

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Requirements for automatic reclosing devices (ARDs) for circuit-breakers, RCBOs and RCCBs for household and similar uses

Exigences pour les dispositifs à refermeture automatique (DRA) pour disjoncteurs, ID et DD, pour usages domestiques et analogues



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Requirements for automatic reclosing devices (ARDs) for circuit-breakers,
RCBOs and RCCBs for household and similar uses**

**Exigences pour les dispositifs à refermeture automatique (DRA) pour
disjoncteurs, ID et DD, pour usages domestiques et analogues**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.50

ISBN 978-2-8322-5132-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	11
4 Classification.....	13
4.1 According to the method of construction	13
4.2 According to the associated MPD.....	13
4.3 According to the type of assessment means	13
4.4 According to the safety means during the assessment.....	14
4.5 According to the connection to FE.....	14
4.6 According to maximum number of reclosing operations	14
4.7 According to mechanical interlock between MPD operating means and ARD enabling/disabling system	14
5 Characteristics	14
5.1 Summary of characteristics.....	14
5.2 Rated quantities	14
5.2.1 Rated voltage	14
5.2.2 Rated operational voltage (U_e).....	15
5.2.3 Rated frequency.....	15
5.2.4 Rated non-operating resistance to earth (R_{d0}).....	15
5.2.5 Rated operating resistance to earth (R_d)	15
5.2.6 Rated non-operating resistance between live parts (R_{CC0})	15
5.2.7 Rated operating resistance between live parts (R_{CC})	16
6 Marking and other product information	16
6.1 Standard marking.....	16
6.2 Instructions for assembly and operation	17
7 Standard conditions for operation in service.....	18
7.1 General.....	18
7.2 Conditions of installation	18
7.3 Pollution degree	18
8 Requirements for construction and operation	18
8.1 Mechanical design	18
8.1.1 General	18
8.1.2 Mechanism	19
8.1.3 Clearances and creepage distances	20
8.1.4 Clearances and creepage distances for electronic circuits connected between live parts or between live parts and the earth.....	20
8.1.5 Screws, current-carrying parts and connections	22
8.1.6 Terminals for external conductors	22
8.2 Protection against electric shock.....	22
8.3 Dielectric properties and isolating capability.....	23
8.4 Temperature rise.....	23
8.5 Mechanical and electrical endurance	23
8.6 Performance at short-circuit currents	23
8.7 Resistance to mechanical shock and impact.....	23

8.8	Resistance to heat.....	23
8.9	Resistance to abnormal heat and to fire	24
8.10	Operating characteristics.....	24
8.11	Assessment means for ARD according to 4.3.2.....	25
8.11.1	General	25
8.11.2	Assessment means operating by limitation of the test voltage	25
8.11.3	Assessment means operating by limitation of the test current	25
8.12	Safety in blocked condition	26
8.13	Test device	26
8.14	Ageing	26
8.15	Electromagnetic compatibility (EMC).....	26
9	Tests	26
9.1	General.....	26
9.2	Test condition	26
9.3	Measurement of the reclosing time after the tripping of the MPD	27
9.4	Test of indelibility of marking	27
9.5	Verification of the non-influence of the ARD on the correct operation of the MPD	27
9.5.1	Verification of the operating characteristics of the MPD	27
9.5.2	Verification of the impossibility of the activation of the ARD when the MPD has been manually opened.....	28
9.5.3	Verification of the enabling/disabling system of the ARD.....	28
9.5.4	Verification of the maximum number of consecutive reclosings	28
9.6	Tests of creepage distances and clearances for electronic circuits (abnormal conditions)	29
9.7	Requirements for capacitors, specific resistors and inductors used in electronic circuits	32
9.7.1	General	32
9.7.2	Capacitors	32
9.7.3	Resistors	32
9.7.4	Inductors and windings.....	33
9.8	Test of reliability of screws, current-carrying parts and connections	33
9.9	Test of reliability of terminals for external conductors.....	33
9.10	Verification of protection against electric shock.....	33
9.11	Test of dielectric properties and isolating capability	33
9.12	Temperature rise	34
9.13	Verification of the mechanical and electrical endurance – Verification of the reclosing system of the ARD	34
9.13.1	General test conditions	34
9.13.2	Test procedure	34
9.13.3	Condition of the ARD after the test	34
9.14	Short-circuit test	35
9.14.1	General conditions for short-circuit test.....	35
9.14.2	Test circuit and test quantities	35
9.14.3	Test procedure	35
9.14.4	Condition of the ARD after the test	35
9.15	Resistance to mechanical shock and impact	36
9.16	Test of resistance to heat.....	36
9.17	Resistance to abnormal heat and to fire	36
9.18	Verification of the operating characteristics.....	36

