

INTERNATIONAL STANDARD

NORME INTERNATIONALE



AMENDMENT 2
AMENDEMENT 2

Low-voltage switchgear and controlgear –
Part 2: Circuit-breakers

Appareillage à basse tension –
Partie 2: Disjoncteurs

[IEC 60947-2:2006/AMD2:2013](https://standards.iteh.ai/catalog/standards/sist/65373ebb-dc03-4ea0-9d0f-50e70a65faa9/iec-60947-2-2006/amd2-2013)

<https://standards.iteh.ai/catalog/standards/sist/65373ebb-dc03-4ea0-9d0f-50e70a65faa9/iec-60947-2-2006-amd2-2013>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2013 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.
If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



AMENDMENT 2
AMENDEMENT 2

**Low-voltage switchgear and controlgear –
Part 2: Circuit-breakers**

**Appareillage à basse tension –
Partie 2: Disjoncteurs**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

R

ICS 29.130.20

ISBN 978-2-83220-578-5

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

FOREWORD

This amendment has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

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

| FDIS | Report on voting |
|---------------|------------------|
| 17B/1796/FDIS | 17B/1807/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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

CONTENTS

Delete the entry referring to Table 1.

1.1 Scope and object

Replace the existing item b)2) of this subclause by the following new item b)2):

- 2) operation and behaviour in case of overload and operation and behaviour in case of short-circuit, including co-ordination in service (selectivity and back-up protection);

2 Definitions

2.17.1 over-current discrimination

Replace the existing term and definition by the following new term and definition, and delete the source:

over-current selectivity

co-ordination of the operating characteristics of two or more over-current protective devices such that, on the incidence of over-currents within stated limits, the device intended to operate within these limits does so, while the other(s) does (do) not

2.17.2**total discrimination (total selectivity)**

Replace the existing term by the following new term:

total selectivity

Replace in the existing definition the word “discrimination” by the word “selectivity”.

2.17.3**partial discrimination (partial selectivity)**

Replace the existing term by the following new term:

partial selectivity

Replace in the existing definition the word “discrimination” by “selectivity”.

Renumber the existing definition 2.21, added by Amendment 1, as definition 2.22.

Add, after 2.20, the following new definition 2.21:

2.21**overload current setting** I_r

current setting of an adjustable overload release

NOTE In case of a non-adjustable overload release, this value is equal to nominal current I_n .

4.3.1.1 Rated operational voltage (U_e)

This correction does not apply to the English version.

4.3.5.1 Rated short-circuit making capacity (I_{cm})

This correction does not apply to the English version.

4.3.5.2 Rated short-circuit breaking capacities

This correction does not apply to the English version.

4.3.5.2.1 Rated ultimate short-circuit breaking capacity (I_{cu})

This correction does not apply to the English version.

4.3.5.2.2 Rated service short-circuit breaking capacity (I_{cs})

Replace the text of the existing subclause, including Table 1, by the following new text:

The rated service short-circuit breaking capacity of a circuit-breaker is the value of service short-circuit breaking capacity (see 2.15.2) assigned to that circuit-breaker by the manufacturer for the corresponding rated operational voltage, under the conditions specified in 8.3.4. It is expressed as a value of prospective breaking current, in kA, or as a % of I_{cu} (for example $I_{cs} = 25 \% I_{cu}$).

I_{cs} shall be at least equal to 25 % of I_{cu} .

Table 1 (void)

Table 4 – Selectivity categories

Replace the existing text of note 2 by the following new text:

NOTE 2 Vacant.

5.2 Marking

This correction does not apply to the English version.

Add, at the end of the existing item b), the following two new bulleted items:

- range of the current setting (I_r) of adjustable overload release (see 4.7.3);
- value or range of the rated instantaneous short-circuit current setting (I_i), fixed or adjustable (see 4.7.3).

This correction does not apply to the English version.

Add, at the end of the existing item c), the following new bulleted items:

- minimum cable cross-section, if different from Table 9 of IEC 60947-1, for ratings ≤ 20 A according to rated ultimate short-circuit breaking capacity I_{cu} ;
- values of tightening torque for the circuit-breaker terminals.

