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Edition 2.0 2024-11

INTERNATIONAL STANDARD

Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) –
Part 2-1: RCBOs according to classification 4.1.1

IEC 61009-2-1:2024-11(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2-1: RCBOs according to classification 4.1.1

FOREWORD

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IEC 61009-2-1 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 second edition cancels and replaces the first edition published in 1991. This edition constitutes a technical revision.

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

a) harmonization of all clauses between the IEC 61008, IEC 61009 and IEC 60755 series using blocks and modules approach;

b) harmonization of all tables and figures between the IEC 61008, IEC 61009 and IEC 60755 series;

c) terms and definitions are now referred to IEC 62873-2;

d) modification of Subclause 4.1 for classification according to supply conditions;

e) specific tests for operating characteristics (9.9) of RCBO according to classification 4.1.1;

f) specific test conditions for temperature-rise (9.8), verification of trip-free (9.15), surge current tests (9.19), reliability (9.20) and ageing (9.21).

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

Draft	Report on voting
23E/1371/FDIS	23E/1389/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.

This International Standard is to be used in conjunction with IEC 61009-1:2024.

Where this document states "addition", "deletion" or "replacement", the corresponding requirement, test specification or explanatory material in IEC 61009-1:2024 is adapted accordingly.

Where this document defines a new subclause, this subclause number starts at 100 (for example an additional definition in this document would read 3.100).

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/publications.

A list of all parts in the IEC 61009 series, published 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 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, or
- revised.

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

Part 2-1: RCBOs according to classification 4.1.1

1 Scope

IEC 61009-1:2024, Clause 1 is applicable except for the first paragraph and the last paragraph, which are replaced by the following, respectively:

This document applies to residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (hereafter referred to as RCBOs), classified according to IEC 61009-1:2024, 4.1.1. RCBOs according to this document are intended for voltages not exceeding 440 V AC with frequencies of 50 Hz, 60 Hz or 50/60 Hz and currents not exceeding 125 A and rated short-circuit capacities not exceeding 25 000 A for operation at 50 Hz or 60 Hz.

This document applies in conjunction with IEC 61009-1:2024. It specifies requirements, tests and test sequences to verify compliance and is used for certification purposes.

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 61009-1:2024, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

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

IEC 62873-2, *Residual current operated circuit-breakers for household and similar use – Part 2: Residual current devices (RCDs) – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62873-2 and in IEC 61009-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 Classification

IEC 61009-1:2024, Clause 4 applies with the following modifications (deletion of 4.1.2, 4.1.3, 4.1.4, 4.1.5, and 4.1.6):

4.1 According to the supply conditions

4.1.1 RCBO operating correctly on the occurrence of residual current

– within the voltage range 1,1 U_e and zero volt; and

– with any number of supply conductors connected.

The RCBO does not open automatically in the event of loss of supply.

5 Characteristics of RCBOs

IEC 61009-1:2024, Clause 5 applies.

6 Marking and other product information

IEC 61009-1:2024, Clause 6 applies.

7 Standard conditions for operation in service and for installation

IEC 61009-1:2024, Clause 7 applies.

8 Requirements for construction and operation

IEC 61009-1:2024, Clause 8 applies.

9 Tests

IEC 61009-1:2024, Clause 9 applies with following modifications.

9.1 General

IEC 61009-1:2024, 9.1 applies with the following modification:

Replace the third paragraph with:

The test sequences and the number of samples to be submitted are stated in Annex A.

9.8 Test of temperature-rise

9.8.2 Test procedure

IEC 61009-1:2024, 9.8.2 applies with the following addition:

The test is performed at any convenient voltage.

9.9 Verification of the operating characteristics

9.9.1 Verification of the operating characteristics under residual current conditions

9.9.1.1 Test circuit and test procedure

The RCBO is installed as for normal use.

