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BSI Standards Publication

Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)

Part 1: General rules

National foreword

This British Standard is the UK implementation of EN 61009-1:2012+A2:2014. It is derived from IEC 61009-1:2010 incorporating amendments 1:2012 and 2:2013. It supersedes BS EN 61009-1:2012, which will be withdrawn on 4 August 2017.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags [C⟩ ⟨C].

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by [A1⟩ ⟨A1].

Where a common modification to an IEC amendment has been introduced, the tags carry the number of the amendment. For example, the common modifications introduced by CENELEC to IEC amendment 1 are indicated by [C1⟩ ⟨C1].

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 this committee 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.

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31 January 2015	Implementation of IEC amendment 1:2012 with CENELEC modifications
31 January 2015	Implementation of IEC amendment 2:2013 with CENELEC modifications
31 January 2015	Implementation of IEC corrigendum January 2014: Table 26 inserted into subclause 9.9.1.3

EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 61009-1+A2:2014

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English version

Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) - Part 1: General rules

(IEC 61009-1:2010, modified)

Interrupteurs automatiques à courant différentiel résiduel avec dispositif de protection contre les surintensités incorporé pour usages domestiques et analogues (DD) -
Partie 1: Règles générales
(CEI 61009-1:2010, modifiée)

Fehlerstrom-/Differenzstrom-Schutzschalter mit eingebautem Überstromschutz (RCBOs) für Hausinstallationen und für ähnliche Anwendungen -
Teil 1: Allgemeine Anforderungen
(IEC 61009-1:2010, modifiziert)

This European Standard was approved by CENELEC on 2012-06-18. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

This document (EN 61009-1:2012) consists of the text of IEC 61009-1:2010 prepared by IEC/TC 23E "Circuit-breakers and similar equipment for household use", together with the common modifications prepared by CLC/TC 23E "Circuit breakers and similar devices for household and similar applications".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-06-18
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2017-06-18

This document supersedes EN 61009-1:2004 + corr.Jul.2006 + A11:2008 + A12:2009 + A13:2009 + A14:2012 + AC:2012.

– complete revision of EMC sequences, including the new test T.2.6, already approved in EN 61543;

– clarification of RCDs current/time characteristics reported in Tables 2 and 3;

– revision of test procedure for $I_{\Delta n}$ between 5 A and 200 A;

– tests for the use of RCBOs in IT systems;

– testing procedure regarding the 6mA d.c. current superimposed to the fault current;

– improvement highlighting RCDs with multiple sensitivity;

– some alignments with EN 60898-1.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 61009-1:2010 are prefixed “Z”.

Endorsement notice

The text of the International Standard IEC 61009-1:2010 was approved by CENELEC as a European Standard with agreed common modifications.

Foreword to amendment A1

This document (EN 61009-1:2012/A1:2014) consists of the text of IEC 61009-1:2010/A1:2012 prepared by SC 23E "Circuit-breakers and similar equipment for household use" of IEC/TC 23 "Electrical accessories", together with the common modifications prepared by CLC/TC 23E "Circuit breakers and similar devices for household and similar applications".

The following dates are fixed:

– latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-08-04
– latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-08-04

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 61009-1:2010/A1:2012 are prefixed “Z”.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

Endorsement notice

The text of the International Standard IEC 61009-1:2010/A1:2012 was approved by CENELEC as a European Standard with agreed common modifications.

Foreword to amendment A2

This document (EN 61009-1:2012/A2:2014) consists of the text of IEC 61009-1:2010/A2:2013 prepared by SC 23E "Circuit-breakers and similar equipment for household use" of IEC/TC 23 "Electrical accessories", together with the common modifications prepared by CLC/TC 23E "Circuit breakers and similar devices for household and similar applications".

The following dates are fixed:

– latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-08-04
– latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-08-04

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 61009-1:2010/A2:2013 are prefixed “Z”.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

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Endorsement notice

The text of the International Standard IEC 61009-1:2010/A2:2013 was approved by CENELEC as a European Standard with agreed common modifications.

〈C〉 Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
CISPR 14-1 + corr. January	2005 2009	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission	EN 55014-1	2006
〈C1〉 *Text deleted* 〈C1〉				
IEC 60060-1 + corr. March + corr. March	1989 1990 1992	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1 S1 [1)]	1991
IEC 60060-2	1994	High-voltage test techniques - Part 2: Measuring systems	EN 60060-2 [2)]	1994
IEC 60068-2-30	2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60068-3-4	2001	Environmental testing - Part 3-4: Supporting documentation and guidance - Damp heat tests	EN 60068-3-4	2002
IEC 60112 + corr. October + corr. June	2003 2003 2003	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	2003
〈C1〉 IEC 60228	2004	Conductors of insulated cables	EN 60228 + corr. May	2005 2005 〈C1〉
IEC 60364	Series	Low-voltage electrical installations	HD 60364	Series
IEC 60417	Data-base	Graphical symbols for use on equipment	-	-
〈C1〉 IEC 60364-4-44 (mod) + corr. May	2007 2010	Low-voltage electrical installations Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances	HD 60364-4-444 + corr. July + AC:2012	2010 2010 2012 〈C1〉
IEC 60364-5-52	2001	Electrical installations of buildings - Part 5-52: Selection and erection of electrical equipment - Wiring systems	-	-
IEC 60364-5-53	2001	Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control	-	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007

