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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Interrupteurs automatiques à courant différentiel résiduel avec dispositif de protection contre les surintensités incorporé pour usages domestiques et analogues (DD) – Partie 1: Règles générales

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FOREWORD

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

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

FDIS	Report on voting
23E/741/FDIS	23E/745/RVD

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

The committee has decided that the contents of this amendment and the base 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- withdrawn,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.

1 Scope

Delete Note 8 and replace it by the following paragraph and new Note 8:

For RCBOs incorporated in, or intended only for association with socket-outlets, the requirements of this standard may be used, as far as applicable, in conjunction with the requirements of IEC 60884-1 or the national requirements of the country where the product is placed on the market.

NOTE 8 Residual current-operated protective devices (RCDs) incorporated in, or intended only for association with socket-outlets, can either meet IEC 62640 or this standard.

2 Normative references

Delete the reference to IEC 60051.

Add to the existing list, the following new references:

IEC 60228:2004, *Conductors of insulated cables*

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

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

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing /hot-wire based test methods – Glow-wire flammability test method for end-products*

Replace the reference to IEC 61543:1995 by the following new reference:

IEC 61543:1995, *Residual current -operated protective devices (RCDs) for household and similar use – Electromagnetic compatibility*
Amendment 1:2004
Amendment 2:2005

4.10 According to the method of connection

In the subclause, replace the existing text and note by the following:

– RCBOs, the electrical connections which are not associated with the mechanical mounting;
– RCBOs, the electrical connections which are associated with the mechanical mounting.

NOTE Examples of this type are:

– plug-in type;
– bolt-on type;
– screw-in type.

Some RCBOs may be of the plug-in type or bolt-on type on the line side only, the load terminals being usually suitable for wiring connection.

Add the following new subclause:

4.13 According to the type of terminals

– RCBOs with screw-type terminals for external copper conductors;
– RCBOs with screwless type terminals for external copper conductors;

NOTE 1 The requirements for RCBOs equipped with these types of terminals are given in Annex J.

– RCBOs with flat quick-connect terminals for external copper conductors;

NOTE 2 The requirements for RCBOs equipped with these types of terminals are given in Annex K.

– RCBOs with screw-type terminals for external aluminium conductors.

NOTE 3 The requirements for RCBOs equipped with this type of terminal are given in annex L.

Table 2 – Limit values of break time and non-actuating time for alternating residual currents (r.m.s. values) for type AC and A RCBO

In the table, replace the word “non-operating” *by* “non-actuating".

In the table, at the end of Footnote[c)]*, add the following text:*

For the tests of 9.9.1.3 and 9.9.1.4 b), the current $I_{\Delta t}$ is established so that the vector sum $I\Delta t + I_n$ is equal to the lower limit of the overcurrent instantaneous tripping range, according to type B, C or D, as applicable.

6 Marking and other product information

Replace the contents of item l) by the following:

l) the position of use, if necessary;

Replace the third paragraph after Note 1 by the following:

If, for small devices, the space available does not allow all the above data to be marked, at least the information under d), f), n), p) and r) (only for type A) shall be marked and visible when the device is installed. The information under a), b), c), h) , l), r) (only for type AC) and s) may be marked on the side or on the back of the device and be visible only before the device is installed. The information under q) may be on the inside of any cover which has to be removed in order to connect the supply wires. Any remaining information not marked shall be given in the manufacturer's catalogues.

Replace in the eleventh paragraph after Note 1, the word “circuit” *by* “conductor”.

Add the following text at the end of Clause 6:

For universal terminals (for rigid-solid, rigid-stranded and flexible conductors):

– no marking.

For non-universal terminals:

– terminals declared for rigid-solid conductors only shall be marked by the letters “s” or "sol";
– terminals declared for rigid (solid and stranded) conductors only shall be marked by the letter "r".

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

8.1.3 Clearances and creepage distances (see Annex B)

Replace the existing text in this subclause by the following:

The minimum required clearances and creepage distances are given in Table 7 which is based on the RCBO being designed for operating in an environment with pollution degree 2.

Compliance for item 1 in Table 7 is checked by measurement and by the test of 9.7.7.4.1 and 9.7.7.4.2. The test is carried out with samples not submitted to the humidity treatment described in 9.7.1.