The test circuit shall be of negligible inductance. For tests according to 9.9.1.2, the test circuit shall correspond to Figure 2. For tests according to 9.9.1.3, the test circuit shall correspond to Figure 3 or Figure 4, as applicable.

The instruments for the measurement of the residual current shall display (or allow to determine) the true RMS value.

Unless otherwise specified in this document, the tests are performed with no load at the ambient air temperature of 20 °C ± 5 °C.

The RCBO shall perform the tests of 9.9.1.2 and 9.9.1.3, as applicable.

Each test is performed by applying the residual current to one pole only, taken at random, with five measurements, unless otherwise specified in this document. The other poles shall not be connected to the supply, unless otherwise specified in this document.

For RCBOs having more than one rated frequency, the tests shall be carried out at the lowest and highest frequency, except for the test in 9.9.1.2.5 where verification is performed at one frequency only.

For RCBOs having multiple settings of residual operating current, the tests shall be carried out for each setting.

9.9.1.2 Tests for all RCBOs

9.9.1.2.1 Verification of correct operation in the case of a steady increase of the residual current

The switch S_1 and the RCBO being in the closed position, the residual current is steadily increased, starting from a value not higher than 0,2 $I_{\Delta n}$, trying to attain the value of $I_{\Delta n}$ within 30 s. The test shall be performed five times, the tripping current being measured each time.

All five measured values shall be situated between $I_{\Delta no}$ and $I_{\Delta n}$.

9.9.1.2.2 Verification of correct operation on closing on a residual current

The test circuit being calibrated at the value of the rated residual operating current $I_{\Delta n}$ and the switch S_1 being closed, the RCBO is closed to simulate service conditions as closely as possible.

The break time is measured five times. No measurement shall exceed the limiting value specified for $I_{\Delta n}$ in IEC 61009-1:2024, Table 11, according to the type of RCBO.

9.9.1.2.3 Verification of correct operation in the case of sudden appearance of residual current

1) All types

The test circuit being successively calibrated at each of the values of residual current specified in IEC 61009-1:2024, Table 11, the RCBO being in the closed position, the test current is suddenly established by closing the switch S_1.

The RCBO shall trip during each test.

Five measurements of the break time are carried out at each value of residual current.

No value shall exceed the relevant specified limiting value given in IEC 61009-1:2024, Table 11.

2) Additional test for type S

The test circuit being successively calibrated at each of the values of residual current specified in IEC 61009-1:2024, Table 11, the RCBO being in the closed position, the residual current is suddenly established by closing the switch S_1 for periods corresponding to the relevant minimum non-actuating times, with a tolerance of $^{0}_{-5}$ %.

Each application of residual current shall be separated from the previous one by an interval of at least 1 min.

The RCBO shall not trip during any of the tests.

9.9.1.2.4 Verification of correct operation in the case of sudden appearance of residual currents between 5 $I_{\Delta n}$ and 500 A

The test circuit is calibrated successively to the following values of the residual current:

5 A, 10 A, 20 A, 50 A, 100 A and 200 A.

The RCBO being in the closed position, the residual current is suddenly established by closing the switch S_1.

The RCBO shall trip during each test. The break time shall not exceed the times given in IEC 61009-1:2024, Table 11.

The test is carried out once for each value of residual current on one pole only, taken at random.

9.9.1.2.5 Verification of correct operation with load

The tests of 9.9.1.2.2 and 9.9.1.2.3 are repeated, the pole under test and one other pole of the RCBO being loaded with rated current, at any convenient voltage.

This test is not intended to reach thermal steady-state conditions.

NOTE The loading with rated current is not shown in Figure 2.

9.9.1.2.6 Tests at the temperature limits

The RCBO shall perform the tests specified in 9.9.1.2.3 under the following conditions, successively:

1) ambient air temperature: −5 °C, off-load, the residual current being connected to one current path only.
2) ambient air temperature: +40 °C, the RCBO having been previously loaded with the rated current, at any convenient voltage, until it attains thermal steady-state conditions.

