field characteristic is the resultant of the r.m.s. values of the three orthogonal vector components

NOTE The terms “resultant electric field” and “resultant magnetic field” are defined in IEC 61786.

#### 3.4

##### **accessible surfaces**

those parts of the walls and roof of prefabricated substations or HV switchgear assemblies that can be touched with all covers and doors in closed position in normal service conditions

#### 3.5

##### **reference surface**

##### **RS**

virtual envelope containing the equipment for evaluation purposes

#### 3.6

##### **measurement surface**

##### **MS**

defined outside the reference surface at 20 cm distance

NOTE This surface is used for measuring the hot spots and the variation of the EMF.

#### 3.7

##### **hot spot**

centre of an area of a local maximum of the electric or the magnetic field

#### 3.8

##### **EMF characteristic**

spatial distribution of the resultant (modulus) of the r.m.s. electric field strength (E) and the magnetic flux density (B). The spatial distribution is derived from a measurement or calculation grid

### 3.9 measurement volume MV

virtual space in which the electromagnetic background field must not exceed an appropriate level to permit the uninfluenced measurement of the electric and magnetic fields generated by the equipment

## 4 Evaluation requirements

### 4.1 General

The EMF characteristic of HV switchgear assemblies or HV/LV prefabricated substations is the measured or calculated electric field strength and magnetic flux density around all accessible surfaces under the conditions for evaluation described below. These conditions represent the service, where the loading of the switchgear assemblies and, in a substation, of the transformer is at defined values.

As the electric and magnetic fields are dependent on the physical arrangement of incoming and outgoing cables and their loadings, these parameters have to be recorded. The presence of other field sources and shielding or other metallic structures shall be recorded.

The EMF characteristic shall be evaluated for the conditions that would result in the highest levels of electric and magnetic fields in normal, undisturbed service. These conditions include the highest currents and largest loops realistically possible through the assembly working at maximum capacity. EMF caused by switching operations, including interruption of fault currents, or other transient phenomena is deemed to be incidental and shall not be considered.

The highest current on the HV side is the rated normal current given on the nameplate of the switchgear assembly, and on the LV side the rated normal current of the transformer with the highest rating. In a calculation both currents have to be simulated. During a measurement it is preferable to have both currents present.

Electric field strength and magnetic flux density shall be recorded as the resultant of the r.m.s. values of the three orthogonal components.

The evaluation shall be carried out at the rated frequency of the equipment.

However, in the frequency range up to and including 60 Hz the actual value of frequency does not significantly affect the levels of generated E fields for any given values of voltage. Therefore evaluation at any frequency up to and including 60 Hz is considered valid.

Similarly, the difference in attenuation of B fields by metallic enclosures at 50 Hz and 60 Hz can be ignored for the purpose of this technical report. Therefore evaluation at 50 Hz is considered applicable also for 60 Hz and vice versa.

In the power-frequency range covered by this technical report the electric and magnetic fields may be treated separately. When selecting the conditions to obtain the highest level of electric and magnetic fields as realistically as possible in undisturbed service, the following subclauses shall be considered.

### 4.2 Methods of evaluation

The manufacturer may evaluate the EMF characteristic by measurement or by calculation.