The clearances of items 2 and 4 may be reduced provided that the measured clearances are not shorter than the minimum allowed in IEC 60664-1 for homogenous field conditions.

In this case, after the humidity treatment described in 9.7.1, compliance for item 2 and 4 and arrangements of 9.7.2 items b), c), d) and e) is checked in the following order:

– Tests according to 9.7.2 to 9.7.6 as applicable;
– Test according to 9.7.7.2 is applied with test voltages given in Table 19 with test arrangements of 9.7.2 items b), c), d), e).

If measurement does not show any reduced clearance, test 9.7.7.2 is not applied.

Compliance for item 3 in Table 7 is checked by measurement.

NOTE 1 All measurements required in 8.1.3 are carried out in Test sequence A on one sample and the tests 9.7.7.2 are carried out before 9.7.1 on three samples of Test sequence B.

Parts of PCBs connected to the live parts protected against pollution by the use of a type 2 protection according to IEC 60664-3 are exempt from this verification.

The insulating materials are classified into material groups on the basis of their comparative tracking index (CTI) according to 4.8.1 of IEC 60664-1:2007.

NOTE 2 Information on the requirements for design of solid insulation and appropriate testing is provided in IEC 60664-1:2007, 5.3 and 6.1.3.

NOTE 3 For clearances on printed wiring material, the following Note 3 in Table F.2 in 60664-1:2007 can be used: "For printed wiring material, the values for pollution degree 1 apply except that the value should not be less than 0,04 mm, as specified in Table F.4." For creepage distances on printed wiring material, distances in Table F.4 in 60664-1:2007 can be used if protected with a coating meeting IEC 60664-3 requirements and tests.

NOTE 4 The dimensioning of clearances and creepage distances for spacings equal to or less than 2 mm for printed wiring board may be optimised under certain conditions in case of use of IEC 60664-5. Only humidity levels HL 2 and HL3 are considered.

Table 7 – Minimum clearances and creepage distances

Delete, in this table, point 5 in the first column and the existing Note 3.

Replace, in the table, the last sentence of the existing Footnote [e] by the following text:

When interpolating, linear interpolation shall be used and values shall be rounded to the same number of digits as the values picked up from the tables. For determination of creepage distances, see Annex B.

8.1.4.4

In the subclause, replace the existing text by the following:

Current-carrying parts including parts intended for protective conductors, if any, shall be made of a metal having, under the conditions occurring in the equipment, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use.

Examples of suitable materials are given below:

– copper;
– an alloy containing at least 58 % copper for parts worked cold, or at least 50 % copper for other parts;
– other metal or suitably coated metal, no less resistant to corrosion than copper and having mechanical properties no less suitable.

In case of using ferrous alloys or suitably coated ferrous alloys, compliance to resistance to corrosion is checked by a test of resistance to rusting (see 9.25).

The requirements of this subclause do not apply to contacts, magnetic circuits, heater elements, bimetals, shunts, parts of electronic devices or to screws, nuts, washers, clamping plates, similar parts of terminals and parts of the test circuit.

8.1.5.1

Delete the second paragraph and the note in this subclause.

Replace the contents of the last paragraph by the following:

Compliance is checked by inspection, by the tests of 9.5 for screw-type terminals, by specific tests for plug-in or bolt-on RCBOs included in the standard, or by the tests of Annexes J, K or L, as relevant for the type of connection.

8.1.5.2

Replace the existing text and Table 8 by the following:

RCBOs shall be provided with:

– either terminals which shall allow the connection of copper conductors having nominal cross-sectional areas as shown in Table 8;

NOTE Examples of possible designs of screw-type terminals are given in Annex IC.

– or terminals for external untreated aluminium conductors and with aluminium screw-type terminals for use with copper or with aluminium conductors according to Annex L.

Compliance is checked by inspection, by measurement and by fitting, in turn, one conductor of the smallest and one of the largest cross-sectional area as specified.

Table 8 – Connectable cross-sections of copper conductors for screw-type terminals

Rated current [a] A		Range of nominal cross-section to be clamped [b] mm^2	
Greater than	**Up to and including**	**Rigid (solid or stranded [c]) conductors**	**Flexible conductors**
–	13	1 to 2,5	1 to 2,5
13	16	1 to 4	1 to 4
16	25	1,5 to 6	1,5 to 6
25	32	2,5 to 10	2,5 to 6
32	50	4 to 16	4 to 10
50	80	10 to 25	10 to 16
80	100	16 to 35	16 to 25
100	125	25 to 50	25 to 35

NOTE Information on AWG is given in Annex ID.

