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2007-05

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**Type B residual current operated circuit-breakers  
with and without integral overcurrent protection  
for household and similar uses (Type B RCCBs  
and Type B RCBOs)**

**Interrupteurs automatiques à courant différentiel  
résiduel de Type B avec et sans protection contre  
les surintensités incorporée pour usages  
domestiques et analogues (ID et DD de Type B)**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TYPE B RESIDUAL CURRENT OPERATED CIRCUIT-BREAKERS  
WITH AND WITHOUT INTEGRAL OVERCURRENT PROTECTION  
FOR HOUSEHOLD AND SIMILAR USES  
(TYPE B RCCBs AND TYPE B RCBOs)**

## FOREWORD

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International Standard IEC 62423 has been prepared by subcommittee 23E: Circuit-breakers and similar equipment for household use, of IEC technical committee 23: Electrical accessories.

This International Standard is to be read in conjunction with the following standards:

IEC 61008-1:1996, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*  
Amendment 1(2002)  
Amendment 2 (2006)

IEC 61009-1:1996, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*  
Amendment 1(2002)  
Amendment 2 (2006)

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

FDIS	Report on voting
23E/629/FDIS	23E/636/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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn,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

RCCBs and RCBOs designed according to IEC 61008-1 and IEC 61009-1 are suitable in most of the applications, however the use of new electronic technology in equipment may result in particular residual currents not covered in IEC 61008-1 or IEC 61009-1.

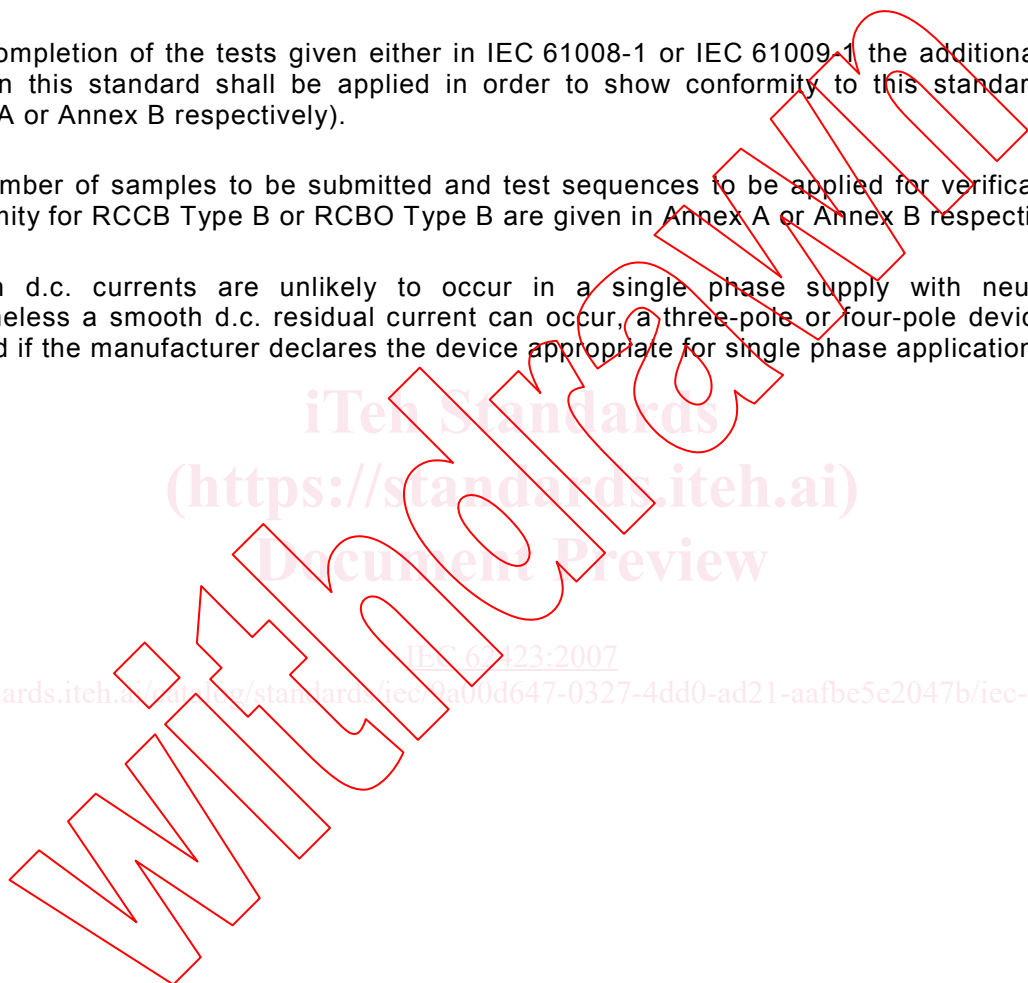
This standard includes definitions, additional requirements and tests for Type B RCCBs and Type B RCBOs to cover particular situations.

