



BSI Standards Publication

Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses

National foreword

This British Standard is the UK implementation of EN 62423:2012+A12:2022. It is derived from IEC 62423:2009, incorporating corrigendum December 2011. It supersedes BS EN 62423:2012, which will be withdrawn on 8 March 2024.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by IEC corrigendum December 2011 is indicated in the text by AC1 AC1.

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 C C.

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The UK participation in its preparation was entrusted to Technical Committee 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 committee manager.

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English Version

Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses
(IEC 62423:2009, modified + corrigendum Dec. 2011)

Interrupteurs automatiques à courant différentiel résiduel de type B et de type F avec et sans protection contre les surintensités incorporée pour usages domestiques et analogues
(CEI 62423:2009, modifiée + corrigendum déc. 2011)

Fehlerstrom-/Differenzstrom-Schutzschalter Typ F und Typ B mit und ohne eingebautem Überstromschutz für Hausinstallationen und für ähnliche Anwendungen
(IEC 62423:2009, modifiziert + corrigendum Dez. 2011)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN 62423:2012) consists of the text of IEC 62423:2009 + corrigendum 2011 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".

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at national level by publication of an identical
national standard or by endorsement
- latest date by which the national standards conflicting (dow) 2017-06-19
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This document supersedes EN 62423:2009.

EN 62423:2012 includes the following significant technical changes with respect to EN 62423:2009:

- requirements and tests for Type F RCD have been introduced;
- requirements and tests for two-pole Type B RCD have been introduced;
- new additional requirements and tests for Type B RCDs have been introduced to cover requirements and tests for Type F too.

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

EN 61008-1:2012, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

EN 61009-1:2012, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

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

Endorsement notice

The text of the International Standard IEC 62423:2009 + corrigendum 2011 was approved by CENELEC as a European Standard with agreed common modifications.

Foreword to amendment A11

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Foreword to Amendment A12

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Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

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INTRODUCTION

RCCBs and RCBOs designed according to IEC 61008-1 and IEC 61009-1 are suitable in most of the applications. IEC 61008-1 and 61009-1 provide appropriate requirements and tests for general use in household and similar uses. 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 covers specific applications where additional requirements and testing are needed.

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

The tests shall first be applied according to IEC 61008-1 for Type F or Type B RCCBs and according to IEC 61009-1 for Type F or 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, Annex B for Type F or Annex C, Annex D for Type B respectively).

The number of samples to be submitted and test sequences to be applied for verification of conformity for Type F RCCBs and Type F RCBOs are given in Annex A and Annex B respectively.

The number of samples to be submitted and test sequences to be applied for verification of conformity for Type B RCCBs and Type B RCBOs are given in Annex C and Annex D respectively.

This standard introduces Type F RCDs (F for Frequency) ~~Text deleted~~ intended for protection of circuits with frequency inverters supplied between phase and neutral or phase and earthed middle conductor taking into account the necessary features for these particular situations in addition to the cases covered by type A RCDs. Type F RCDs cannot be used where electronic equipment with double bridge rectifiers supplied from two phases is found or if a smooth d.c. residual current can occur.

In case of a frequency inverter, e.g. used for motor speed control, supplied between phase and neutral, a composite residual current including the power frequency, the motor frequency and the chopper clock frequency of the frequency inverter may occur in addition to alternating or pulsating d.c. residual currents.

This standard introduces Type B RCDs to be used in case of residual pulsating rectified direct current which results from one or more phases, and smooth d.c. residual current in addition to the cases covered by Type F RCDs. For these applications, two, three or four pole Type B RCDs can be used.

TYPE F AND TYPE B RESIDUAL CURRENT OPERATED CIRCUIT-BREAKERS WITH AND WITHOUT INTEGRAL OVERCURRENT PROTECTION FOR HOUSEHOLD AND SIMILAR USES

1 Scope

☐ The scope of EN 61008-1 and EN 61008-2-1 or EN 61009-1 and EN 61009-2-1 applies with the following additions.

This standard specifies requirements and tests for Type F and Type B RCDs (Residual current devices). Requirements and tests given in this standard are in addition to the requirements of Type A residual current devices according to EN 61008-2-1 or EN 61009-2-1. This standard can only be used together with EN 61008-1 and EN 61009-1. ☐

Type F RCCBs (Residual Current Circuit Breaker) and Type F RCBOs (Residual current Circuit Breaker with Overcurrent protection) ☐ *Text deleted* ☐ are intended for installations when frequency inverters are supplied between phase and neutral or phase and earthed middle conductor and are able to provide protection in case of alternating residual sinusoidal at the rated frequency, pulsating direct residual currents and composite residual currents that may occur.

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.

☐ Type F and type B RCDs have high resistance against unwanted tripping even if the surge voltage causes a flashover and a follow-on current occurs and in case of inrush residual currents with a maximum duration of 10 ms which can occur in case of switching ON electronic equipment or EMC-filters. ☐

RCDs 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 ☐ EN ☐ 61008-1 or ☐ EN ☐ 61009-1 are under consideration.