[a] A range of RCBOs having the same fundamental design and having the same design and construction of terminals, the terminals are fitted with copper conductors of the smallest cross-section for the minimum rated current and largest cross-section for the maximum rated current, as specified, solid and stranded, as applicable.

[b] It is required that, for current ratings up to and including 50 A, terminals be designed to clamp solid conductors as well as rigid stranded conductors. Nevertheless, it is permitted that terminals for conductors having cross-sections from 1 mm^2 up to 6 mm^2 be designed to clamp solid conductors only.

[c] Rigid stranded conductors shall be used for conductors having cross-sections from 1,5 mm^2 up to 50 mm^2 and shall be in compliance with class 2 of IEC 60228, related to stranded conductors for single-core.

8.3 Dielectric properties and isolating capability

In the last paragraph, delete the words “and 9.20”.

Table 10 – Time-current operating characteristics

Delete the note in the table.

8.13 Behaviour of RCBOs in case of a single-phase overcurrent through a three-pole or four-pole RCBO

Replace the text of this subclause by “Void”.

Table 12 – List of type tests

In the table, delete the following items:

– Limiting values of the non-operating current under overcurrent conditions 9.18

– Resistance of the insulation against an impulse voltage 9.20

In the table, add the following item at the end of the existing list:

– Resistance to rusting 9.25

9.5 Test of reliability of terminals for external conductors

Replace the title of the subclause by the following:

9.5 Tests of reliability of screw-type terminals for external copper conductors

9.5.1

In the subclause, replace the contents and Table 15 by the following:

The terminals are fitted with copper conductors *of the* same type (solid, stranded or flexible) of the smallest and largest cross-sections specified in Table 8.

The terminal shall be suitable for all types of conductors: rigid (solid or stranded) and flexible, unless otherwise specified by the manufacturer.

Terminals shall be tested with the minimum and maximum cross-section of each type of conductors on new terminals as follows:

– Tests for solid conductors shall use conductors having cross-sections from 1 mm^2 up to 6 mm^2, as applicable.
– Tests for stranded conductors shall use conductors having cross-sections from 1,5 mm^2 up to 50 mm^2, as applicable.
– Tests for flexible conductors shall use conductors having cross-sections from 1 mm^2 up to 35 mm^2, as applicable.

NOTE Information on AWG is given in Annex ID.

The conductor is inserted into a new terminal for the minimum distance prescribed or, where no distance is prescribed, until it just projects from the far side, and in the position most likely to assist the wire to escape.

The clamping screws are then tightened with a torque equal to two-thirds of that shown in the appropriate column of Table 14.

Each conductor is then subjected to a pull of the value, in Newton, shown in Table 15, according to the relevant cross-section of the tested conductor.

The pull is applied without jerks, for 1 min, in the direction of the axis of the conductor space.

When it is necessary, the tested values, for the different cross-sections with the relevant pulling force, shall be clearly indicated in the test report.

Table 15 – Pulling forces

Cross-section of the conductor inserted in the terminal mm^2	1 up to and including 4	Above 4 up to and including 6	Above 6 up to and including 10	Above 10 up to and including 16	Above 16 up to and including 50
Pull N	50	60	80	90	100

During the test, the conductor shall not move noticeably in the terminal.

9.5.3

In the subclause, replace the first sentence by the following:

The terminals are fitted with the largest cross-section area specified in Table 8, for stranded and/or flexible copper conductor.

Delete Table 16.

9.7.1.4 Condition of the RCBO after the test

Replace the existing text by the following:

After this treatment, the sample shall show no damage within the meaning of this standard and shall withstand the tests of 9.7.2, 9.7.3, 9.7.4, 9.7.6 and 9.7.7.2 (if applicable).

9.7.7.1 Verification of impulse withstand voltage across the open contacts (suitability for isolation)

Replace the existing title and text by the following:

9.7.7.1 General testing procedure for the impulse withstand voltage tests

The impulses are given by a generator producing positive and negative impulses having a front time of 1,2 µs, and a time to half-value of 50 µs, the tolerances being as follows:

± 5 % for the peak value;

± 30 % for the front time;

± 20 % for the time to half-value.

