

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

ICS 29.120.50

National foreword

This Published Document was published by BSI. It is the UK implementation of IEC/TR 62350:2006.

The UK participation in its preparation was entrusted by Technical Committee PEL/23, Electrical accessories, to Subcommittee PEL/23/1, Circuit breakers and similar equipment for household use.

A list of organizations represented on PEL/23/1 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 28 February 2007

© BSI 2007

ISBN 978 0 580 50221 7

Amendments issued since publication

Amd. No.	Date	Comments

**RAPPORT
TECHNIQUE
TECHNICAL
REPORT**

**CEI
IEC
TR 62350**

Première édition
First edition
2006-12

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

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



Numéro de référence
Reference number
CEI/IEC/TR 62350:2006

CONTENTS

INTRODUCTION.....	3
1 Scope.....	4
2 Normative references	4
3 Terms and definitions	5
4 General information concerning availability of RCD protection	5
4.1 Availability of RCD protection	5
4.2 Failure of the RCD to operate.....	6
4.3 Failure rate.....	7
4.4 Useful life (see Figure 3)	7
4.5 Available surveys	7
5 Information related to contribution of products to the availability of protection	8
5.1 Contribution of compliance with RCD standards	8
5.2 Contribution of design and manufacturing.....	9
6 Availability of protection in installations fitted with RCDs	10
6.1 General considerations.....	10
6.2 Recommendations concerning the correct use of the test button	11
6.3 Recommendations for testing the availability of RCD protection within the installation.....	11
6.4 Recommendations concerning the choice and installation of RCDs	12
7 Information related to the installation and use of RCDs in the field	14
7.1 General considerations and measures concerning harsh environment.....	14
7.2 Most significant parameters to take into account	14
7.3 Recommendation for selection and installation to avoid unwanted tripping of RCDs	16
7.4 Relationship between availability of the protection and the selection of RCDs	18
Annex A (informative) General diagram showing contribution to availability of the protective measure	21
Annex B (informative) Definitions from the IEC	22
Annex C (informative) Operation of RCDs with possible fault currents	24
Annex D (informative) Example of use of the test button	26
Bibliography.....	27
Figure 1 – Theoretical availability of protection without corrective measure within the installation	6
Figure 2 – Theoretical availability of protection with corrective measures made within the installation during periodical verification.....	6
Figure 3 – Failure rate and useful life.....	7

INTRODUCTION

It is the purpose of this document to provide guidance and information to designers, manufacturers, installers, users and persons in charge of installation maintenance on the selection, erection and use of RCDs in fixed installations with a view to optimisation of the long term availability of the protection provided by RCDs.

Over the last forty years the experience accumulated on RCDs by manufacturers, laboratories, installers, users and installation bodies has been collated and used by IEC technical committees (in particular within SC23E) to achieve improvements in the reliability of RCDs through revisions of IEC RCD standards. Requirements and tests have been added or improved within such IEC standards towards this objective. Considerable progress was made when SC23E decided to introduce requirements such as a 28-day environmental test whose purpose is to simulate RCD ageing.

Users, installers and other committees within IEC need to be informed that although the reliability of an RCD compliant with relevant RCD standards has been substantially improved in comparison to earlier RCDs, availability of protection provided by RCDs is linked to many parameters, not all being related to RCDs themselves but including also the installation and the environmental conditions.

This guide has identified and addressed in a comprehensive way the key factors impacting on availability of RCD protection so as to contribute further towards the reliable operation of RCDs in service and further enhance the valuable protective functions provided by these devices. SC23E will continue to monitor this important area with a view to building on the work that has been completed through publication of this guide.

Additional information: during a meeting between TC64 and SC23E officers it was confirmed that this guide does not conflict with TC64 standards and that the purpose of the guide is to provide information leading to a better understanding of the correct use of RCDs.

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.

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.