[1)] HD 588.1 S1 is superseded by EN 60060-1:2010, which is based on IEC 60060-1:2010.
[2)] EN 60060-2 is superseded by EN 60060-2:2011, which is based on IEC 60060-2:2010. 〈C〉

[C] Publication	Year	Title	EN/HD	Year
[C1] IEC 60664-3	-	Insulation coordination for equipment within low-voltage systems Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	-
IEC 60695-2-10	-	Fire hazard testing Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10[1)]	-
IEC 60695-2-11 + corr. January	2000 2001	Fire hazard testing Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	2001 [C1]
IEC 60898-1 (mod)	2002	Electrical accessories - Circuit breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation	EN 60898-1 + corr. February + A11 + A12	2003 2004 2005 2008
IEC 61009	Series	Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBO's)	EN 61009	Series
[C1] IEC 61543 - + A1 (mod) - + A2 -	1995 - 2004 - 2005 -	Residual current-operated protective devices (RCDs) for household and similar use - Electromagnetic compatibility	EN 61543 + corr. December + A11 + corr. May + A2 + A12	1995 1997 2003 2004 2006 2005 [C1]
ISO 7000	1989	Graphical symbols for use on equipment - Index and synopsis	-	- [C]

[C1] 1) EN 60695-2-10 is superseded by EN 60695-2-10:2013, which is based on IEC 60695-2-10:2013. [C1]

〈C〉 Annex ZB
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard / Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause	Special national condition
General	**Germany**
	In Germany the use of RCBOs of type AC is not permitted.

〈C〉

[C〉 Annex ZC
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CENELEC member.

This European Standard falls under Directive 2004/108/EC.

NOTE (from CEN/CENELEC IR Part 2:2011 , 2.17) Where standards fall under EC Directives, it is the view of the Commission of the European Communities (OJ No C 59, 1982-03-09) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted except under the safeguard procedure provided for in the relevant Directive.

A-deviations in an EFTA-country are valid instead of the relevant provisions of the European Standard in that country until they have been removed.

Clause	Deviation
	Austria
	Regulations for electrical low voltage installations, statutory order BGBl. II/223/2010, issued 12. July 2010.
4.1	The content of the note of IEC 61009-1 Ed. 3 remains with the adaption to national reference: “The selection of the various types is made according to the requirements of OVE/ONORM E 8001-1:2010.”
4.1	Table Z1 is not valid in Austria. 〈C]

〚C〛 Annex ZD
(normative)

Classification of RCBOs Type B and C up to and including 63A into energy limiting classes

RCBOs of B-type and C-type up to and including 63A, shall be classified into energy limiting classes 1 or 3 in accordance with Tables ZD.1 or ZD.2, as applicable, and be marked with the number of the energy limiting class in a square adjoining the symbol given in t) of Clause 6. This classification shall not be applied to RCBOs type D and to RCBOs with rated current higher than 63A.

Table ZD.1 – Permissible I^2t (let-through) values for RCBOs type B with rated current up to and including 63 A

Type B					
Rated short-circuit capacity(A) I_{cn}	Class 1	class 3			
	≤ 63A	≤ 16A	20A, 25A, 32A	40A	50A, 63A
3 000	No limits specified	15 000	18 000	21 600	28 000
4 500		25 000	32 000	38 400	48 000
6 000		35 000	45 000	54 000	65 000
10 000		70 000	90 000	108 000	135 000

Table ZD.2 – Permissible I^2t (let-through) values for RCBOs type C with rated current up to and including 63 A

Type C					
Rated short-circuit capacity(A) I_{cn}	Class 1	class 3			
	≤ 63A	≤ 16A	20A, 25A, 32A	40A	50A, 63A
3 000	No limits specified	17 000	20 000	24 000	30 000
4 500		28 000	37 000	45 000	55 000
6 000		40 000	52 000	63 000	75 000
10 000		80 000	100 000	120 000	145 000

〚C1〛 The maximum I^2t values measured during the test sequence F_0 or F_1 as applicable serve as reference values for the classification. 〈C1〉
Compliance with the requirements of Tables ZD.1 and ZD.2 is checked on the RCBOs with the highest rated current available within the range covered by each of these tables.
If these current ratings are not included in the samples submitted to test sequences F_0 or F_1 of Annex A, the appropriate number of samples of these ratings shall be additionally submitted to that test sequence. None of the values measured shall exceed the permissible I^2t value of the proposed energy limiting class in accordance with Tables ZD.1 and ZD.2.
If RCBOs rated 40 A are submitted with the range of RCBOs with rating exceeding 16 A and their measured I^2t values are lower than those indicated in Tables ZD.1 or ZD.2 for rating 32 A, no relevant test is necessary for the RCBOs rated 32 A.
If RCBOs rated 50 A or 63 A are submitted with the range of RCBOs with rating exceeding 32 A and their measured I^2t values are lower than those indicated in Tables ZD.1 or ZD.2 for rating 40 A, no relevant test is necessary for the RCBOs rated 40 A 〈C〉

[C1] Annex J
(normative)

Particular requirements for RCBOs with screwless type terminals for external copper conductors

J.1 Scope

This annex applies to RCBOs within the scope of Clause 1, equipped [C1] with universal screwless terminals [C1], for current not exceeding 20 A primarily suitable for connecting unprepared (see J.3.6) copper conductors of cross-section up to 4 mm^2.

NOTE 1 [C1] Non-universal terminals are subject to special national conditions. [C1]

In this annex, screwless terminals are referred to as terminals and copper conductors are referred to as conductors.

