IEC 60755-1

Edition 1.0 2022-10

INTERNATIONAL STANDARD

GROUP SAFETY PUBLICATION

General safety requirements for residual current operated protected devices – Part 1: Residual current operated protective devices for DC systems

IEC 60755-1:2022-10(en)

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2022 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.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

IEC 60755-1

Edition 1.0 2022-10

INTERNATIONAL STANDARD

GROUP SAFETY PUBLICATION

General safety requirements for residual current operated protected devices – Part 1: Residual current operated protective devices for DC systems

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.120.50

ISBN 978-2-8322-5867-5

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 7
3 Terms and definitions 7
4 Classification 9
5 Characteristics of residual current devices 9
6 Marking and other product information 12
7 Conditions for operation in service and for installation 12
8 Requirements for construction and operation 12
9 Tests 15
Annex A (informative) Recommended diagram for short-circuit tests 29
Bibliography 32

Figure 118 – Example of test circuit for verification of ageing of electronic components 27
Figure 200 – Examples of installation 28
Figure A.101 – Diagram for all the short-circuit tests 30

Table 100 – Example for values of rated operational voltage (U_e) 22
Table 101 – Values of influencing quantities 22
Table 102 – Marking for DC-RCDs according to 4.15.1 23
Table 103 – Marking for DC-RCDs according to 4.15.2 and 4.15.3 24
Table 104 – Standard values of maximum break time for non-time-delay DC-RCDs 24
Table 108 – Standard values of break time and non-actuating time for time-delay DC-RCDs 25
Table 113 – Tripping current limits 25
Table 130 – Withstand values and duration of temporary overvoltages 25
Table 145 – Immunity tests 26
Table 146 – Voltage dips and short interruptions levels 26

Documents
Document Sharing Hub
Full document details: IEC 60755-1 2022

INTERNATIONAL ELECTROTECHNICAL COMMISSION

GENERAL SAFETY REQUIREMENTS FOR RESIDUAL CURRENT OPERATED PROTECTED DEVICES –

Part 1: Residual current operated protective devices for DC systems

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.

IEC 60755-1 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 document is intended to be used in conjunction with IEC 60755.

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

Draft	Report on voting
23E/1273/FDIS	23E/1299/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.

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

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.

A list of all parts in the IEC 60755 series, published under the general title *General safety requirements for residual current operated protected devices*, can be found on the IEC website.

This International Standard is to be used in conjunction with IEC 60755:2017.

The following differing practices of a less permanent nature exist in the countries indicated below:

– IEC 60755:2017, IEC 60755:2017, 5.3.1.12: 1 000 A, 2 000 A, 2 500 A, 7 500 A and 9 000 A are also considered preferred values (Korea and Japan);
– IEC 60755:2017, IEC 60755:2017, 8.1.1: multiple settings are not allowed (Australia, Germany, Denmark, the UK and Switzerland);
– IEC 60755:2017, IEC 60755:2017, 8.1.2: the colours red and green are not used for contact position indication (US).

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

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

INTRODUCTION

Residual current devices are used for protection against electric shocks.

In IEC 60364 (all parts), residual current devices are used for automatic disconnection of supply in case of fault (see Clause 411 of IEC 60364-4-41:2005+AMD1:2017) and residual current devices with rated residual operating current not exceeding 30 mA are used as additional protection (see Clause 415 of IEC 60364-4-41:2005+AMD1:2017). The IEC has developed a set of standards for residual current operated protective devices intended to be used in AC systems.

DC systems are used for applications such as photovoltaic installations, data and telecom centres and electric vehicle charging systems. In addition, standards for plugs and socket-outlets for ICT equipment installed in data centres and telecom centres have been published.

Residual current devices for DC systems are used to provide fault protection and/or additional protection (according to IEC 60364-4-41:2005 and IEC 60364-4-41:2005/AMD1:2017).

This document defines the operating characteristics for residual current operated protective devices for DC systems. Details of how they should be installed to provide the desired level of protection are specified in the various parts of the IEC 60364 series. The operating characteristics given in this document are based on the information contained in IEC 60479 (all parts).

This document has been prepared as a Group Safety Publication by subcommittee 23E in accordance with its Group Safety Function for residual current devices. It is intended for use by technical committees in the preparation of standards for residual current unit, function or devices when it is intended to provide protective measures according to IEC 60364 (all parts). It is not intended for use as a stand-alone document, for example, for certification.

This document is intended for use in conjunction with IEC 60755. Where a particular subclause of IEC 60755 is not mentioned in this Part 1, that subclause applies as far as is reasonable. Where this Part 1 states "addition", "deletion" or "replacement", the corresponding requirement, test specification or explanatory material in IEC 60755 should be adapted accordingly.

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

GENERAL SAFETY REQUIREMENTS FOR RESIDUAL CURRENT OPERATED PROTECTED DEVICES –

Part 1: Residual current operated protective devices for DC systems

Replacement of Clause 1 of IEC 60755:2017 by:

1 Scope

This document gives requirements, recommendations and information for the drafting of standards for residual current operated protective devices, intended to be used in DC systems, hereafter referred to as DC-RCDs.

NOTE 1 When referring to IEC 60755, "RCD" shall be understood as "DC-RCD".

This document is primarily intended to be used as a reference for drafting product safety standards for:

– DC-RCD intended for general use;
– DC-RCD specifically intended to be incorporated in a specific item of equipment;
– DC-RCD embedded in an equipment.

This document is applicable for standards covering devices:

– which detect a residual current,
– compare it to a reference value, and
– open the contacts when the residual current exceeds this reference value.