   Preheating may be carried out at any convenient voltage at either 50 Hz or 60 Hz but auxiliary circuits shall be supplied at rated voltage, or loaded with rated current, as applicable.

   In practice, these conditions are reached when the variation of temperature-rise does not exceed 1 K per hour.

   For the tripping tests in 2), the flow of rated current may be interrupted, provided that the total interruption period does not exceed 30 s. As soon as the sum of interruption periods exceeds 30 s, the RCBO shall be loaded again with rated current for 5 min before the next tripping time measurement.

9.9.1.3 Additional verification of correct operation for RCBOs of type A

9.9.1.3.1 Verification of correct operation in the case of a continuous rise of residual pulsating direct current

The test shall be performed according to Figure 3.

The switch S_1 and the RCBO shall be closed. The relevant thyristor shall be controlled in such a manner that current delay angles α of 0, 90 and 135 are obtained. Each pole of the RCBO shall be tested twice at each of the current delay angles, in position I as well as in position II of the switch S_2.

For each test, the current shall be steadily increased at an approximate rate of 1,4 $I_{\Delta n}$ / 30 amperes per second for RCBOs with $I_{\Delta n}$ > 0,01 A, and at an approximate rate of 2 $I_{\Delta n}$ / 30 amperes per second for RCBOs with $I_{\Delta n}$ ≤ 0,01 A, starting from zero. The tripping current shall be in accordance with IEC 61009-1:2024, Table 14.

9.9.1.3.2 Verification of correct operation in the case of suddenly appearing residual pulsating direct currents

The RCBO shall be tested according to Figure 3.

The circuit being successively calibrated at the values specified hereafter and the RCBO being in the closed position, the residual current is suddenly established by closing the switch S_1.

The test is carried out at each value of residual current specified in IEC 61009-1:2024, Table 12, according to the type of RCBO.

Two measurements of the break time are made at each value of residual current, at a current delay angle α = 0 with the switch S_2 in position I for the first measurement and in position II for the second measurement.

No value shall exceed the specified limiting values.

9.9.1.3.3 Verification of correct operation with load

The tests of 9.9.1.3.1 are repeated, the pole under test and one other pole of the RCBO being loaded with the rated current, at any convenient voltage.

For this test it is not intended to reach thermal steady-state conditions.

NOTE The loading with rated current is not shown in Figure 3.

9.9.1.3.4 Verification of correct operation in the case of residual pulsating direct currents superimposed by a smooth direct current of 0,006 A

The RCBO shall be tested according to Figure 4 with a half-wave rectified residual current (current delay angle α = 0) superimposed by a smooth direct current of 0,006 A of same polarity.

Each pole of the RCBO is tested in turn, twice at each of positions I and II.

For each test, the current shall be steadily increased at an approximate rate of 1,4 $I_{\Delta n}$ / 30 amperes per second for RCBOs with $I_{\Delta n}$ > 0,01 A, and at an approximate rate of 2 $I_{\Delta n}$ / 30 amperes per second for RCBOs with $I_{\Delta n}$ ≤ 0,01 A, starting from zero. The tripping current shall be in accordance with the upper limit of IEC 61009-1:2024, Table 14.

9.15 Verification of the trip-free mechanism

9.15.1 General test conditions

The RCBO is mounted and wired as in normal use and supplied under the conditions of 9.9.1.1. It is tested in a substantially non-inductive circuit, the diagram of which is shown in Figure 2.

For RCBOs having multiple settings, the test is carried out for each setting.

If the RCBO is fitted with more than one operating means, the trip-free operation is verified for all operating means.

9.15.2 Test procedure

A residual current equal to 1,5 $I_{\Delta n}$ is passed by closing the switch S_1, the RCBO having been closed and the operating means being held in the closed position. The RCBO shall trip.