9.18.1	General	36
9.18.2	Verification of the reclosing subordinated to the measurements of the resistance to earth	36
9.18.3	Verification of the reclosing subordinated to the measurements of the resistance between live parts.....	37
9.18.4	Verification of the influence of the distributed capacities in the installation on the operating characteristic	37
9.18.5	Verification of the maximum current in FE under normal condition	37
9.19	Verification of the safety during the assessment	38
9.19.1	Verification of the limitation of the voltage	38
9.19.2	Verification of the limitation of the test current	38
9.19.3	Verification of the safety in blocked condition	38
9.20	Verification of the operation of the test device at the limits of rated voltage.....	39
9.21	Verification of ageing	39
9.22	Electromagnetic compatibility.....	39
9.22.1	General	39
9.22.2	Low-frequency electromagnetic phenomena	39
9.22.3	High-frequency immunity	40
9.22.4	Electrostatic discharges.....	41
9.22.5	Electromagnetic emission of ARDs	41
9.22.6	Performance criteria	41
Annex A (informative)	Classification of ARDs according to 4.3.1	48
Annex B (informative)	Classification of ARDs according to 4.3.2.1 a) and/or 4.3.2.2 a)	49
Annex C (informative)	Classification of ARDs according to 4.3.2.1 b) and/or 4.3.2.2 b)	50
Annex D (normative)	Test sequences and number of samples to be submitted for verification of conformity	51
Bibliography	54
Figure 1	– Minimum creepage distances and clearances measured	42
Figure 2	– Minimum creepage distances and clearances as a function of peak value of operating voltage	43
Figure 3	– Verification of the reclosing subordinated to the measurements of the resistance to earth for ARD without functional earthing (9.18.2 a), 9.18.2 b) and 9.19.2)	44
Figure 4	– Verification of the reclosing subordinated to the measurements of the resistance to earth for ARD with functional earthing (9.18.2 a), 9.18.2 b) and 9.19.2)	45
Figure 5	– Verification of the reclosing subordinated to the measurements of the resistance between live parts (9.18.3 a) and 9.18.3 b))	46
Figure 6	– Test circuit for the verification of the maximum current in FE under normal condition.....	47
Figure A.1	– Classification of ARDs according to 4.3.1.....	48
Figure B.1	– Classification of ARDs according to 4.3.2.1 a) and/or 4.3.2.2 a).....	49
Figure C.1	– Classification of ARDs according to 4.3.2.1 b) and/or 4.3.2.2 b).....	50
Table 1	– Minimum admissible R_D values	15
Table 2	– Minimum clearances and creepage distances	21
Table 3	– Behaviour of the ARD in enable condition	25
Table 4	– Maximum permissible temperatures under abnormal conditions	31
Table 5	– Low frequency immunity test conditions	40

Table 6 – High-frequency immunity test conditions 40

Table 7 – Test conditions for electrostatic discharges 41

Table D.1 – Test sequences 51

Table D.2 – Number of samples for full test procedure 52

Table D.3 – Additional tests for ARD already fully tested together with one kind of MPD 53

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**REQUIREMENTS FOR AUTOMATIC RECLOSING DEVICES (ARDs)
FOR CIRCUIT-BREAKERS, RCBOs AND RCCBs
FOR HOUSEHOLD AND SIMILAR USES**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 63024 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 International Standard is based on the following documents:

FDIS	Report on voting
23E/1037/FDIS	23E/1038/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Automatic reclosing devices (ARDs) are intended to reclose circuit-breakers, RCBOs, and RCCBs after tripping in order to re-establish continuity of service.

REQUIREMENTS FOR AUTOMATIC RECLOSING DEVICES (ARDs) FOR CIRCUIT-BREAKERS, RCBOs AND RCCBs FOR HOUSEHOLD AND SIMILAR USES

1 Scope

This International Standard applies to automatic reclosing devices (ARDs) for household and similar uses, for rated voltage not exceeding 440 V AC, and which are intended to be used in combination with circuit-breakers, RCCBs and RCBOs, and designed either for factory assembly or for assembly on site.

These devices are intended to reclose main protective devices (MPDs) such as circuit-breakers complying with IEC 60898-1 and/or IEC 60898-2, RCCBs complying with IEC 61008-1 and/or IEC 62423, and RCBOs complying with IEC 61009-1 and/or IEC 62423 after tripping of those devices in order to re-establish continuity of service.

This document includes the following types of ARDs:

- ARDs with assessment means, reclosing only if both the prospective line current and the prospective earth-fault current do not exceed given values;
- ARDs with assessment means, reclosing only if the prospective line current does not exceed a given value;
- ARDs with assessment means, reclosing only if the prospective earth-fault current does not exceed a given value;
- ARDs that recloses without any assessment.

NOTE 1 Installation rules define the condition of use of each of the products and the types.

NOTE 2 The assessment cannot substitute the verifications required by IEC 60364-6.

NOTE 3 The requirements and tests for the assessment function in IT systems are under consideration.

This document does not apply to ARDs with multiple settings adjustable by means accessible to the user in normal service.

Devices covered by this document are intended to be suitable for operation by uninstructed persons without the need for maintenance.

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 60065:2014, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60384 (all parts), *Fixed capacitors for use in electronic equipment*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles requirements and tests*

IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*