For each test, five positive impulses and five negative impulses are applied. The interval between consecutive impulses being at least 1 s for impulses of the same polarity and being at least 10 s for impulses of the opposite polarity.

When performing the impulse voltage test on complete RCBO, the attenuation or amplification of the test voltage shall be taken into account. It needs to be assured that the required value of the test voltage is applied across the terminals of the equipment under test.

The surge impedance of the test apparatus shall have a nominal value not higher than 500 Ω.

NOTE 1 In 9.7.7.2, for the verification of clearances within the basic insulation, on complete RCBO, a very low impedance of the generator is needed for the test. For this purpose, a hybrid generator with a virtual impedance of 2 Ω is appropriate if internal components are not disconnected before testing. However, in any case, a measurement of the correct test voltage directly at the clearance is needed.

The shape of the impulses is adjusted with the RCBO under test connected to the impulse generator. For this purpose appropriate voltage dividers and voltage sensors shall be used. It is recommended to disconnect surge protective components before testing.

NOTE 2 For RCBOs with incorporated surge arresters that cannot be disconnected, the shape of the impulses is adjusted without connection of the RCBO to the impulse generator.

Small oscillations in the impulses are allowed, provided that their amplitude near the peak of the impulse is less than 5 % of the peak value.

For oscillations on the first half of the front, amplitudes up to 10 % of the peak value are allowed.

There shall be no disruptive discharge (sparkover, flashover or puncture) during the tests.

NOTE 3 It is recommended that an oscilloscope be used to observe the impulse voltage in order to detect disruptive discharge.

9.7.7.2 Verification of impulse withstand voltage for the parts not tested in 9.7.7.1

In the subclause, replace the existing title and text by the following:

9.7.7.2 Verification of clearances with the impulse withstand voltage

If the measurement of clearances of items 2 and 4 in Table 7 and arrangements given in 9.7.2 b), c) d) and e) shows a reduction of the required length, this test applies. This test is carried out immediately after the measurement of the insulation resistance in 9.7.4.

NOTE The measurement of the clearances can be replaced by this test.

The test is carried out on a RCBO fixed on a metal support and being in the closed position.

The test impulse voltage values shall be chosen in Table 19 in accordance with the rated impulse voltage of the RCBO as given in Table 5. These values are corrected for barometric pressure and/or altitude at which the tests are carried out, according to Table 19.

A first series of tests is made applying the impulse voltage between:

– the phase pole(s) and the neutral pole (or path) connected together,
– and the metal support connected to the terminal(s) intended for the protective conductor(s), if any.

A second series of tests is made applying the impulse voltage between:

– the phase pole(s), connected together,
– and the neutral pole (or path) of the RCBO, as applicable.

A third series of tests is made applying the impulse voltage between arrangements given in 9.7.2 b), c), d) and e) and not tested during the two first sequences described here above.

There shall be no disruptive discharge. If, however, only one such disruptive discharge occurs, ten additional impulses having the same polarity as that which caused the disruptive discharge are applied, the connections being the same as those with which the failure occurred.

No further disruptive discharge shall occur.

Table 19 – Test voltage for verification of impulse withstand voltage for the parts not tested in 9.7.7.1

Replace the title of the table by the following:

Table 19 – Test voltage for verification of impulse withstand voltage

9.7.7.3 Verification of leakage currents across open contacts (suitability for isolation)

Replace the first paragraph of the subclause by the following:

Each pole of a RCBO having been submitted to one of the applicable tests of 9.12.11.2.1, 9.12.11.2.2, 9.12.11.3, 9.12.11.4b), 9.12.11.4c) is supplied at a voltage 1,1 times its rated operational voltage, the RCBO being in the open position.

Add the following new subclauses 9.7.7.4, 9.7.7.4.1, 9.7.7.4.2, 9.7.7.4.3, 9.7.7.5:

9.7.7.4 Verification of resistance of the insulation of open contacts and basic insulation against an impulse voltage in normal conditions

9.7.7.4.1 General

These tests are not preceded by the humidity treatment described in 9.7.1.

