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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Residual current-operated protective devices (RCDs) for household and similar use – Electromagnetic compatibility

Dispositifs différentiels résiduels (DDR) pour usages domestique et analogues – Compatibilité électromagnétique

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Dispositifs différentiels résiduels (DDR) pour usages domestique et analogues – Compatibilité électromagnétique

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RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICES (RCDs) FOR HOUSEHOLD AND SIMILAR USE – ELECTROMAGNETIC COMPATIBILITY

FOREWORD

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IEC 61543 has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This second edition cancels and replaces the first edition published in 1995, Amendment 1:2004 and Amendment 2:2005. This edition constitutes a technical revision.

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

a) some editorial modifications were introduced to comply to the ISO/IEC Directives Part 2:2021, e.g. introduction of Clause 3 – Terms and Definitions and renumbering of the whole document. In particular, the numbering of performance criteria has been changed (5.1.1, 5.1.2 become A, B, etc.);
b) some technical improvements:
   - Modification of scope and addition of Clause 6 and Clause 7 to enable the use of this document as a guideline for the preparation of EMC requirements and tests for other product standards under the scope of SC 23E;
   - Requirements for voltage dips and interruptions added;

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- Repetition rate for burst-test, defined at 5 kHz;
- Surge test: Specifying impulse voltage application point and adding of voltages 2 kV, 1 kV and 0,5 kV to test T 5b;
- Radiated radio-frequency electromagnetic field: Adding of frequency range 1,4 GHz to 6 GHz and specifying frequencies for the test at 1,25 $I_{\Delta n}$;
- Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz: Specifying frequencies for the test at 1,25 $I_{\Delta n}$;
- Electrostatic discharges: Change of performance criteria from 5.1.3 to B.

The text of this International Standard is based on the following documents:

Draft	Report on voting
23E/1268/FDIS	23E/1305/RVD

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 International Standard 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/standardsdev/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,
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INTRODUCTION

IEC 61543 is product family standard for RCDs Electromagnetic Compatibility and, more generally it is used as a guide for other devices of IEC Subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

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RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICES (RCDs) FOR HOUSEHOLD AND SIMILAR USE – ELECTROMAGNETIC COMPATIBILITY

1 Scope

This international standard provides specific emission and immunity requirements, tests and performance criteria for residual current-operated protective devices (RCDs), for household and similar use, for rated voltages not exceeding 440 V.

Household and similar use corresponds to the description given in the generic standard IEC 61000-6-1 for residential, commercial, and light-industrial electromagnetic environments.

This document is intended to be referred to by RCD product standards and is not intended to be used as a standalone document.

Residual current-operated protective devices are:

- Residual current operated circuit-breakers without integral overcurrent protection for household and similar use (RCCBs) covered by the IEC 61008 series and IEC 62423;
- Residual current operated circuit-breakers with integral overcurrent protection for household and similar use (RCBOs) covered by the IEC 61009 series and IEC 62423;
- Residual current devices with or without overcurrent protection for socket-outlets (SRCDs) covered by IEC 62640;
- Portable residual current devices without integral overcurrent protection (PRCDs) covered by IEC 61540;
- Devices with an RCD functionality for household and similar use according product standards following the group safety publications for general safety requirements for RCDs, IEC 60755.

This edition applies if it is referred to as a dated reference in the relevant product standard.

This document is also intended to be used as a guideline in the preparation of EMC requirements and tests for other product standards under the scope of IEC Subcommittee 23E. It also specifies generic performance criteria intended to be transformed into specific performance criteria by the relevant product standard.

NOTE Examples of other product standards under the scope of SC 23E are:

- IEC 62020-1, Electrical accessories – Residual current monitors (RCMs) – Part 1: RCMs for household and similar uses
- IEC 62606, General requirements for arc fault detection devices
- IEC 63024, Requirements for automatic reclosing devices (ARDs) for circuit breakers, RCBOs-RCCBs for household and similar uses
- IEC 63052, Power frequency overvoltage protective devices (POPs) for household and similar applications
- IEC 62752, In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD)
- IEC 62955, Residual direct current detecting device (RDC-DD) to be used for mode 3 charging of electric vehicles

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3 : Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-16:2015, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

CISPR 14-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 Electromagnetic emission of RCDs

Emission tests are required only for RCDs containing a continuously operating oscillator. The requirements of CISPR 14-1 apply.

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RCDs other than those containing a continuously operating oscillator do not usually generate continuous or transient disturbances except during their switching process. The frequency, the level and the consequences of such emissions are considered as part of the normal electromagnetic environment of low- voltage installations.