NOTE 2 The numbering in this annex follows that of the main body of the text. Hence, the numbering is not necessarily continuous. Any content which is not explicitly mentioned, applies, without modification.

J.2 Normative references

Clause 2 applies.

J.3 Definitions

As a complement to Clause 3, the following definitions apply:

J.3.1
clamping units
parts of the terminal necessary for mechanical clamping and the electrical connection of the conductors including the parts which are necessary to ensure correct contact pressure

J.3.2
screwless-type terminal
terminal for the connection and subsequent disconnection obtained directly or indirectly by means of springs, wedges or the like

Note 1 to entry: Examples are given in Figure J.2

J.3.3
universal terminal
terminal for the connection and disconnection of all types of conductors (rigid and flexible)

[C1] *Text deleted* [C1]

J.3.4
non-universal terminal
terminal for the connection and disconnection of a certain kind of conductor only (e.g. rigid-solid conductors only or rigid-[solid or stranded] conductors only)

J.3.5
push-wire terminal
non-universal terminal in which the connection is made by pushing-in rigid (solid or stranded) conductors [C1]

[C1] **J.3.6**
unprepared conductor
conductor which has been cut and the insulation of which has been removed over a certain length for insertion into a terminal

Note 1 to entry: A conductor the shape of which is arranged for introduction into a terminal or of which the strands may be twisted to consolidate the end, is considered to be an unprepared conductor.

Note 2 to entry: The term "unprepared conductor" means conductor not prepared by soldering of the wire, use of cable lugs, formation of eyelets, etc., but includes its reshaping before introduction into the terminal or, in the case of flexible conductor, by twisting it to consolidate the end.

J.4 Classification

Clause 4 applies.

J.5 Characteristics of RCBOs

Clause 5 applies.

J.6 Marking and other product information

In addition to Clause 6, the following requirements apply:

Universal terminals:

– no marking.

Non-universal terminals [C1] (if accepted by Special National Conditions) [C1]:

– terminals declared for rigid-solid conductors shall be marked by the letters "sol";
– terminals declared for rigid (solid and stranded) conductors shall be marked by the letter "r";
– terminals declared for flexible conductors shall be marked by the letter "f".

The markings should appear on the RCBO or, if the space available is not sufficient, on the smallest package unit or in technical information.

An appropriate marking indicating the length of insulation to be removed before insertion of the conductor into the terminal shall be shown on the RCBO.

The manufacturer shall also provide information, in his literature, on the maximum number of conductors which may be clamped.

J.7 Standard conditions for operation in service and for installation

Clause 7 applies.

J.8 Requirements for construction and operation

Clause 8 applies, with the following modifications.

In 8.1.5, only 8.1.5.1, 8.1.5.2, 8.1.5.3, 8.1.5.6 and 8.1.5.7 apply.

Compliance is checked by inspection and by the tests of J.9.1 and J.9.2 of this annex, instead of 9.4 and 9.5. [C1]

[C1] In addition the following requirements apply.

J.8.1 Connection or disconnection of conductors

The connection or disconnection of conductors shall be made

– by the use of a general purpose tool or by a convenient device integral with the terminal to open it and to assist the insertion or the withdrawal of the conductors (e.g. for universal terminals);

or, for rigid conductors

– by simple insertion. For the disconnection of the conductors an operation other than a pull on the conductor shall be necessary (e.g. for push-wire terminals).

Universal terminals shall accept rigid (solid or stranded) and flexible unprepared conductors.

Non-universal terminals shall accept the types of conductors declared by the manufacturer.

Compliance is checked by inspection and by the tests of J.9.1 and J.9.2.

J.8.2 Dimensions of connectable conductors

The dimensions of connectable conductors are given in Table J.1.

The ability to connect these conductors shall be checked by inspection and by the tests of J.9.1 and J.9.2.

[C1] Table J.1 – Connectable conductors

Connectable conductors and their theoretical diameter				
Rigid			**Flexible**	
	Solid	**Stranded**		
mm^2	∅ mm	∅ mm	mm^2	∅ mm
1,0	1,2	1,4	1,0	1,5
1,5	1,5	1,7	1,5	1,8
2,5	1,9	2,2	2,5	2,3
4,0	2,4	2,7	4,0	2,9
NOTE Diameters of the largest rigid and flexible conductors are based on IEC 60228.				

[C1]

J.8.3 Connectable cross-sectional areas

The nominal cross-sections to be clamped are defined in Table J.2. [C1]

〈C1〉 Table J.2 – Cross-sections of copper conductors connectable to screwless-type terminals

Rated current A	Nominal cross-sections to be clamped mm^2
Up to and including 13	1 up to and including 2,5
Above 13 up to and including 20	1,5 up to and including 4

Compliance is checked by inspection and by the tests of J.9.1 and J.9.2.

J.8.4 Insertion and disconnection of conductors

The insertion and disconnection of the conductors shall be made in accordance with the manufacturer's instructions.

Compliance is checked by inspection.

J.8.5 Design and construction of terminals

Terminals shall be so designed and constructed that:

– each conductor is clamped individually;
– during the operation of connection or disconnection the conductors can be connected or disconnected either at the same time or separately;
– inadequate insertion of the conductor is avoided.

It shall be possible to clamp securely any number of conductors up to the maximum provided for.

Compliance is checked by inspection and by the tests of J.9.1 and J.9.2.

J.8.6 Resistance to ageing

The terminals shall be resistant to ageing.

Compliance is checked by the test of J.9.3.