This test is then repeated by moving the operating means of the RCBO slowly over a period of approximately 1 s to a position where the current starts to flow. Tripping shall occur without further movement of the operating means.

Both tests are carried out three times, at least once on each pole intended to be connected to a phase.

9.19 Verification of the behaviour of RCBOs in the event of current surges caused by impulse voltages

9.19.1 Current surge test for all RCBOs (0,5 µs / 100 kHz ring wave test)

IEC 61009-1:2024, 9.19.1 applies with the following addition:

The test is performed without the RCBO being connected to the supply voltage.

9.19.2 Verification of the behaviour at surge currents up to 3 000 A (8/20 µs surge current test)

9.19.2.1 Test conditions

IEC 61009-1:2024, 9.19.2.1 applies with the following addition:

The test is performed without the RCBO being connected to the supply voltage.

9.20 Verification of reliability

9.20.1.3 Test procedure

IEC 61009-1:2024, 9.20.1.3 applies with the following addition after b) 1):

The RCBOs shall be in the closed position and not supplied.

9.20.2 Test with temperature of 40 °C

IEC 61009-1:2024, 9.20.2 applies with the following addition:

The test is performed at any convenient voltage.

9.21 Verification of withstand against ageing

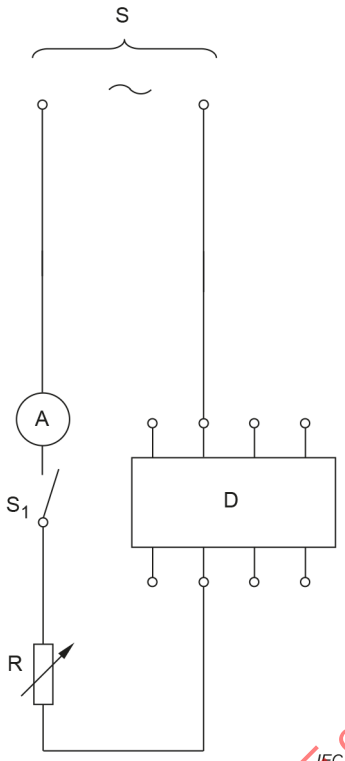
IEC 61009-1:2024, 9.21 applies with the following addition:

The test is performed at any convenient voltage.

9.22 Electromagnetic compatibility (EMC)

RCBOs shall be tested according to the test sequences H, I and J listed in Annex A.

The test T1 of IEC 61543 does not apply.