The tests shall first be applied according to IEC 61008-1 for Type B RCCBs and according to IEC 61009-1 for Type B RCBOs.

After completion of the tests given either in IEC 61008-1 or IEC 61009-1 the additional tests given in this standard shall be applied in order to show conformity to this standard (see Annex A or Annex B respectively).

The number of samples to be submitted and test sequences to be applied for verification of conformity for RCCB Type B or RCBO Type B are given in Annex A or Annex B respectively.

Smooth d.c. currents are unlikely to occur in a single phase supply with neutral. If nevertheless a smooth d.c. residual current can occur, a three-pole or four-pole device may be used if the manufacturer declares the device appropriate for single phase application.



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# TYPE B RESIDUAL CURRENT OPERATED CIRCUIT-BREAKERS WITH AND WITHOUT INTEGRAL OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR USES (TYPE B RCCBs AND TYPE B RCBOs)

## 1 Scope

The scope of IEC 61008-1 and IEC 61009-1 applies.

This standard specifies requirements and tests for type B RCDs. Requirements and tests given in this standard are in addition to the requirements of type A residual current devices. Type B RCCBs and Type B RCBOs are able to provide protection in case of alternating residual sinusoidal currents up to 1 000 Hz, pulsating direct residual currents and smooth direct residual currents in case of three phase supply.

Type B RCCBs and Type B RCBOs according to this standard are not intended to be used in d.c. supply systems.

Further requirements and tests for products to be used in situations where the residual current was not intended to be covered in IEC 61008-1 or IEC 61009-1 are under consideration.

For the purpose of manufacturer's declaration or verification of conformity type tests should be carried out in test sequences in compliance with Annex A or Annex B of this standard.

The complete test sequence for type test of Type B RCCBs and Type B RCBOs is given in Tables A.1 or B.1.

NOTE 1 Throughout the document, the term RCD refers to RCCBs and RCBOs.

NOTE 2 Requirements for 1 pole and 2 poles are under consideration.

## 2 Normative references

The following referenced documents are indispensable for the application 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 60479-1, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC 60479-2, *Effects of current passing through the human body – Part 2: Special aspects*

IEC 61008-1:1996, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*  
Amendment 1 (2002)  
Amendment 2 (2006)

IEC 61009-1:1996, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*  
Amendment 1 (2002)  
Amendment 2 (2006)

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 3.1

##### **smooth direct current**

a direct current which is ripple free

#### 3.2

##### **type B residual current device**

residual current device for which tripping is ensured as for type A according to IEC 61008-1 or IEC 61009-1, as applicable, and in addition

- for residual sinusoidal alternating currents up to 1 000 Hz,
- for residual pulsating direct currents,
- for residual alternating currents superimposed on a smooth direct current,
- for residual pulsating direct currents superimposed on a smooth direct current,
- for residual pulsating rectified d.c. which results from two or more phases,
- for residual smooth direct currents,

independent of polarity and independent whether the residual current appears suddenly or is slowly increased

### 4 Classification

According to IEC 61008-1 or IEC 61009-1, as applicable.

### 5 Characteristics

#### 5.1 Type B residual current device

Type B RCD for which tripping is ensured as for type A according to IEC 61008-1 or IEC 61009-1 as applicable and in addition

- for residual sinusoidal alternating currents up to 1 000 Hz (see 8.1.1),
- for residual smooth direct current of 0,4 times the rated residual operating current ( $I_{\Delta n}$ ) or 10 mA whichever is the highest value superimposed on an alternating current (see 8.1.2),
- for residual smooth direct current of 0,4 times the rated residual operating current ( $I_{\Delta n}$ ) or 10 mA, whichever is the highest value superimposed on a pulsating direct current (see 8.1.3),
- for residual pulsating rectified d.c. currents which results from two or more phases (see 8.1.4 and 8.1.5),
- for residual smooth direct currents originating from multiphase circuits (see 8.1.6).

The above specified residual currents may be suddenly applied or slowly increased.