J.9 Tests

Clause 9 applies, by replacing 9.4 and 9.5 by the following tests:

J.9.1 Test of reliability of screwless terminals

J.9.1.1 Reliability of screwless system

The test is carried out on three terminals of poles of new samples, with copper conductors of the rated cross sectional area in accordance with Table J.2. The types of conductors shall be in accordance with J.8.1.

The connection and subsequent disconnection shall be made five times with the smallest diameter conductor and successively five times with the largest diameter conductor.

New conductors shall be used each time, except for the fifth time, when the conductor used for the fourth insertion is clamped at the same place. Before insertion into the terminal, wires 〈C1〉

[C1] of stranded rigid conductors shall be re-shaped and wires of flexible conductors shall be twisted to consolidate the ends.

For each insertion, the conductors are either pushed as far as possible into the terminal or shall be inserted so that adequate connection is obvious.

After each insertion, the conductor being inserted is rotated 90 ° along its axis at the level of the clamped section and subsequently disconnected.

After these tests, the terminal shall not be damaged in such a way as to impair its further use.

J.9.1.2 Test of reliability of connection

Three terminals of poles of new samples are fitted with new copper conductors of the type and of the rated cross sectional area according to Table J.2.

The types of conductors shall be in accordance with J.8.1.

Before insertion into the terminal, wires of stranded rigid conductors and flexible conductors shall be reshaped and wires of flexible conductors shall be twisted to consolidate the ends.

It shall be possible to fit the conductor into the terminal without undue force in the case of universal terminals and with the force necessary by hand in the case of push-wire terminals.

The conductor is either pushed as far as possible into the terminal or shall be inserted so that adequate connection is obvious.

After the test, no wire of the conductor shall have escaped outside the terminal.

J.9.2 Tests of reliability of terminals for external conductors: mechanical strength

For the pull-out test three terminals of poles of new samples are fitted with new conductors of the type and of the minimum and maximum cross-sectional areas according to Table J.2.

Before insertion into the terminal, wires of stranded rigid conductors and flexible conductors shall be reshaped and wires of flexible conductors shall be twisted to consolidate the ends.

Each conductor is then subjected to a pull force of the value shown in Table J.3. The pull is applied without jerks for 1 min in the direction of the axis of the conductor.

Table J.3 – Pull forces

Cross-sectional area mm^2	**Pull force** N
1,0	35
1,5	40
2,5	50
4,0	60

During the test the conductor shall not slip out of the terminal.

J.9.3 Cycling test

The test is made with new copper conductors having cross section according to Table 13. [C1]

[C1] The test is carried out on new samples (a sample is one pole), the number of which is defined below, according to the type of terminals:

– universal terminals for rigid (solid and stranded) and flexible conductors: 3 samples each (6 samples in total);
– non-universal terminals for solid conductors only: 3 samples;
– non-universal for rigid (solid and stranded) conductors: 3 samples each (6 samples);

NOTE In case of rigid conductors, solid conductors should be used (if solid conductors are not available in a given country, stranded conductors may be used).

– non-universal for flexible conductors only: 3 samples.

A conductor having the cross section defined in Table 13 is connected in series as in normal use to each of the three samples as defined on Figure J.1.

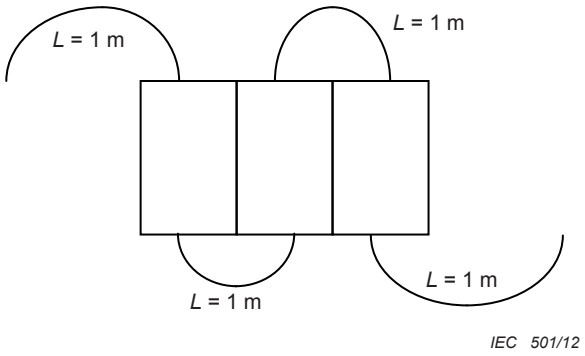


Figure J.1 – Connecting samples

The sample is provided with a hole (or equivalent) in order to measure the voltage drop on the terminal.

The whole test arrangement, including the conductors, is placed in a heating cabinet which is initially kept at a temperature of (20 ± 2) °C.

To avoid any movement of the test arrangement until all the following voltage drop tests have been completed it is recommended that the poles are fixed on a common support.

Except during the cooling period, a test current corresponding to the rated current of the circuit breaker is applied to the circuit.

The samples shall be then subjected to 192 temperature cycles, each cycle having a duration of approximately 1 h, as follows:

The air temperature in the cabinet is raised to 40 °C in approximately 20 min. It is maintained within ± 5 °C of this value for approximately 10 min.

The samples are then allowed to cool down in approximately 20 min to a temperature of approximately 30 °C, forced cooling being allowed. They are kept at this temperature for approximately 10 min and, if necessary for measuring the voltage drop, allowed to cool down further, to a temperature of (20± 2) °C.

The maximum voltage drop, measured at each terminal, at the end of the 192nd cycle, with the nominal current shall not exceed the smaller of the two following values:

– either 22,5 mV; [C1]

[C1] – or 1,5 times the value measured after the 24th cycle.

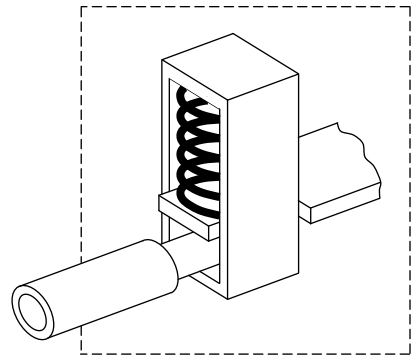
The measurement shall be made as near as possible to the area of contact on the terminal.