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

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

NOTE 2 ☐ *Deleted* ☐

☐ NOTE 3 Type F and type B RCDs have high resistance against unwanted tripping, even if the surge voltage causes a flashover and a follow-on current occurs, and in case of inrush residual currents with a maximum duration of 10 ms which can occur in case of switching ON electronic equipment or EMC-filters. ☐

2 Normative references

☐ Normative references to international publications are listed in Annex ZA ☐

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 F according to this standard and in addition:

- for residual sinusoidal alternating currents up to 1 000 Hz,
- 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 direct current which results from two or more phases
- for residual smooth direct currents whether suddenly applied or slowly increased independent of polarity

3.3

Type F 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 composite residual currents, whether suddenly applied or slowly rising intended for circuit supplied between phase and neutral or phase and earthed middle conductor
- for residual pulsating direct currents superimposed on smooth direct current

4 Classification

According to IEC 61008-1 or IEC 61009-1, as applicable with the following addition:

4.1 According to behaviour in presence of d.c. components

- Type F RCDs
- Type B RCDs

5 Characteristics

5.1 Type F 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 composite residual currents, whether suddenly applied or slowly rising intended for circuit supplied between phase and neutral or phase and earthed middle conductor (see 8.1);
- and for residual pulsating direct currents superimposed on smooth direct current of 0,01 A (see 8.3.3).

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

5.2 Type B residual current device

5.2.1 General

Residual current device for which tripping is ensured as for Type F and in addition

- for residual sinusoidal alternating currents up to 1 000 Hz (see 8.2.1.1),
- for residual alternating currents superimposed on a smooth direct current of 0,4 times the rated residual current ($I_{\Delta n}$) (see 8.2.1.2),
- for residual pulsating direct currents superimposed on a smooth direct current of 0,4 times the rated residual current ($I_{\Delta n}$) or 10 mA, whichever is the highest value (see 8.2.1.3),
- for residual direct currents which may result from rectifying circuits, i.e.,
 - two-pulse bridge connection line to line for 2-, 3- and 4-pole devices (see 8.2.1.4),
 - three-pulse star connection or six-pulse bridge connection for 3- and 4-pole devices (see 8.2.1.5),
- for residual smooth direct currents (see 8.2.1.6).

NOTE In NL, this characteristic is modified.

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

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

Table 1 – Type B RCDs – 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_{Δ}) 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 a	
General	Any value	Any value	0,3	0,15	0,04	0,04	Maximum break times
S	≥ 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.

^a The tests are only made during the verification of the correct operation as mentioned in 9.2.1.5 b) according to Figure 6a, and 9.2.1.6 b) according to Figure 6b.

5.2.3 Values of tripping current according to frequencies which differ from the rated frequency 50 Hz

Table 2 – Type B RCDs – Residual non-operating and operating current according to frequencies which differ from the rated frequency 50 Hz

Frequency Hz	Residual non-operating current $I_{\Delta n}$	Residual operating current $I_{\Delta n}$
150	$0,5 I_{\Delta n}$	$2,4 I_{\Delta n}^a$
400	$0,5 I_{\Delta n}$	$6 I_{\Delta n}^a$
1 000	$I_{\Delta n}$	$14 I_{\Delta n}^{a b}$

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 Hz is recommended.

^a The values correspond to the threshold of ventricular fibrillation according to IEC/TS 60479-1 in combination with the frequency factor for ventricular fibrillation according to IEC/TS 60479-2.

^b IEC 60479 series gives no factors for frequencies above 1 kHz.

6 Marking and other product information

6.1 Marking for Type F RCDs

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

Alternatively the following symbol may be used 

6.2 Marking for Type B RCDs

Add the following symbol  adjacent to the symbol for Type F, e.g.:   

Alternatively the following symbol may be used: 

NOTE Where a 4-pole RCBO is used for single phase supply the device should be connected and installed according to the manufacturer's instructions.

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 Conditions for Type F and Type B RCDs – Requirements for operation in case of sinusoidal residual currents comprising of multi-frequency components resulting from control equipment supplied from single phase

- a) Type F and Type B RCDs shall operate in response to a steady increase of residual current within the limits given in Table 4.

Compliance is checked by the tests of 9.1.2.

- b) Type F and Type B RCDs shall operate in response to a sudden appearance of the residual operating current.

For residual currents greater than 5 times the upper limit of Table 4 the maximum break time of RCDs of the general type shall be 0,04 s, and, for RCDs Type S, the minimum non-actuating time shall be equal to or greater than 0,05 s and the maximum break time shall not exceed 0,15 s.

Compliance is checked by the tests of 9.1.3.

8.2 Conditions for Type B RCDs

8.2.1 Operation in response to the type of residual current

8.2.1.1 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 9.2.1.2a).

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 type S 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 9.2.1.2b).

8.2.1.2 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 or lower than $I_{\Delta n}$.

Compliance is checked by the tests of 9.2.1.3.

8.2.1.3 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 RCD 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.