5 Electromagnetic immunity of RCDs

5.1 General

Unless otherwise stated, the tests are made at rated voltage without load, and, for residual current devices fitted with an FE, the FE is connected to the supply neutral.

5.2 Performance criteria for RCDs

For safety reasons, some tests levels and test specifications have been chosen at levels higher than those required by the generic standard. The performance criteria A, B and C listed below apply.

A: During the test referring to this performance criterion, the RCD shall remain closed at continuously applied residual current of 0,3 $I_{\Delta n}$ and shall trip at 1,25 $I_{\Delta n}$.

B: During the tests referring to this performance criterion, the RCD shall not trip. After the test, verification of correct operation in case of sudden appearance of sinusoidal AC residual current at $I_{\Delta n}$ only shall be checked, in order to verify that the device operates as intended.

C: During the test referring to this performance criterion, the RCD may trip. After the test, with the sample in closed position, verification of correct operation in case of sudden appearance of sinusoidal AC residual current at $I_{\Delta n}$ only shall be checked.

5.3 Immunity tests

5.3.1 General

For the immunity tests, Table 1 applies.

Table 1 – Immunity tests

Test reference	Electromagnetic phenomena	Reference EMC standard	Test level and specification	Performance criteria
T 1	Voltage dips	IEC 61000-4-11	See 5.3.2 Class 2: 0 % U_n during 1 cycle 70 % U_n during 25/30 cycles (50/60Hz)	B
	Voltage interruptions	IEC 61000-4-11	See 5.3.2 Class 2: 0 % U_n during 250/300 cycles (50/60Hz)	C
T 2	Power frequency magnetic field	IEC 61000-4-8	Covered by overload test and short circuit tests of the relevant product standards NOTE All product standards of IEC 23E contain at least a short circuit test with a minimum of 500 A. This creates a magnetic field higher than the value of 3A/m given in IEC 61000-6-1.	
T 3	Conducted disturbances, induced by radio-frequency fields	IEC 61000-4-6	See 5.3.3 0,15 MHz to 80 MHz Level 2: 3 V	A

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Test reference	Electromagnetic phenomena	Reference EMC standard	Test level and specification	Performance criteria
T 4	Fast transients / bursts	IEC 61000-4-4	See 5.3.4 (Tr/Th 5/50 ns)	B
			RCCBs and RCBOs: Level 4 – 4 kV (peak) **SRCDs and PRCDs:** Level 3 – 2 kV (peak)	
T 5a	Surges	IEC 61000-4-5	See 5.3.5 (Tr/Th 1,2/50 µs) **RCCBs and RCBOs:** Common mode: 12 Ω – 5 kV Differential mode: 2 Ω – 4 kV **SRCDs and PRCDs:** Common mode: 12 Ω – 4 kV Differential mode: 2 Ω – 2 kV	C
T 5b	Surges	IEC 61000-4-5	See 5.3.5 (Tr/Th 1,2/50 µs) **RCCBs and RCBOs:** Common mode: 12 Ω – 4 kV, 2 kV, 1 kV, 0,5 kV Differential mode: 2 Ω – 2 kV, 1 kV, 0,5 kV **SRCDs and PRCDs:** Common mode: 12 Ω – 2 kV, 1 kV, 0,5 kV Differential mode: 2 Ω – 1 kV, 0,5 kV	B C
T 6	Radiated radio-frequency electromagnetic field	IEC 61000-4-3	See 5.3.6 80 MHz to 1 000 MHz: 3V/m 1,4 GHz to 6 GHz: 3V/m	A
T 7[a]	Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz	Values derived from IEC 61000-4-16	See 5.3.7 for $I_{\Delta n}$ < 30 mA: Level 2 for $I_{\Delta n}$ ≥ 30 mA: Level 3	A
T 8	Electrostatic discharges	IEC 61000-4-2	See 5.3.8 Level 3: +/- 8 kV air +/- 6 kV contact	B
[a] In the US this test is not applicable.				
NOTE 1 IEC 61000-4-19 covers differential mode disturbances at frequency ranges 2 kHz to 150 kHz, with no residual current. RCDs are not sensitive to such tests. Therefore, the tests of IEC 61000-4-19 are not necessary for RCDs. NOTE 2 IEC 61000-4-5:2014, Annex C provides explanatory notes about source impedance values for test T 5a and T 5b.				

5.3.2 Voltage dips and voltage interruptions (T 1)

RCDs shall be tested according to IEC 61000-4-11 on the power supply lines of the device under test.

For voltage dips, abrupt changes in supply voltage shall occur at zero crossings of the voltage, and at 45°, 90°, 135°, one angle tested selected at random on each phase.

For short interruptions, the angle shall be 0° for one of the phases.

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