If the measuring points cannot be positioned closely to the point of contact, the voltage drop within the part of the conductor between the ideal and the actual measuring points shall be deducted from the voltage drop measured.

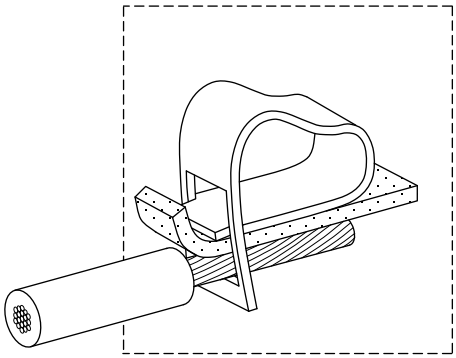
The temperature in the heating cabinet shall be measured at a distance of at least 50 mm from the samples.

After this test an inspection with the naked eye, by normal or corrected vision, without additional magnification, shall show no changes evidently impairing further use, such as cracks, deformations or the like. [C1]

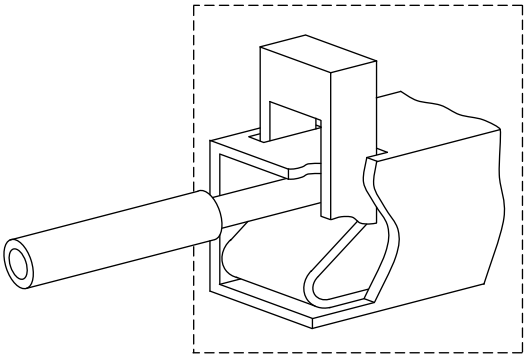
〈C1〉



Screwless-type terminal with indirect pressure



Screwless-type terminal with direct pressure



Screwless-type terminal with actuating element

IEC 502/12

Figure J.2 – Examples of screwless-type terminals 〈C1〉

[C1] J.10 Reference documents

IEC 60228, *Conductors of insulated cables*

IEC 60998-1, *Connecting devices for low-voltage circuits for household and similar purposes – Part 1: General requirements*

IEC 60998-2-2, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

IEC 60999 (all parts), *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units* [C1]

[C1] *Text deleted* [C1]

[C1] Annex K
(normative)

Particular requirements for RCBOs with flat quick-connect terminations

K.1 Scope

This annex applies to RCBOs within the scope of Clause 1, equipped with flat quick-connect terminations consisting of a male tab (see K.3.2) with nominal width 6,3 mm and thickness 0,8 mm, to be used with a mating female connector for connecting electrical copper conductors according to the manufacturer's instructions, for rated currents up to and including 16 A.

[C1] *Text deleted* [C1]

The connectable electrical copper conductors are flexible, having a cross-sectional area up to and including 4 mm^2, or rigid stranded, having a cross-sectional area up to and including 2,5 mm^2. [C1] *Text deleted* [C1]

This annex applies exclusively to RCBOs having male tabs as an integral part of the device.

NOTE 2 The numbering in this annex follows that of the main body of the text. Hence, the numbering is not necessarily continuous. Any content which is not explicitly mentioned applies without modification.

K.2 Normative references

As a complement to Clause 2, the following normative reference applies:

IEC 61210, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

K.3 Definitions

As a complement to Clause 3, the following definitions apply:

K.3.1
flat quick-connect termination
electrical connection consisting of a male tab and a female connector which can be pushed into and withdrawn with or without the use of a tool

K.3.2
male tab
portion of a quick-connect termination which receives the female connector

K.3.3
female connector
portion of a quick-connect termination which is pushed onto the male tab

K.3.4
detent
dimple (depression) or hole in the male tab which engages a raised portion on the female connector to provide a latch for the mating parts. [C1]

K.4 Classification

Clause 4 applies.

K.5 Characteristics of RCBOs

Clause 5 applies.

K.6 Marking and other product information

The whole of Clause 6 applies, with the following addition after the lettered item k).

The following information regarding the female connector according to IEC 61210 and the type of conductor to be used shall be given in the manufacturers' instructions:

l) manufacturer’s name or trade mark;

m) type reference;

n) information on cross-sections of conductors and colour code of insulated female connectors (see Table K.1 below);

o) the use of only silver or tin-plated copper alloys.

Table K.1 – Informative table on colour code of female connectors in relationship with the cross section of the conductor

Cross-section of the conductor mm^2	Colour code of the female connector
1	Red
1,5	Red or blue
2,5	Blue or yellow
4	Yellow

K.7 Standard conditions for operation in service and for installation

Clause 7 applies.

K.8 Requirements for construction and operation

Clause 8 applies, with the following exceptions:

Replace the contents of 8.1.3 by the following text:

K.8.1 Clearances and creepage distances (see also Annex B)

Subclause 8.1.3 applies, the female connectors being fitted to the male tabs of the RCBO.

Replace the contents of 8.1.5 by the following text:

K.8.2 Terminals for external conductors

K.8.2.1 Male tabs and female connectors shall be of a metal having mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use.

[C1] NOTE Silver or tin plated copper alloys are examples of suitable solutions.

K.8.2.2 The nominal width of the male tab is 6,3 mm and the thickness 0,8 mm, applicable to rated currents up to and including 16 A.

[C1] *Text deleted* [C1]

The dimensions of the male tab shall comply with those specified in Table K.3 and in figures K.2, K.3, K.4 and K.5, where the dimensions A, B, C, D, E, F, J, M, N and Q are mandatory.

