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Guidance for the correct use of residual current-operated protective devices (RCDs) for household and similar use

iTeh STANDARD PREVIEW

Indications pour un bon usage des dispositifs différentiels résiduels (DDR) pour usages domestiques et analogues

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**Indications pour un bon usage des dispositifs
différentiels résiduels (DDR) pour usages
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**Guidance for the correct use of residual current-
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GUIDANCE FOR THE CORRECT USE OF RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICES (RCDs) FOR HOUSEHOLD AND SIMILAR USE

FOREWORD

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IEC 62350, which is a technical report, has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

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

| | |
|---------------|------------------|
| Enquiry draft | Report on voting |
| 23E/604/DTR | 23E/622/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.

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- withdrawn,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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GUIDANCE FOR THE CORRECT USE OF RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICES (RCDs) FOR HOUSEHOLD AND SIMILAR USE

1 Scope

This technical report provides an overview of protection availability provided by residual current-operated protective devices (RCDs) complying with IEC standards for household and similar uses. It highlights the main parameters influencing protection reliability and provides information on how to install and operate RCDs in relationship to their environmental conditions after installation.

This guide gives general information concerning availability of the protection within the fixed installation and how to keep a high level of availability of protection during use (installation and maintenance). It has been drafted for the benefit of IEC technical committees, installers, inspectors and users.

NOTE 1 The term RCD is a generic term applied to a family of products which open automatically in response to a residual current at or exceeding the RCD's rated residual operating current, $I_{\Delta n}$. This generic term is often applied to the following.

RCCB - Residual Current Circuit Breaker without overcurrent protection

RCBO - Residual Current Breaker with Overcurrent protection

SRCD - Socket outlet Residual Current Device

PRCD - Portable Residual Current Device

A RCCB differs from a RCBO in that the RCBO will additionally respond to overcurrent conditions whereas the RCCB will not respond to such conditions.

NOTE 2 PRCDs are not considered to be part of the fixed installation, and are not covered by this guide.

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 60364 (all parts), *Electrical installations of buildings*

IEC 60364-4-44:2001, *Electrical installations of buildings – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-5-51, *Electrical installations of buildings – Part 5-51: Selection and erection of electrical equipment – Common rules*

IEC 61008 (all parts), *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)*

IEC 61008-1:1996, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

Amendment 1 (2002)

Amendment 2 (2006)

IEC 61009 (all parts), *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)*

IEC 61009-1:1996, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

Amendment 1 (2002)

Amendment 2 (2006)

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61543:1995, *Residual current-operated protective devices (RCDs) for household and similar use - Electromagnetic compatibility*

3 Terms and definitions

(See in Annex B official definitions from IEC)

4 General information concerning availability of RCD protection

4.1 Availability of RCD protection

Availability of RCD protection is the ability of an item to perform a required protective function under given conditions within an appropriate installation over a given period of time. Availability of RCD protection is not limited to the equipment but includes parameters from the installation such as PE continuity, appropriate earth resistance value, insulation resistance and environmental conditions. [SIST-TP IEC/TR 62350:2010](https://standards.iteh.ai/catalog/standards/sist/f36512a-0769-405b-a963-962932410/sist-tp-iec-tr-62350-2010)

NOTE 1 Periodic verification of the installation, including verification of electrical loads and equipment incorporating RCDs is advised. After verification, appropriate corrective measures have to be taken, e.g. repairing the installation or replacing faulty equipment, etc.

The value of availability of RCD protection may be expressed in percentage terms when looking at a homogeneous population of RCDs within the same installation, or to express the probability for a single device to perform the protective function after a defined period of time.

NOTE 2 Protection: the required function is to operate when required to do so and not to operate when not required to do so.

NOTE 3 The availability of the protective measure corresponds to the real need of the user.