## 5.2 Standard values of break time and non-actuating time for residual direct currents which result from rectifying circuits and for residual smooth direct current

**Table 1 – Standard values of break time and non-actuating time for residual direct currents which result from rectifying circuits and for residual smooth direct current**




Type	$I_n$ A	$I_{\Delta n}$ A	Standard values of break time and non-actuating time at a residual operating current ( $I_{\Delta}$ ) equal to s				
			$2 I_{\Delta n}$	$4 I_{\Delta n}$	$10 I_{\Delta n}$	5 A, 10 A, 20 A, 50 A, 100 A, 200 A <sup>a</sup>	
General	Any value	Any value	0,3	0,15	0,04	0,04	Maximum break times
S	$\geq 25$	$> 0,030$	0,5	0,2	0,15	0,15	Maximum break times
			0,13	0,06	0,05	0,04	Minimum non-actuating times
For Type B RCBOs, any value exceeding the lower limit of the overcurrent instantaneous tripping range are not tested.							
<sup>a</sup> The tests are only made during the verification of the correct operation as mentioned in 9.1.4b) according to Figure 4a and in 9.1.5b) according to Figure 4b.							


## 5.3 Standard values of tripping current according to frequencies which differ from the rated frequency 50/60 Hz

**Table 2 – Residual non-operating and operating current according to frequencies which differ from the rated frequency 50/60 Hz**

Frequency Hz	Residual non-operating current	Residual operating current
	$I_{\Delta n}$	$I_{\Delta n}$
150	0,5	2,4 <sup>a</sup>
400	0,5	6 <sup>a</sup>
1 000		14 <sup>a b</sup>
<sup>a</sup> The values correspond to the threshold of ventricular fibrillation according to IEC 60479-1 in combination with the frequency factor for ventricular fibrillation according to IEC 60479-2. <sup>b</sup> The IEC 60479 series gives no factors for frequencies above 1 kHz.		
NOTE 1 The definitions of "residual non-operating current and of "operating currents" are those of IEC 61008-1 and IEC 61009-1.		
NOTE 2 The waveform for the given frequencies is sinusoidal.		
NOTE 3 The maximum permissible earthing impedance at a frequency $f_x$ depends on the upper limit of the operating currents of the RCD at that frequency.		
NOTE 4 The relationship between the frequency of the acceptable touch voltages and the dissipated power in the human body are under consideration. Until final values are fixed the maximum allowed touch voltage of 50 V for 50/60 Hz is recommended.		

## 6 Marking and other product information

Add the following symbol  adjacent to the symbol for type A, e.g.  

Alternatively the following symbol may be used: 

NOTE The manufacturer should provide information regarding the maximum earthing resistance of the electrical installation taking into account the tripping level at higher frequencies.

## 7 Standard conditions for operation in service and for installation

According to IEC 61008-1 or IEC 61009-1, as applicable.

## 8 Conditions for construction and operation

### 8.1 Operation in response to the type of residual current

#### 8.1.1 Residual sinusoidal alternating currents up to 1 000 Hz

Type B RCDs shall comply with the values given in Table 2 of this standard.

*Compliance is checked by the tests of 9.1.1a).*

Type B RCDs shall operate in response to a sudden appearance of the residual operating current given in Table 2. The maximum break time of RCDs of the general type shall be 0,3 s and for RCDs of the S-type the minimum non-actuating time shall be equal to or not lower than 0,13 s, and the maximum break time shall not exceed 0,5 s.

*Compliance is checked by the tests of 9.1.1b).*

#### 8.1.2 Residual alternating current superimposed on a residual smooth direct current

Type B RCDs shall operate in case of residual alternating currents of the rated frequency superimposed on a residual smooth direct current of 0,4 times the rated residual current ( $I_{\Delta n}$ ) or 10 mA, whichever is the highest value.

The alternating tripping current shall be equal to or lower than  $I_{\Delta n}$ .

*Compliance is checked by the tests of 9.1.2.*

#### 8.1.3 Residual pulsating direct current superimposed on a smooth direct current

Type B RCDs shall operate in case of residual pulsating direct currents superimposed on a residual smooth direct current of 0,4 times the rated residual current ( $I_{\Delta n}$ ) or 10 mA, whichever is the highest value.

The tripping current shall not be higher than  $1,4 I_{\Delta n}$  for RCDs with  $I_{\Delta n} > 0,01$  A, or  $2 I_{\Delta n}$  for RCDs with  $I_{\Delta n} \leq 0,01$  A.

NOTE The tripping current  $1,4 I_{\Delta n}$  or  $2 I_{\Delta n}$ , as applicable, is the r.m.s. value due to the half-wave pulsating direct current.