The dimensions of the female connector which may be fitted-on are given in Figure K.6 and in Table K.4.

NOTE 2 The shapes of the various parts may deviate from those given in the figures, provided that the specified dimensions are not influenced and the test requirements are complied with, for example: corrugated tabs, folded tabs, etc.

Compliance is checked by inspection and by measurement.

K.8.2.3 Male tabs shall be securely retained.

Compliance is checked by the mechanical overload test of K.9.1.

K 9 Tests

Clause 9 applies, with the following modifications:

Replace the contents of 9.5 by the following text:

K.9.1 Mechanical overload-force

This test is done on 10 terminals of RCBOs, mounted as in normal use when wiring takes place.

The axial push force, and successively the axial pull force specified in the following Table K.2, are gradually applied to the male tab integrated in the RCBO, once only with a suitable test apparatus.

Table K.2 – Overload test forces

Push N	**Pull** N
96	88

No damage which could impair further use shall occur to the tab or to the RCBO in which the tab is integrated. [C1]

〈C1〉 Add the following text to 9.8.3:

Fine-wire thermocouples shall be placed in such a way as not to influence the contact or the connection area. An example of placement is shown in Figure K.1.

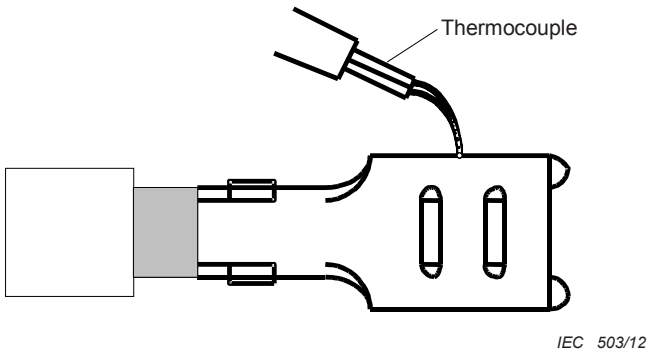


Figure K.1 – Example of position of the thermocouple for measurement of the temperature-rise