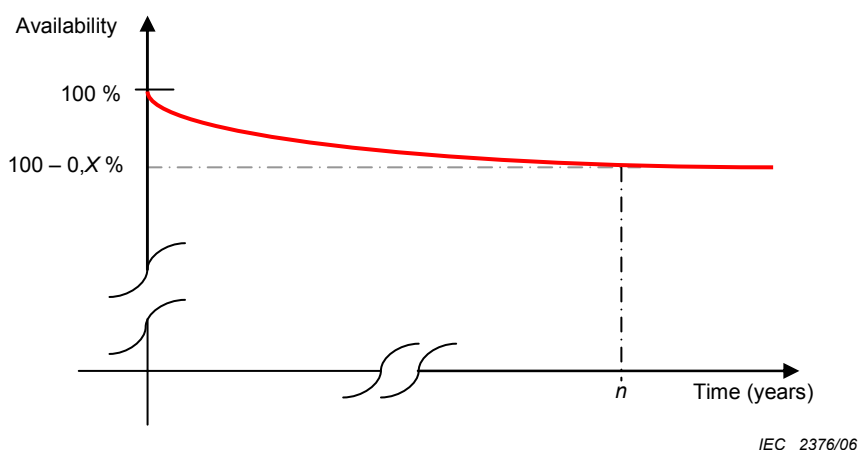
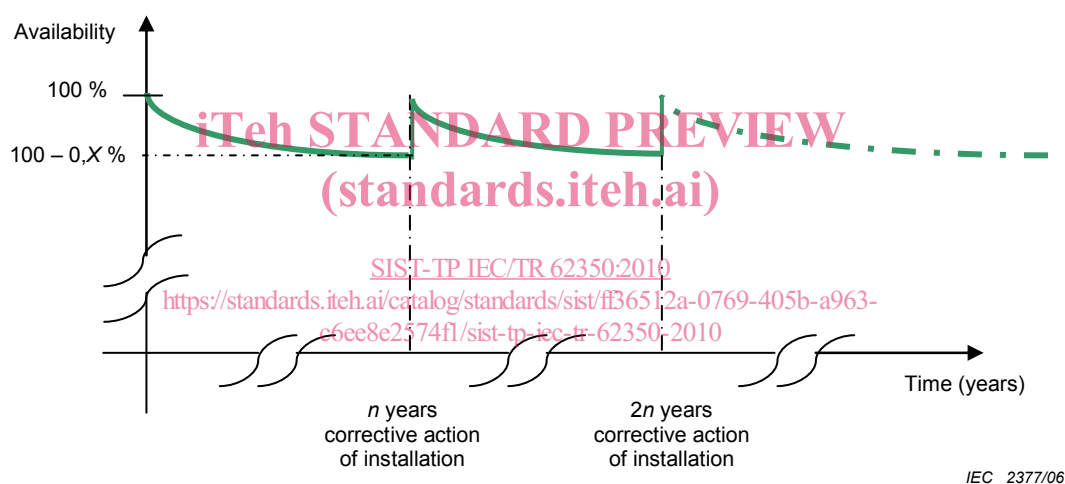


Figure 1 – Theoretical availability of protection without corrective measure within the installation



NOTE This figure is based on hypothesis of Figure 3, which supposes that the failure rate is stable within the useful life.

Figure 2 – Theoretical availability of protection with corrective measures made within the installation during periodical verification

Figure 1 shows that the RCD protection will decrease if the installation is not verified. For example a 300 mA RCD used for indirect contact protection might not trip if the earth resistance increases after a certain time.

Figure 2 shows that in case of periodic verification within the installation, the availability of protection is restored to 100 % if appropriate corrective measures are taken, e.g. replacement of faulty equipment.

4.2 Failure of the RCD to operate

The lack of operation of an RCD which should have operated but which did not operate as intended.