Key

S Voltage source

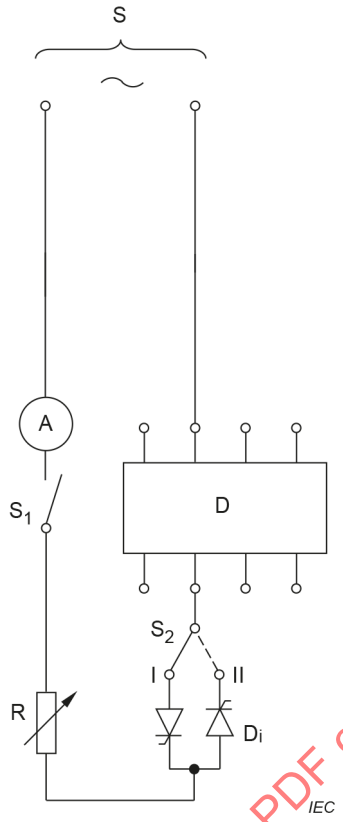
A Ammeter

S_1 Single-pole switch

D RCBO under test

R Variable resistor

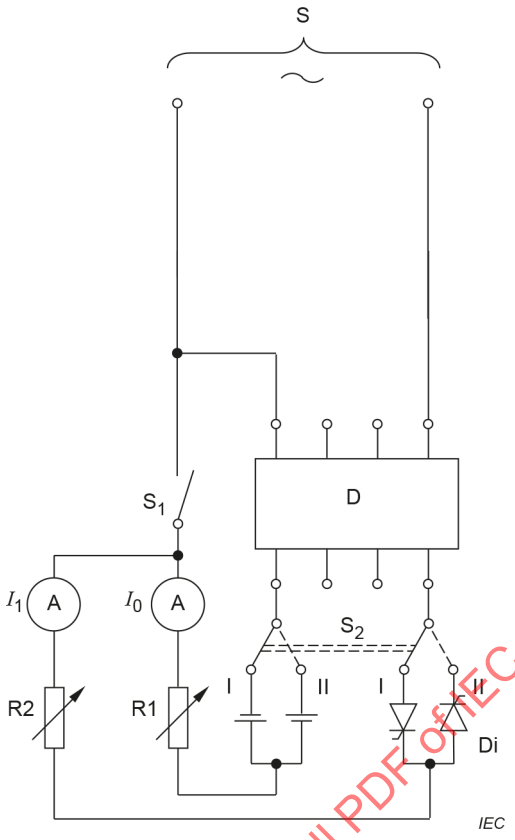
Figure 2 – Test circuit for the verification of operating characteristics and trip-free mechanism for RCBOs classified according to 4.1.1



Key

S	Voltage source
A	Ammeter (measuring RMS values)
D	RCBO under test
D_i	Thyristors
R	Variable resistor
S_1	Single-pole switch
S_2	Two-way switch

Figure 3 – Test circuit for the verification of the correct operation in case of residual pulsating direct currents for RCBOs classified according to 4.1.1



Key

S	Voltage source
A	Ammeter (measuring RMS values)
D	RCBO under test
D_i	Thyristors
R_1 R_2	Variable resistors
S_1	Single-pole switch
S_2	Two-way switch

Figure 4 – Test circuit for the verification of the correct operation in case of residual pulsating direct currents in the presence of a standing smooth direct current of 0,006 A for RCBOs classified according to 4.1.1

Annex A
(normative)

Test sequence and number of samples to be submitted for certification[1] purposes

A.1 Test sequences

To verify compliance with the requirements of this document, the tests are carried out according to Table A.1 where the tests in each sequence are carried out in the order indicated.

Table A.1 – Test sequences

Test sequence	Clause or subclause [a]	Test (or inspection)
A_1	6	Marking and other product information
	8.1.1	General
	8.1.2	Mechanism
	9.3	Indelibility of marking
	8.1.3	Clearances, creepage distances and solid insulation (external parts only)
	8.1.6	Non-interchangeability
	9.15	Verification of the trip-free mechanism
	9.4	Test of reliability of screws, current-carrying parts and connections
	9.5	Reliability of terminals for external conductors
	9.6	Protection against electric shock
	9.13	Resistance to heat
	8.1.3	Clearances and creepage distances (internal parts)
	9.23	Resistance to rusting
A_2	9.24	Verification of the behaviour of the RCBO under temporary overvoltage (TOV) conditions
	9.14	Resistance to abnormal heat and to fire
B	9.7.7.3	Verification of resistance of the insulation of open contacts against an impulse voltage (suitability for isolation)
	9.7.1	Resistance to humidity
	9.7.2	Insulation resistance of the main circuit
	9.7.3	Dielectric strength of the main circuit
	9.7.4	Insulation resistance and dielectric strength of auxiliary circuits
	9.7.7.2	Verification of clearances with the impulse withstand voltage
	9.7.5	Secondary circuit of detection transformers
	9.7.6	Capability of control circuits connected to the main circuits, etc.
	9.8	Temperature-rise
	9.20.2	Reliability at 40 °C
	9.21	Verification of withstand against ageing

1 The term "certification" denotes either a declaration of conformity by the manufacturer, or a third-party certification, e.g., by an independent testing station.