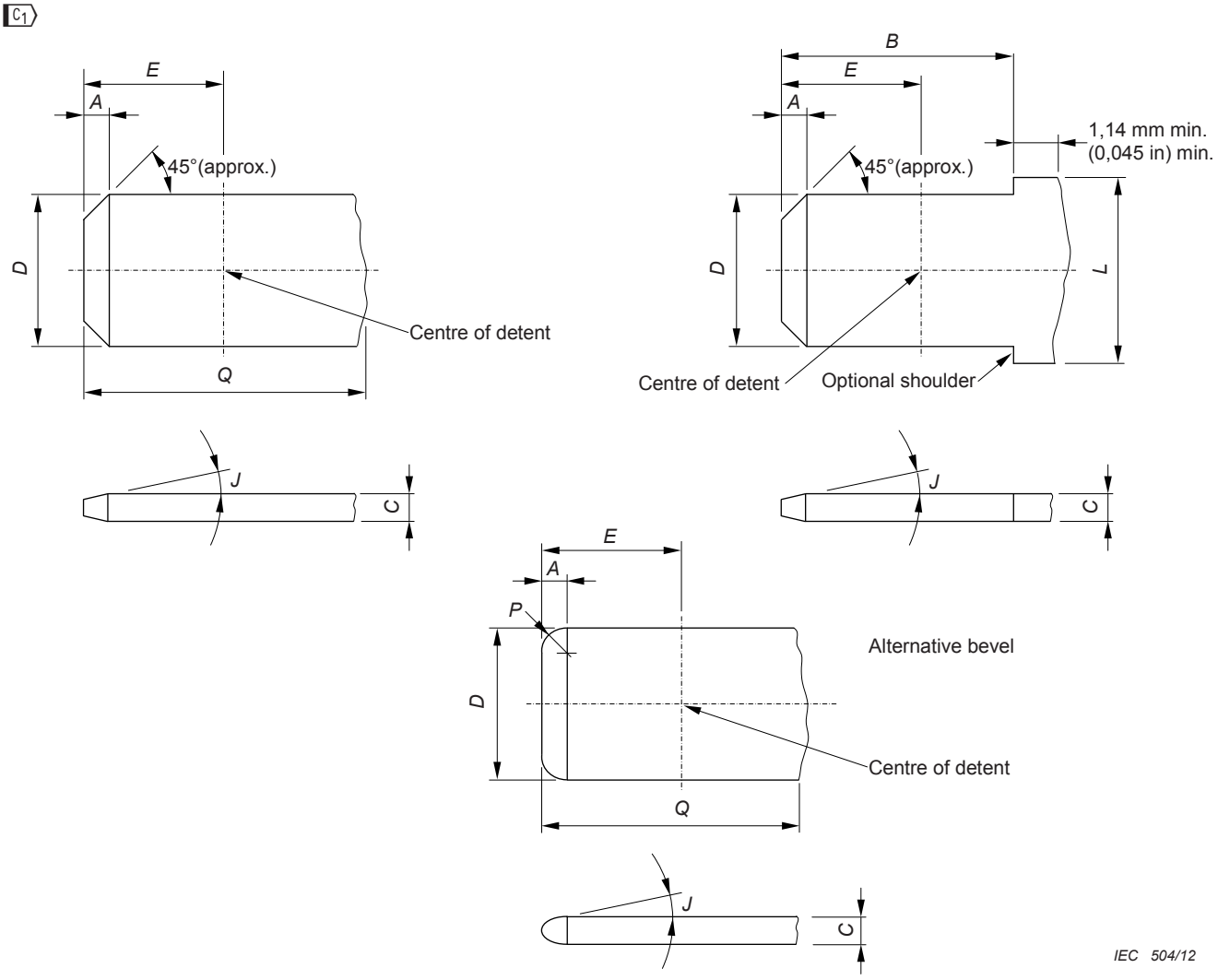
Table K.3 – Dimensions of tabs

Nominal size mm		***A***	***B*** **min**	***C***	***D***	***E***	***F***	***J***	***M***	***N***	***P***	***Q*** **min**
6,3 × 0,8	Dimple	1,0		0,84	6,40	4,1	2,0	12 °	2,5	2,0	1,8	
		0,7	7,8	0,77	6,20	3,6	1,6	8 °	2,2	1,8	0,7	8,9
	Hole	1,0		0,84	6,40	4,7	2,0	12 °			1,8	
		0,5	7,8	0,77	6,20	4,3	1,6	8 °			0,7	8,9

NOTE 1 For the dimensions *A* to *Q* refer to Figures K.2 to K.5.

NOTE 2 Where two values are shown in one column, they give the maximum and the minimum dimension.

〈C1〉



NOTE 1 Bevel *A* of 45 ° need not be a straight line if it is within the confines shown.

NOTE 2 Dimension *L* is not specified and may vary by the application (for example fixing).

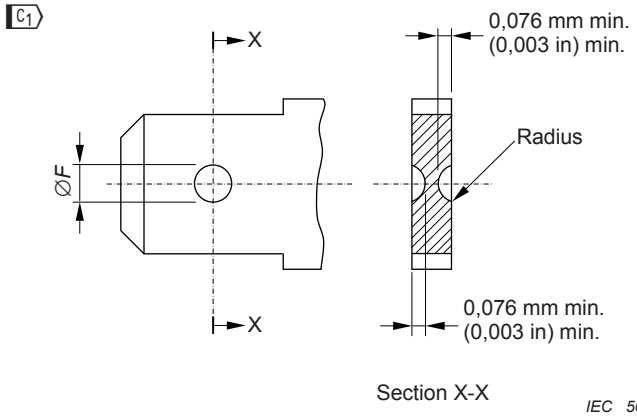
NOTE 3 Dimension *C* of tabs can be produced from more than one layer of material provided that the resulting tab complies in all respects with the requirements of this standard. A radius on the longitudinal edge of the tab is permissible.

NOTE 4 The sketches are not intended to govern the design except with regard to the dimensions shown.

NOTE 5 The thickness *C* of the male tab may vary beyond *Q* or beyond *B* + 1,14 mm (0,045 in)

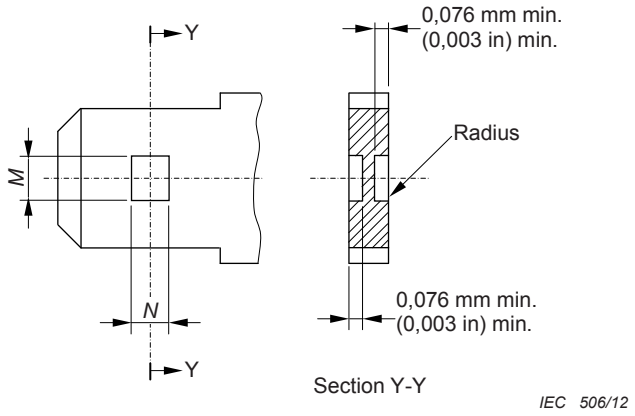
NOTE 6 All portions of the tabs are flat and free of burrs or raised plateaus, except that there may be a raised plateau over the stock thickness of 0,025 mm (0,001 in) per side, in an area defined by a line surrounding the detent and distant from it by 1,3 mm (0,051 in).

Figure K.2 – Dimensions of male tabs C1



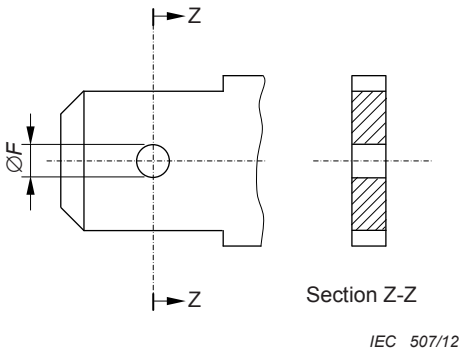
Detent shall be located within 0,076 mm (0,003 in) of the centre-line of the tab.

Figure K.3 – Dimensions of round dimple detents (see Figure K.2)



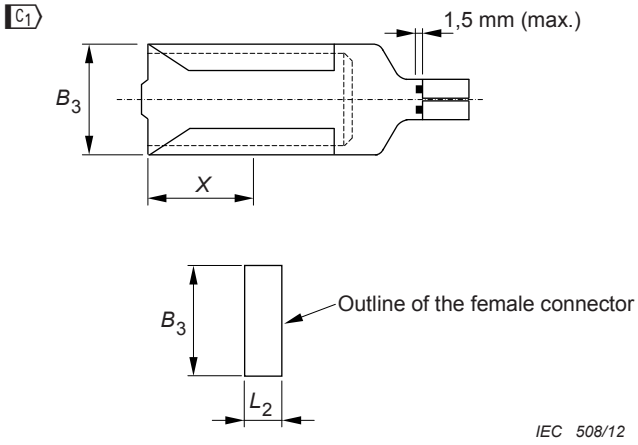
Detent shall be located within 0,13 mm (0,005 in) of the centre-line of the tab.