NOTE The tests in 9.7.7.4, as stated in requirements of 8.1.3, will be carried out before 9.7.1 on three samples of Test sequence B.

The test impulse voltage values shall be chosen from Table 28, in accordance with the rated voltage of the installation for which the RCBO is intended to be used as given in Table 5. These values are corrected for barometric pressure and/or altitude at which the tests are carried out, according to Table 28.

Table 28 – Test voltage for verifying the suitability for isolation, referred to the rated impulse withstand voltage of the RCBO and the altitude where the test is carried out

Nominal voltage of the installation V	Test voltages at corresponding altitude				
	$U_{1,2/50}$ a.c. peak kV				
Single-phase system	Sea level	200 m	500 m	1 000 m	2 000 m
with mid-point earthed 120/240 [a]	3,5	3,5	3,4	3,2	3,0
Single phase system 120/240 240 [b]	6,2	6,0	5,8	5,6	5,0
Three-phase systems 230/400	6,2	6,0	5,8	5,6	5,0

[a] For installation practice in Japan.

[b] For installation practice in North American countries.

9.7.7.4.2 RCBO in opened position

The series of tests is carried out on a RCBO fixed on a metal support as in normal use.

The impulses are applied between:

– the line terminals connected together;
– and the load terminals connected together with the contacts in the open position.

There shall be no disruptive discharges during the test.

9.7.7.4.3 RCBO in closed position

The series of tests is carried out on a RCBO fixed on a metal support, wired as in normal use and being in closed position.

All components bridging the basic insulation have to be disconnected.

NOTE If necessary, separate samples can be prepared by the manufacturer.

A first series of tests is made, the impulses being applied between:

– the phase pole(s) and the neutral pole (or path) connected together;
– and, the metal support connected to the terminal(s) intended for the protective conductor(s), if any.

A second series of tests is made, the impulses being applied between:

– the phase pole(s), connected together;
– and the neutral pole (or path) of the RCBO.

There shall be no disruptive discharge. If, however, only one such disruptive discharge occurs, ten additional impulses having the same polarity as that which caused the disruptive discharge are applied, the connections being the same as those with which the failure occurred.

No further disruptive discharge shall occur.

Afterwards, a new sample is tested according to 9.7.7.5.

9.7.7.5 Verification of the behaviour of components bridging the basic insulation

A new RCBO sample is tested in order to check that components bridging the basic insulation would not reduce safety with respect to short term temporary overvoltages.

NOTE 1 Afterwards it is necessary to ensure that components, bridging the basic insulation and having been disconnected during the impulse voltage test for testing the basic insulation, would not impair the behaviour or the safety of the basic insulation of the equipment during normal use.

The test voltage has a frequency of 50/60 Hz. In accordance with IEC 60364-4-44:2007, Table 44.A2, and to IEC 60664-1, the r.m.s. value of the test voltage for the basic insulation is 1 200 V + U0, U0 being the nominal voltage value between line and neutral.

NOTE 2 This test is performed only on RCBOs, where components bridging the basic insulation have been disconnected during the impulse voltage test of 9.7.7.4.3.

NOTE 3 As an example, for an RCBO having a rated voltage of U_0 = 250 V, the value of the a.c. test voltage for basic insulation is 1 200 V + 250 V, thus the r.m.s. test voltage is 1 450 V.

The voltage is applied during 5 s between:

– the phase pole(s) and the neutral pole (or path) connected together;
– and the metal support connected to the terminal(s) intended for the protective conductor(s), if any.

The equipment is then visually inspected; no component bridging the basic insulation should show a visible alteration.

NOTE 4 It is accepted to replace a fuse before connecting the equipment to the mains. If a fuse protecting a surge arrester has blown, it is accepted to replace the surge arrester too.

Then, the equipment is connected to the mains in accordance with the manufacturer's instruction. Under the condition of 9.9.1.2 c) the RCBO shall trip with a test current of 1,25 $I_{\Delta n}$. One test only is made on one pole, taken at random, without measurement of break time.

This test is not applied to devices with solid neutral.

9.9.1.1 Test circuit

Replace the last three paragraphs by the following:

The instruments for the measurement of the residual current shall show (or permit to determine) the true r.m.s. value.