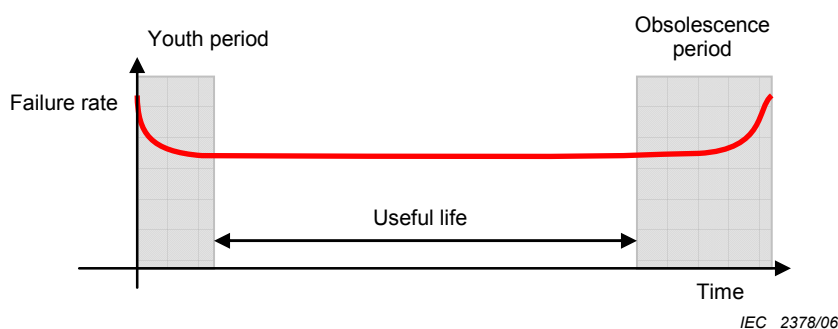
4.3 Failure rate

The probability of occurrence of a “failure to operate” over a given period of time.

4.4 Useful life (see Figure 3)

Under given conditions, the time interval from commencement of use to when the failure level becomes unacceptable.

NOTE The useful life of an RCD cannot be expressed in hours or years due to the influence of the particular conditions of service. Endurance, short-circuit and accelerated life tests, etc. are conventional means to assess an expected useful life.



NOTE At the end of the useful life period the failure rate will increase and availability of the protection can only be assured by replacement of the protective device.

Figure 3 – Failure rate and useful life

4.5 Available surveys

Several surveys have been published in relation to RCDs installed in various countries over many years and in different types of installation.

The analysis of these surveys highlights the following key information.

- Up to 50 % of the “faulty” RCDs were found to be fully functional when subsequently tested in the laboratory. These “failures” were attributed to installation conditions, such as faulty installations, miswiring, etc.
- Many RCDs had been fitted in installations in agricultural premises without due regard for the environmental conditions in such installations which were far more severe than those encountered in households and similar installations.
- Climatic and electromagnetic environmental conditions were major influencing factors. It was noted that the failure rate increased significantly in cases of use of RCDs in conditions that are beyond those defined in the relevant RCD standards.

Most of the studies related

- to RCDs fitted in installations more than twenty years old,
- and to RCDs not covered by current editions of IEC RCD standards. Most of the RCDs tested had been installed prior to publication of IEC 61543 (1995), which sets out EMC requirements for RCDs. Prior to 1996, RCDs were not subjected to a broad range of EMC tests.

5 Information related to contribution of products to the availability of protection

5.1 Contribution of compliance with RCD standards

5.1.1 General

The relevant IEC standards covering RCDs intended for household and similar use are as follows:

- IEC 61008 RCCBs for household and similar use,
- IEC 61009 RCBOs for household and similar use,
- IEC 61543 EMC requirements for RCDs.

Compliance with relevant product standards has to be ensured by the manufacturer for all devices produced. This compliance can be ensured through

- type test conformity assessment (manufacturer's declaration or certification), and
- routine tests as required by the standard.

Installers and users should only use RCDs fully complying with IEC standards.

RCD ratings are given in the relevant RCD product standards. Except for the tolerances specified in these standards, the RCD ratings must not be exceeded. Operation of the RCD outside its specified ratings is likely to result in damage to the RCD and undermine availability of the protective function.

5.1.2 Contribution of standardised environmental conditions to the availability of protection

RCDs complying with IEC 61008, IEC 61009 and IEC 61543 are intended to be used in normal indoor conditions expected in household and similar uses where

- the extreme temperature range does not exceed -5 °C to 40 °C , with a reference value of 20 °C ;
- the relative humidity level does not exceed 50% at 40 °C ;
- the air pressure remains in the range of 70 kPa to 106 kPa (altitude < 2 000 m);
- the quality of the atmosphere is that to be normally expected in a household, being neither corrosive nor lacking of adequate ventilation;
- the external magnetic field does not exceed 5 times the earth's magnetic field in any direction.

5.1.3 Contribution of the standardised tests to the availability of protection

The availability of the RCD protection during its useful life and under the conditions of use as foreseen is considered to be verified by specific tests (see list below referring to IEC 61008) performed in the different type test sequences.

These specific requirements and tests either simulate ageing of the RCD or verify the withstand capability to stresses that may occur at any time during use.