Test sequence		Clause or subclause [a]	Test (or inspection)
C	C_1	9.10	Mechanical and electrical endurance
		9.11.11.2.1	Performance at reduced short-circuit currents (test on all RCBOs)
		9.11.12	Verification of the RCBO after short-circuit test
	C_2	9.11.11.2.2	Short-circuit test on RCBOs for verifying their suitability for use in IT systems
		9.11.12	Verification of the RCBO after short-circuit test
D	D_0	9.9.1	Residual operating characteristics
	D_1	9.19	Verification of the behaviour of RCBOs in the event of current surges caused by impulse voltages
		9.11.13	Performance at $I_{\Delta m}$
		9.16	Test device
E	E_0	9.9.2	Overcurrent operating characteristics
	E_1	9.12	Resistance to mechanical shock and impact
		9.11.11.3	Short-circuit performance at 1 500 A
		9.11.12	Verification of the RCBO after short-circuit test
F_0		9.11.11.4 b)	Performance at service short-circuit capacity
		9.11.12	Verification of the RCBO after short-circuit test
F_1		9.11.11.4 c)	Performance at rated short-circuit capacity
		9.11.12	Verification of the RCBO after short-circuit test
G		9.20.1	Reliability (climatic test)
H		IEC 61543:2022, Table 1, T 5a and T 5b	Surges
I		IEC 61543:2022, Table 1, T 3	Conducted disturbances induced by radio-frequency fields
		IEC 61543:2022, Table 1, T 6	Radiated radio-frequency electromagnetic field
		IEC 61543:2022, Table 1, T 4	Fast transients (bursts)
J		IEC 61543:2022, Table 1, T 7	Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz
		IEC 61543:2022, Table 1, T 8	Electrostatic discharges

[a] Unless otherwise specified, clauses and subclauses refer to IEC 61009-1:2024.

A.2 Number of samples to be submitted for full test procedure

If one current rating and one residual operating current rating of one type (number of poles, instantaneous tripping) of RCBO only is submitted for test, the number of samples to be submitted to the different test series are those indicated in Table A.2 where the minimum performance criteria are also indicated.

If all samples submitted according to the second column of Table A.2 pass the tests the compliance with this document is met. If only the minimum number given in the third column pass the tests, additional samples as shown in the fourth column shall be tested and all shall then satisfactorily complete the test sequence.

For RCBOs having only one rated current but more than one residual operating current, two separate sets of samples shall be submitted to each test sequence, one adjusted to the highest residual operating current, the other adjusted to the lowest residual operating current.

Table A.2 – Number of samples for full test procedure

Test sequence	Number of samples	Minimum number of accepted samples [a, b]	Number of samples for repeated tests [c]
A_1	1	1	–
A_2	3	2	3
B	3	2	3
C_1	3	2 [d]	3
C_2	3	2 [d]	3
D	3	2 [d]	3
E	3	2 [d]	3
F_0	3	2 [d]	3
F_1	3	2 [d]	3
G	3	2	3
H [e]	3	2	3
I [e]	3	2	3
J [e]	3	2	3

[a] In total a maximum of three test sequences may be repeated.

[b] It is assumed that a sample which has not passed a test has not met the requirements due to workmanship or assembly defects which are not representative of the design.

[c] In the case of repeated tests, all samples are required to pass the tests.

[d] Permanent arcing or flashover between poles or between poles and the frame shall not occur in any sample during the tests of IEC 61009-1:2024, 9.11.11.2, 9.11.11.3, 9.11.11.4 and 9.11.13.

[e] At the manufacturer's request, the same set of samples may be subjected to more than one of these test sequences.

A.3 Number of samples to be submitted for simplified test procedures if submitting simultaneously a range of RCBOs of the same fundamental design

A.3.1 If a range of RCBOs of the same fundamental design or additions to such a range of RCBOs are submitted for certification, the number of samples to be tested may be reduced according to Table A.3, Table A.4, and Table A.5.