NOTE The information for instrument measurement is available at the following CTL webserver:

http://www.iecee.org/ctl/sheet/pdf/CTL%20DSH%20251B%20Beijing%202009_05_15.pdf

For RCBOs having more than one rated frequency, the tests shall be carried out at the lowest and highest frequency, except for test in 9.9.1.3 (Verification of the correct operation with load at the reference temperature), where verification is performed at only one frequency.

9.9.1.2 Off-load tests with residual sinusoidal alternating currents at the reference temperature of 20 °C ± 5 °C

In item c) 2), delete the last two sentences.

9.9.1.4 Tests at the temperature limits

In the first paragraph, after 9.9.1.2 c), delete the reference to "1)".

9.9.2.2 Test of instantaneous tripping

Replace item a) by the following:

a) General test conditions

For the lower values of the test current of 9.9.2.2 b), 9.9.2.2 c) and 9.9.2.2 d) respectively the test is made once, at any convenient voltage.

For the upper value of the test current, the two following tests are carried out:

– At any convenient voltage, one opening operation on each combination of two poles connected in series is performed. The tripping time is measured and shall be within the limits of Table 10.

– At rated voltage U_0 (phase to neutral) with a power factor between 0,95 and 1 separately on each protected pole of the RCBO, the following sequence of operation is performed:

O-t-CO-t-CO-t-CO

the interval, t, being as defined in 9.12.11.1. The tripping time of the O operation is measured. After each operation the indicating means shall show the open position of the contacts.

9.12.2 Test circuit for short-circuit performance

Replace the contents of the first three paragraphs by the following:

Figures 7, 8 and 9 give diagrams of the circuits to be used for the tests concerning:

– a single-pole RCBO with two current paths;

– a two-pole RCBO (with one or two overcurrent protected poles);

– a three-pole RCBO;

– a three-pole RCBO with four current paths;

– a four-pole RCBO.

The resistances and reactances of the impedances Z, Z_1 and Z_2 shall be adjustable to satisfy the specified test conditions. The reactors shall preferably be air-cored; they shall always be connected in series with the resistors and their value shall be obtained by series coupling of individual reactors; parallel connecting of reactors is permitted when these reactors have practically the same time-constant.

Since the transient recovery voltage characteristics of test circuits including large air-cored reactors are not representative of normal service conditions, the air-cored reactor in any phase shall be shunted by a resistor, r, taking approximately 0,6 % of the current through the reactor (see Figure 9).This resistor may be omitted if agreed by the manufacturer.

Replace the contents of the ninth paragraph by the following:

A resistor R_2 of about 0,5 Ω is connected in series with a copper wire, F, as shown in Figures 7 and 8.

After the twelfth paragraph, delete the following sentence:

The current sensors O_1 are connected on the load side of the RCBO.

Replace the contents of the fourteenth paragraph by the following:

The voltage sensors are connected

– across the terminals of the pole for single-pole RCBOs;
– across the supply terminals for multipole RCBOs.

9.12.7.1

Replace the contents of the subclause by the following:

To calibrate the test circuit, links G_1 and G_2 having negligible impedance compared with that of the test circuit are connected in the positions shown in Figures 7 and 8.

9.12.7.3

Replace the contents of the subclause by the following:

To obtain a test current lower than the rated short-circuit capacity of the RCBO, additional impedances Z_1 are inserted on the load side of the links G_2, as shown in Figures 7 and 8.

9.12.7.4

Replace the contents of the subclause by the following:

To obtain a prospective current equal to the rated residual making and breaking capacity, at the corresponding power factor as Table 21, an impedance Z_2 is inserted as shown in Figure 7.

9.12.9.1 Test in free air

After Note 1, add the following paragraph:

The grid circuit(s) (see Figure C.3) shall be connected to the points B and C as shown in the test circuit diagrams of Figures 7 and 8.

9.12.9.2 Test in enclosures

In the subclause, replace the second paragraph and the note by the following:

The test shall be performed with the RCBO placed in an enclosure having the most unfavourable configuration.

NOTE This means that if other RCBOs (or other devices) are normally fitted in the direction(s) in which the grid(s) would be placed, they could be installed there. These RCBOs (or other devices) should be supplied as in normal use, but via F' and R' as defined in 9.12.9.1 and connected as shown in the appropriate Figures 7 and 8.