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TECHNICAL REPORT

colour inside

Assessment of contact current related to human exposure to electric, magnetic and electromagnetic fields

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ASSESSMENT OF CONTACT CURRENT RELATED TO HUMAN EXPOSURE TO ELECTRIC, MAGNETIC AND ELECTROMAGNETIC FIELDS

FOREWORD

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IEC TR 63167 has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure. It is a Technical Report.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) revised in accordance with the latest revision of international EMF guidelines;

b) revised in accordance with updates of relevant IEC standards on electrical safety.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
106/641/DTR	106/656/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

In the guidelines limiting human exposure to electric, magnetic and electromagnetic fields (EMF guidelines), limits or a guidance for the contact current are given to avoid adverse indirect effects, i.e. electric shocks and burn hazards caused by contact with a conductive object located in an electric field or magnetic field or both, when the object has an electric potential owing to electric or magnetic induction to the object.

At the moment, no standardized method for evaluating the contact current, in the context of human exposures to the above fields has been well established. On the other hand, there is a vast amount of knowledge, as well as many standards and regulations on the issue of electrical safety (i.e. direct contact with live part of conductive object) to avoid severe electric shock hazards. Therefore, the evaluation methods used in the field of electrical safety can be useful references. This document summarizes general information on the assessment of contact current related to human exposure to electric, magnetic and electromagnetic fields.

ASSESSMENT OF CONTACT CURRENT RELATED TO HUMAN EXPOSURE TO ELECTRIC, MAGNETIC AND ELECTROMAGNETIC FIELDS

1 Scope

This document, which is a Technical Report, provides general information on the assessment of contact current related to human exposure to electric, magnetic and electromagnetic fields. The contact currents in this context occur when a human body comes into contact with a conductive object that is non-electrified but exposed to an electric field or magnetic field or both at a different electric potential owing to electric or magnetic induction to the object. This is distinguished from the issue of electrical safety where contact with live parts of a conductive object is dealt with.

In reference to the international EMF guidelines [1], [2], and [3][1], the frequency range of contact current covered in this document is DC to 110 MHz, and only steady-state (continuous) contact currents are covered. Transient contact currents (spark discharges) which can occur immediately before the contact with the object are not covered.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
contact current
<to human exposure> current flowing through the body resulting from contact with an insulated conductive object that has been energized in an electric, magnetic or electromagnetic field or from an insulated body that has been energized in an electric, magnetic or electromagnetic field and is in contact with a grounded conductive object

3.2
exposure
<to human> situation that occurs when a person is subjected to an electric, magnetic or electromagnetic field, or to a contact current other than those originating from physiological processes in the body and other natural phenomena

3.3
indirect effect
effect arising when an object present in an electromagnetic field becomes a cause of safety or health hazard

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1 Numbers in square brackets refer to the Bibliography.

3.4
touch current
electric current passing through a human body when it touches one or more accessible and energized parts of an installation or of equipment, or object, used in the field of electrical safety

Note 1 to entry: The term "leakage current" had also been used as a synonym for touch current in the field of electrical safety.

[SOURCE: IEC 60050-195:2021, 195-05-21, modified – In the definition, "or through livestock" has been deleted, "and energized" has been added, "or object, used in the field of electrical safety" has been added. Note 1 to entry has been added.]

3.5
spark discharge
transfer of current through an air gap prior to making contact with another conductive object at a different potential

4 Abbreviated terms

3D	three dimensional
AC	alternating current
AM	amplitude modulation
DC	direct current
EMF	electric, magnetic or electromagnetic field
EV	electric vehicle
FM	frequency modulation
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
IH	induction heating
MRI	magnetic resonance imaging
PC	personal computer
RF	radio frequency
WPT	wireless power transfer

5 Contact current in EMF guidelines

Clause 5 overviews contact currents described in the EMF guidelines [1], [2], and [3].

In the frequency range up to approximately 10 MHz (predominantly up to 100 kHz), the flow of electric current from an object in a field to the body of an individual can result in the stimulation of muscles or peripheral nerves. With increasing current, this can be manifested as perception, pain from an electric shock or burn, the inability to release the object, difficulty in breathing and, at higher currents, cardiac ventricular fibrillation.

In the frequency range of about 100 kHz to 110 MHz, shocks and burns can result either from an individual touching an ungrounded metal object that has acquired a charge in a field or from contact between a charged individual and a grounded metal object.