*Compliance is checked by the tests of 9.1.3.*

#### 8.1.4 Residual pulsating direct currents which may result from rectifying circuits supplied from two phases

Type B RCDs shall operate in response to a steady increase of residual pulsating direct current resulting from rectifying circuits within the limits of  $0,5 I_{\Delta n}$  to  $2 I_{\Delta n}$ .

*Compliance is checked by the tests of 9.1.4a).*

Type B RCDs shall operate in response to a sudden appearance of residual pulsating direct current resulting from rectifying circuits according to the limits specified in Table 1.

*Compliance is checked by the tests of 9.1.4b).*

#### 8.1.5 Residual pulsating direct currents which may result from rectifying circuits supplied from three phases

Type B RCDs shall operate in response to a steady increase of residual pulsating direct current resulting from rectifying circuits within the limits of  $0,5 I_{\Delta n}$  to  $2 I_{\Delta n}$ .

*Compliance is checked by the tests of 9.1.5a).*

Type B RCDs shall operate in response to a sudden appearance of residual pulsating direct current resulting from rectifying circuits according to the limits specified in Table 1.

*Compliance is checked by the tests of 9.1.5b).*

#### 8.1.6 Residual smooth direct current

Type B RCDs shall operate in response to a steady increase of smooth direct residual current within the limits of  $0,5 I_{\Delta n}$  to  $2 I_{\Delta n}$ .

*Compliance is checked by the tests of 9.1.6.1a) and 9.1.6.2.*

Type B RCDs shall operate in response to a sudden appearance of smooth direct residual current according to the limits specified in Table 1 of this standard.

*Compliance is checked by the tests of 9.1.6.1b).*

## 9 Tests

### 9.1 Verification of the operating characteristic at the reference temperature ( $20 \pm 5$ ) °C

*The RCD is installed as for normal use.*

*All tests shall be carried out with the RCD supplied first at  $0,85 U_n$  and then at  $1,1 U_n$  with rated frequency and, unless otherwise specified, without load.*

*In case of RCDs having multiple settings of residual operating current, the tests are made for each setting.*

**9.1.1 Verification of the correct operation in case of residual sinusoidal alternating currents up to 1 000 Hz**

- a) *The test shall be performed according to Figure 1. The test switches  $S_1$  and  $S_2$  and the RCD 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 residual operating current given in Table 2 within 30 s, the tripping current being measured.*

*The test is carried out on one pole taken at random at each frequency given in Table 2 and repeated five times, the tripping values shall be in compliance with Table 2.*

- b) *A second series of tests is carried out to verify the break time.*

*The test circuit being calibrated at the residual operating current corresponding to 1 000 Hz according to Table 2, the test switch  $S_1$  and the RCD being in the closed position, the residual current is suddenly established by closing the test switch  $S_2$ .*

*Five measurements of the break time are made on one pole taken at random.*

*The maximum break time shall not exceed 0,3 s for general type RCDs and for S-type RCDs the minimum non-actuating time shall be equal to or greater than 0,13 s and the maximum break time shall not exceed 0,5 s.*

**9.1.2 Verification of the correct operation in the case of a residual alternating current superimposed on a residual smooth direct current**

*The test shall be performed according to Figure 2.*

*The test switches  $S_1$  and  $S_2$  and the RCD being in the closed position, the residual smooth direct current is applied through one pole chosen at random and is adjusted to  $0,4 I_{\Delta n}$  or 10 mA, whichever is the highest value.*

*The residual alternating current of the rated frequency is applied to another pole and 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 tripping current being measured.*

*The test is made twice at each position I and II of  $S_3$ .*

*The alternating tripping current shall be equal or lower than  $I_{\Delta n}$ .*

**9.1.3 Verification of the correct operation in the case of a residual pulsating direct current superimposed on a residual smooth direct current**

*The test shall be performed according to Figure 3.*

*The test switches  $S_1$  and  $S_2$  and the RCD being in the closed position, the residual smooth direct current is applied through one pole chosen at random and is adjusted to  $0,4 I_{\Delta n}$  or 10 mA, whichever is the highest value.*

*The residual pulsating direct current is applied to another pole chosen at random with a current delay angle  $\alpha$  of  $0^\circ$  and is steadily increased, starting from a value not higher than  $0,2 I_{\Delta n}$ , trying to attain the value of  $1,4 I_{\Delta n}$  for RCDs with  $I_{\Delta n} > 0,01$  A, or  $2 I_{\Delta n}$  for RCDs with  $I_{\Delta n} \leq 0,01$  A within 30 s, the tripping current being measured.*

*The RCD is tested, twice at each position I and II of  $S_3$  and  $S_4$ .*