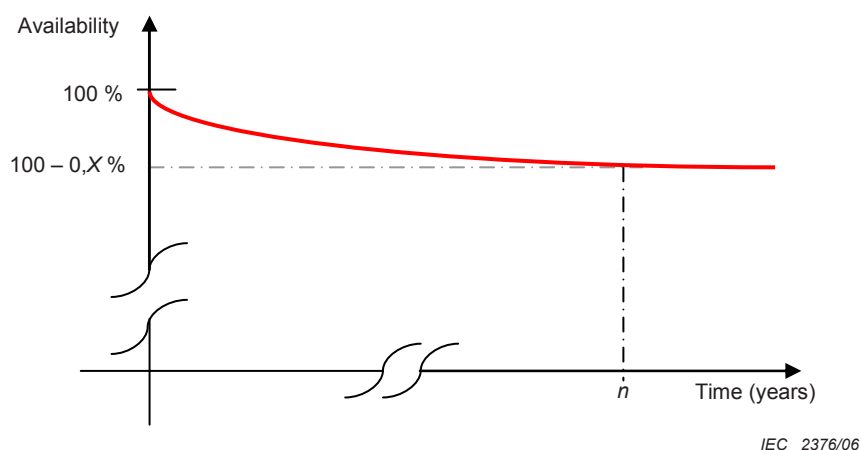
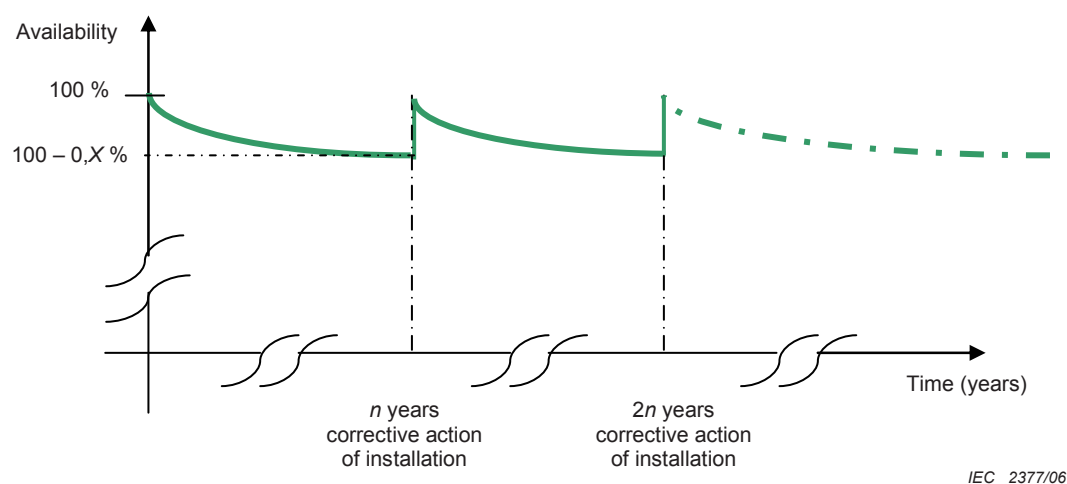


Figure 1 – Theoretical availability of protection without corrective measure within the installation



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.

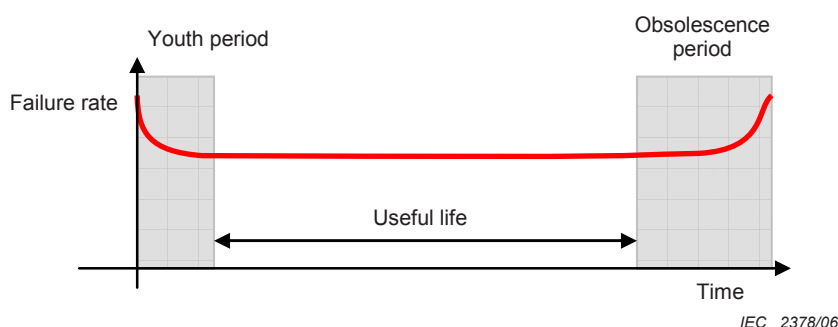
4.3 Failure rate

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.