Any association of devices, each one of them performing separately one or two of the above-mentioned functions but acting together in order to accomplish all three functions, is also covered by this document.

DC-RCDs are intended to provide fault protection, the exposed conductive parts of the installation being connected to a protective conductor, in accordance with IEC 60364-4-41:2005 and IEC 60364-4-41:2005/AMD1/2017.

DC-RCDs having a rated residual operating direct current not exceeding 80 mA and having a rated voltage not exceeding 220 V DC for single-pole or 440 V DC for two-pole_are also used as a provision for additional protection, according to IEC 60364-4-41.

NOTE 2 Further requirements for higher voltages are under consideration.

NOTE 3 The value of 80 mA was the result of a calculation based on the content of clause 6 of IEC 60479-1:2018 and 5.3.4 of IEC 60479-2:2019.

NOTE 4 In Austria the value of 80 mA is considered as provisional until a broader and more solid set of data than the actual basis of the IEC 60479 series is available for DC.

In accordance with IEC 60364-4-42, residual current devices with a rated residual operating current not exceeding 300 mA can also be used to provide protection against fire hazards due to insulation faults.

DC-RCDs are suitable for isolation. They are suitable for use in TN, TT, and, under specific conditions, IT systems.

AVA Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

DC-RCDs are resistant to unwanted tripping including the case where surge voltages (as a result of switching transients or induced by lightning) cause loading currents in the installation without occurrence of flashover.

This group safety publication is primarily intended for use by technical committees in the preparation of standards in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51. It is not intended for use by manufacturers or certification bodies.

One of the responsibilities of a technical committee is, wherever applicable, to make use of group safety publications in the preparation of its publications. The requirements, test methods or test conditions of this group safety publication will not apply unless specifically referred to or included in the relevant publications.

2 Normative references

Clause 2 of IEC 60755:2017 is applicable except as follows:

Addition:

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, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

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

IEC 61000-4-16, *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 61000-4-17, *Electromagnetic compatibility (EMC) – Part 4-17: Testing and measurement techniques – Ripple on d.c. input power port immunity test*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61543:2022, *Residual current-operated protective devices (RCDs) for household and similar use – Electromagnetic compatibility*

3 Terms and definitions

Clause 3 of IEC 60755:2017 is applicable except as follows:

Addition:

Documents
Document Sharing Hub

Full document details: IEC 60755-1 2022

3.101
residual operating direct current
value of residual direct current which causes the DC residual current device to operate under specified conditions

[SOURCE: IEC 60050-442:2019, 442-05-72]

3.102
residual non-operating direct current
value of residual direct current at and below which the DC residual current device does not operate under specified conditions

[SOURCE: IEC 60050-442:2019, 442-05-73]

3.103
residual direct current making and breaking capacity
value of a residual prospective direct current which a DC residual current device can make, carry for its opening time and break under specified conditions of use and behaviour

[SOURCE: IEC 60050-442:2019, 442-05-74, modified]

3.104
conditional direct short-circuit current
value of a prospective direct current, which a DC residual current device without integral short-circuit protection, but protected by a short-circuit protective device in series, can withstand under specified conditions of use and behaviour

[SOURCE: IEC 60050-442:2019, 442-05-75]

3.105
conditional residual direct short-circuit current
value of a residual direct prospective current, which a DC residual current device without integral short-circuit protection, but protected by a short-circuit protective device in series, can withstand under specified conditions of use and behaviour

[SOURCE: IEC 60050-442;2019, 442-05-76, modified]

3.106
mid-point
common point between two symmetrical circuit elements the opposite ends of which are electrically connected to different line conductors of the same circuit

[SOURCE: IEC 60050-195:1998, 195-02-04]

3.107
M-pole
part of a DC-RCD associated exclusively with one electrically separated conducting path intended to connect and to disconnect the mid-point

3.108
time constant
rise time $T = L/R$ (ms) of a prospective direct current to reach a value of 0,632 times the maximum peak current

Documents
Document Sharing Hub
Full document details: IEC 60755-1 2022

3.109
rated direct making and breaking capacity
I_m
value of a prospective direct current, which a DC residual current device is capable of making and breaking at a stated voltage under specified conditions of use and behaviour

4 Classification

Clause 4 of IEC 60755:2017 is applicable except as follows:

Deletion of Subclause 4.4.

4.10 According to the number of poles and current paths

Subclause 4.10 of IEC 60755:2017 is applicable except as follows:

Replacement of notes to 4.10.1 and 4.10.3:

NOTE In this case, the M-path does not contain any switching contact.

Deletion of 4.10.5 and 4.10.6.

4.15 According to the intended use

Deletion in note 1:

e.g. IEC 61008-1

Addition:

4.101 According to the current direction through the poles

4.101.1 Polarised DC-RCD

4.101.2 Non-polarised DC-RCD

5 Characteristics of residual current devices

5.1 Summary of characteristics

Subclause 5.1 of IEC 60755:2017 is applicable except as follows:

Deletion of the third dash.

Replacement of the fourth, fifth, sixth and seventh dashes:

– rated direct making and breaking capacity I_m (see 5.2.4);
– rated residual operating direct current $I_{\Delta n}$ (see 5.2.5);
– rated residual non-operating direct current $I_{\Delta no}$ (see 5.2.6);
– rated residual direct making and breaking capacity $I_{\Delta m}$ (see 5.2.7);

Replacement of the ninth, tenth and eleventh dashes:

– operating characteristics (see 5.2.10)
– rated conditional short-circuit direct current I_{nc} (see 5.2.8);

Documents
Document Sharing Hub
Full document details: IEC 60755-1 2022