7.1.5 List of construction breaks

Replace the first dashed item by the following new dashed item:

- material, finish and dimensions of internal current-carrying parts, admitting, however, the variations listed in a), b), c), f) and g) below;

Replace the item f) introduced by Amendment 1 by the following new item f):

- f) in the case of the 2-pole and 4-pole variants, replacement of the trip unit in one pole by a link, to provide an unprotected neutral;

Add, at the end of the existing list, the following new item g):

- g) creating a 2-pole breaker from a 3-pole breaker by removing the centre current path.

8.3.1.2 Tests omitted from sequence I and made separately

Replace, in this subclause introduced by Amendment 1, the existing first dashed item by the following new dashed item:

- tripping limits and characteristics (8.3.3.1); in which case the sample(s) tested in the sequence shall be subjected to the tests of 8.3.3.1.3, only on the phase poles at the maximum setting, at room temperature and without the additional test of item b) to verify the time-current characteristic;

8.3.1.4 Alternative test programmes for circuit-breakers having both three-pole and four-pole variants

Replace the existing title and text of this subclause, introduced by Amendment 1, including Table 9b and Table 9c, by the following new title, text and Table 9b, Table 9c:

8.3.1.4 Alternative test programmes for circuit-breakers of a given frame size and design having a different number of poles

These alternative test programmes may only be applied when all ratings are the same or lower than the variant submitted to the full programme of Table 9, and construction breaks are the same for all variants. In the case of 1-pole circuit-breakers the voltage ratings shall be equal to or lower than the line-to neutral voltage of the variant tested to Table 9. A 2-pole circuit-breaker produced by removing the centre current path from a 3-pole circuit-breaker tested to Programme 1 or Programme 2 of this clause need not be tested as it is considered to be covered by the tests on the 3-pole variant.

Compliance with the test requirements is met by carrying out one of the alternative programmes 1 or 2 below.

- Programme 1: The applicable test sequences according to Table 9 shall be carried out on the three-pole variant. In addition, where applicable, the tests or test sequences listed in Table 9b shall be carried out on the other variants.
- Programme 2: The applicable test sequences according to Table 9 shall be carried out on the four-pole variant. In addition, where applicable, the tests or test sequences listed in Table 9c shall be carried out on the other variants.

The principle for the application of the alternative test programmes is illustrated below:

| | Programme 1 | | | | Programme 2 | | | |
|-----------------------------|--|---------|---------|---------|-------------|---------|---------|---------|
| | 1-pole | 2-poles | 3-poles | 4-poles | 1-pole | 2-poles | 3-poles | 4-poles |
| Construction 1 ^a | ☑ | ☐ | ■ | ☐ | ○ | ○ | ○ | ■ |
| Construction 2 | - | - | ■ | ☐ | - | - | - | ■ |
| Construction 3 | - | - | ■ | ☐ | - | - | - | ■ |
| ... | - | - | ■ | ☐ | - | - | - | ■ |
| Construction n | - | - | ■ | ☐ | - | - | - | ■ |
| NOTE | ■ fully tested per Table 9 ☐ tested per Table 9b ○ tested per Table 9c - no test required | | | | | | | |
| ^a | construction 1 is the construction which covers the max rating. | | | | | | | |

Table 9b – Applicability of tests or test sequences to 1, 2 and 4-pole circuit-breakers according to the alternative programme 1 of 8.3.1.4