Figure K.4 – Dimensions of rectangular dimple detents (see Figure K.2)



Detent shall be located within 0,076 mm (0,003 in) of the centre-line of the tab.

Figure K.5 – Dimensions of hole detents C1



Dimensions B_3 and L_2 are mandatory.

NOTE 1 For determining female connector dimensions varying from B_3 and L_2 it is necessary to refer to the tab dimensions in order to ensure that in the most onerous conditions the engagement (and detent, if fitted) between tab and female connector is correct.

NOTE 2 If a detent is provided, the dimension *X* is at manufacturer's discretion in order to meet the requirements of the performance clauses.

NOTE 3 Female connectors should be so designed that undue insertion of the conductor into the crimping area is visible or prevented by a stop in order to avoid any interference between the conductor and a fully inserted tab.

NOTE 4 The sketches are not intended to govern the design except as regards the dimensions shown.

Figure K.6 – Dimensions of female connectors

Table K.4 – Dimensions of female connectors

Tab size mm	**Dimensions of female connector** mm	
	B_3 max	**L_2 max**
6,3 × 0,8	7,8	3,5

K.10 Reference documents

IEC 61210, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements* C1

[C2] Annex ZXX
(Informative)
List of clauses that require retesting

Based on EN 61009-1:2012/FprA1:2014, the following tests and/or requirements have been technically modified and may require retesting or inspection as applicable:

− 8.1.3 Clearances and creepage distances (see Annex B) [C2]

[C〉 Annex ZZ
(informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Article 1 of Annex I of the EU Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive(s) concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

———————— 〈C]

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RESIDUAL CURRENT OPERATED CIRCUIT-BREAKERS WITH INTEGRAL OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR USES (RCBOs) –

Part 1: General rules

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International Standard IEC 61009-1 has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

This third edition cancels and replaces the second edition, published in 1996, amendment 1 (2002) and amendment 2 (2006). It constitutes a technical revision.

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

– complete revision of EMC sequences, including the new test T.2.6, already approved in IEC 61543;
– clarification of RCDs current/time characteristics reported in Tables 2 and 3;
– revision of test procedure for $I_{\Delta n}$ between 5 A and 200 A;

– tests for the use of RCBOs in IT systems;
– testing procedure regarding the 6mA d.c. current superimposed to the fault current;
– improvement highlighting RCDs with multiple sensitivity;
– some alignments with IEC 60898-1.

The text of this standard is based on the following documents:

FDIS	Report on voting
23E/682/FDIS	23E/686/RVD

Full information on the voting for the approval of this standard 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.

A list of all the parts in the IEC 61009 series, under the general title *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs),* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

INTRODUCTION

This part includes definitions, requirements and tests covering all types of RCBOs. For applicability to a specific type, this part applies in conjunction with the relevant part, as follows:

Part 2-1: Applicability of the general rules to RCBOs functionally independent of line voltage.

Part 2-2: Applicability of the general rules to RCBOs functionally dependent on line voltage.

RESIDUAL CURRENT OPERATED CIRCUIT-BREAKERS WITH INTEGRAL OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR USES (RCBOs) –

Part 1: General rules

1 Scope

This International Standard applies to residual current operated circuit-breakers with integral overcurrent protection functionally independent of, or functionally dependent on, line voltage for household and similar uses (hereafter referred to as RCBOs), for rated voltages not exceeding 440 V a.c. 〚C〛 *text deleted* 〚C〛 and rated currents not exceeding 125 A 〚C〛 for fixed installations 〚C〛 and rated short-circuit capacities not exceeding 25 000 A. 〚C〛 They are intended for use in an environment with pollution degree 2, and overvoltage category III. 〚C〛

These devices are intended to protect people against indirect contact, the exposed conductive parts of the installation being connected to an appropriate earth electrode and to protect against overcurrents the wiring installations of buildings and similar applications. They may be used to provide protection against fire hazards due to a persistent earth fault current, without the operation of the overcurrent protective device.

RCBOs having a rated residual operating current not exceeding 30 mA are also used as a means for additional protection in the case of failure of the protective means against electric shock.

This standard applies to devices performing simultaneously the function of detection of the residual current, of comparison of the value of this current with the residual operating value and of opening of the protected circuit when the residual current exceeds this value, and also of performing the function of making, carrying and breaking overcurrents under specified conditions.

NOTE 1 The content of the present standard related to operation under residual current conditions is based on IEC 61008-1. The content of the present standard related to protection against overcurrents is based on IEC 60898-1.

NOTE 2 RCBOs are essentially intended to be operated by uninstructed persons and designed not to require maintenance. They may be submitted for certification purposes.

NOTE 3 Installation and application rules of RCBOs are given in the IEC 60364 series.

They are intended for use in an environment with pollution degree 2.

NOTE 4 For more severe overvoltage conditions, circuit-breakers complying with other standards (e.g. IEC 60947-2) should be used.

NOTE 5 For environments with higher pollution degrees, enclosures giving the appropriate degree of protection should be used.

RCBOs of the general type 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.

RCBOs of type S are considered to be sufficiently proof against unwanted tripping even if the surge voltage causes a flashover and a follow-on current occurs.

NOTE 6 Surge arresters installed downstream of the general type of RCBOs and connected in common mode may cause unwanted tripping.