NOTE For the purposes of this Annex A, the term "same fundamental design" covers a range of RCBOs having a series of rated currents (I_n) a series of rated residual operating currents ($I_{\Delta n}$) and/or different numbers of poles.

RCBOs can be considered to be of the same fundamental design if **all of the following conditions are met**:

1) they have the same basic design, in particular according to the supply conditions (4.1);
2) the residual current operating means have identical tripping mechanisms and identical relays or solenoids except for the variations permitted in c) and d) below;
3) the materials, finish and dimensions of the internal current-carrying parts are identical other than the variations detailed in a) below;
4) the terminals are of similar design (see b) below);
5) the contact size, material, configuration and method of attachment are identical;
6) the manual operating mechanism, materials and physical characteristics are identical;
7) the moulding and insulating materials are identical;

8) the method, materials and construction of the extinction device are identical;

9) the basic design of the residual current sensing device is identical, for a given type of characteristic, other than the variations permitted in c) below;

10) the basic design of the residual current tripping device is identical except for the variations permitted in d) below;

11) the basic design of the test device is identical except for the variations permitted in e) below.

The following variations are permitted provided that the RCBOs comply in all other respects with the requirements detailed in the numbered list above:

a) cross-sectional area of the internal current-carrying connections and lengths of the toroid connections;

b) size of terminals;

c) number of turns and cross-sectional area of the windings and the size and material of the core of the differential transformer;

d) the sensitivity of the relay and/or the associated electronic circuit, if any;

e) the ohmic value of the means to produce the maximum ampere-turns necessary to conform to the tests of IEC 61009-1:2024, 9.16. The circuit may be connected across phases or phase to neutral.

A.3.2 For RCBOs of the same classification according to the supply conditions (4.1), the behaviour in the presence of DC components (IEC 61009-1:2024, 4.3) and the same classification according to time-delay (IEC 61009-1:2024, 4.4), having different current rating and rated residual operating current, the number of samples to be tested may be reduced, according to Table A.3.

Table A.3 – Number of samples for simplified test procedure

Test sequence	Number of samples according to number of poles [a, g]		
	Two poles [b, c]	Three poles [d, f, j]	Four poles [e]
A_1	1 max. rating I_n min. rating $I_{\Delta n}$	1 max. rating I_n min. rating $I_{\Delta n}$	1 max. rating I_n min. rating $I_{\Delta n}$
A_2	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$
B	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$
C	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$
$D_0 + D_1$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$
D_0	1 for all other ratings of $I_{\Delta n}$ with max. I_n		
$E_0 + E_1$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$
E_0	1 [i] for all other ratings of I_n with min. $I_{\Delta n}$		

Test sequence	Number of samples according to number of poles [a, g]		
	Two poles [b, c]	Three poles [d, f, j]	Four poles [e]
F_0	3 max. rating I_n min. rating $I_{\Delta n}$ 3 min. rating I_n max. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$ 3 min. rating I_n max. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$ 3 min. rating I_n max. rating $I_{\Delta n}$
F_1	3 max. rating I_n min. rating $I_{\Delta n}$ 3 min. rating I_n max. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$ 3 min. rating I_n max. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$ 3 min. rating I_n max. rating $I_{\Delta n}$
G	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$	3 max. rating I_n min. rating $I_{\Delta n}$
H [k]			3 [h] samples of the same rating I_n chosen at random min. rating $I_{\Delta n}$
I			3 [h] samples of the same rating I_n chosen at random min. rating $I_{\Delta n}$
J			3 [h] samples of the same rating I_n chosen at random min. rating $I_{\Delta n}$

[a] If a test is to be repeated according to the minimum performance criteria of Clause A.2, a new set of samples is used for the relevant test. In the repeated test, all samples are required to pass the test.

[b] If only three-pole or four-pole RCBOs are submitted to test, this column shall also apply to a set of samples with the smallest number of poles.

[c] Also applicable to one-pole RCBOs with uninterrupted neutral and to two-pole RCBOs with one protected pole.

[d] Also applicable to three-pole RCBOs with two protected poles.

[e] Also applicable to three-pole RCBOs with uninterrupted neutral and to four-pole RCBOs with three protected poles.

[f] This column is omitted when four-pole RCBOs have been tested.

[g] If only one value of $I_{\Delta n}$ is submitted, min. rating $I_{\Delta n}$ and max. rating $I_{\Delta n}$ are replaced by $I_{\Delta n}$.

[h] Only the highest number of current paths.

[i] For this sequence only the test of 9.9.2 is required.

[j] If a three-pole RCBO with four current paths and a four-pole RCBO are submitted, then only the four-pole RCBO is tested, with exception of the test of 9.8 of test sequence B for which both types are submitted to the test.

[k] If the requirement to test max. rating I_n and minimum rating $I_{\Delta n}$ does not cover all the possible range of RCBOs, the minimum $I_{\Delta n}$ shall in any case be chosen for the test.

A.3.3 For a sub-range of RCBOs of the same fundamental design as those described in A.3.1 and tested according to A.3.2, but of a different instantaneous tripping class according to IEC 61009-1:2024, 4.10 being subsequently submitted for tests, the additional sequences may be reduced according to Table A.4, the number of samples being taken from Table A.3.

Table A.4 – Test sequences for RCBOs having different instantaneous tripping currents

RCBO type tested first	Test sequences for other RCBO types		
	B-type	C-type	D-type
B-type	–	$(E_0 + E_1) + F$	$(E_0 + E_1) + F$
C-type	E_0 [a] + B [a]	–	$(E_0 + E_1) + F$
D-type	E_0 [a] + B [a]	E_0 [a] + B [a, b]	–

[a] For this sequence only the tests of 9.8 and 9.9.2.2 are required.

[b] When certification is requested at the same time for B-type, C-type and D-type RCBOs having the same rated short-circuit capacity, only test sequence E_0 is required if B-type and D-type samples have been tested.

A.3.4 For a sub-range of RCBOs of the same fundamental design as those described in A.3.1, and tested according to A.3.2, but of a different time-delay classification according to IEC 61009-1:2024, 4.4, subsequently submitted for tests, the additional number of samples and sequences shall be as given in Table A.3, except that sequences A, B, and E_0 may be omitted.

A.3.5 For a sub-range of RCBOs of the same fundamental design as those described in A.3.1, and tested according to A.3.2, but of a different classification according to behaviour due to DC components (according to IEC 61009-1:2024, 4.3), subsequently submitted for tests, the additional number of samples and sequences may be reduced according to Table A.5.

Table A.5 – Test sequences for RCBOs of different classification according to IEC 61009-1:2024, 4.3

Test sequence	Number of samples according to the number of poles [a]		
	Two poles [b, c]	Three poles [d, f]	Four poles [e]
$D_0 + D_1$	1 max. rating I_n min. rating $I_{\Delta n}$	1 max. rating I_n min. rating $I_{\Delta n}$	1 max. rating I_n min. rating $I_{\Delta n}$
D_0	1 for all other ratings of $I_{\Delta n}$ with max. I_n		

[a] If a test is to be repeated according to the minimum performance criteria of Clause A.2, a new set of samples is used for the relevant test. In the repeated test, all samples are required to pass the test.

[b] If only three-pole or four-pole RCBOs are submitted to test, this column shall also apply to a set of samples with the smallest number of poles.

[c] Also applicable to one-pole RCBOs with uninterrupted neutral and to two-pole RCBOs with one protected pole.

[d] Also applicable to three-pole RCBOs with two protected poles.

[e] Also applicable to three-pole RCBOs with uninterrupted neutral and to four-pole RCBOs with three protected poles.

[f] This column is omitted when four-pole RCBOs have been tested.