| Test sequence | Test clause | Test | Applicability to 4-pole variant ^{f, h} | Applicability to 1-pole or 2-pole variants ^g |
|---------------|---|---|---|---|
| I | 8.3.3.1 | Test of tripping limits and characteristics | | |
| | 8.3.3.1.1 | General | X | X |
| | 8.3.3.1.2 | Short-circuit releases | X ^a | X ^e |
| | 8.3.3.1.3a) ^k or 8.3.3.1.3b) ^k (as applicable) | Overload releases: –instantaneous/definite time-delay –inverse time-delay | X X | X ^e |
| | 8.3.3.1.4 | Additional test for definite time-delay releases: | | |
| | 8.3.3.2 | Dielectric properties | X | X |
| | 8.3.3.3 | Mechanical operation and operational performance capability | | |
| | 8.3.3.3.1 | General | X | X |
| | 8.3.3.3.2 | Construction and mechanical operation | X ^d | X ^{d, e} |
| | 8.3.3.3.3 | Operational performance capability without current | X | X |
| | 8.3.3.3.4 | Operational performance capability with current | X | X |
| | 8.3.3.3.5 | Withdrawable circuit-breakers | X | |
| | 8.3.3.4 | Overload performance | X | X |
| | 8.3.3.5 | Verification of dielectric withstand | X | X |
| | 8.3.3.6 | Verification of temperature-rise | X | X |
| | 8.3.3.7 | Verification of overload releases | X | X |
| | 8.3.3.8 | Verification of undervoltage and shunt releases | X | X |
| 8.3.3.9 | Verification of the main contact position | X | X | |
| II | 8.3.4 | Rated service short-circuit breaking capacity | | |
| III | 8.3.5 ^{b, c} | Rated ultimate short-circuit breaking capacity | X | X |
| IV | 8.3.6 | Rated short-time withstand current | X 4th pole and adjacent pole only (see 8.3.2.6.4) | |
| V | 8.3.7 | Performance of integrally fused circuit-breakers | X | X |
| VI | 8.3.8 | Combined test sequence | | |
| Annex C | | Individual pole short-circuit test sequence | | |
| Annex H | | Test sequence for circuit-breakers for IT systems | | |

NOTE The applicability of a test or test sequence is indicated by X in the relevant space.

- ^a One test on one pair of phase poles chosen at random. In the case of an electronic trip unit, this test may be made on one pole chosen at random.
- ^b This test sequence also applies when, for the 3-pole testing, Sequence III on the 3-poles variant is replaced by Sequence II or Sequence VI (see Table 9).
- ^c One sample of maximum current rating only, tested at max kVA rating ($I_{cu} \times$ corresponding U_e).
- ^d Without verification tests of items c) (undervoltage releases) and d) (shunt releases).
- ^e Applicable only to 1-pole variant; not required for 2-poles variants.
- ^f In case of 4-poles devices with different levels of neutral protection (e.g. 60 % or 100 %), only the variant with the highest level has to be tested according to Table 9b.
- ^g One sample of maximum current rating only, for each test sequence.
- ^h One sample of maximum current rating for each test sequence; in the case of one or more construction breaks (see 2.1.2 and 7.1.5) within the frame size, a further sample is tested at the maximum rated current corresponding to each construction.
- ⁱ Vacant.
- ^j Vacant.
- ^k This test is not required for electronic trip units.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

IEC 60947-2:2006/AMD2:2013

<https://standards.iteh.ai/catalog/standards/sist/65373ebb-dc03-4ea0-9d0f-50e70a65faa9/iec-60947-2-2006-amd2-2013>

Table 9c – Applicability of tests or test sequences to 1, 2 and 3-pole circuit-breakers according to the alternative programme 2 of 8.3.1.4

| Test sequence | Test clause | Test | Applicability to 3-pole variant ^g | Applicability to 1-pole or 2-pole variants ^g |
|---------------|---|---|---|---|
| I | 8.3.3.1 | Test of tripping limits and characteristics | | |
| | 8.3.3.1.1 | General | | X |
| | 8.3.3.1.2 | Short-circuit releases | | X ^e |
| | 8.3.3.1.3a) ^k or 8.3.3.1.3b) ^k (as applicable) | Overload releases: - instantaneous/definite time-delay - inverse time-delay | | X ^e |
| | 8.3.3.1.4 | Additional test for definite time-delay releases | | |
| | 8.3.3.2 | Dielectric properties | X | X |
| | 8.3.3.3 | Mechanical operation and operational performance capability | | |
| | 8.3.3.3.1 | General | X | X |
| | 8.3.3.3.2 | Construction and mechanical operation | | X ^{d, e} |
| | 8.3.3.3.3 | Operational performance capability without current | X | X |
| | 8.3.3.3.4 | Operational performance capability with current | X | X |
| | 8.3.3.3.5 | Withdrawable circuit-breakers | | |
| | 8.3.3.4 | Overload performance | X | X |
| | 8.3.3.5 | Verification of dielectric withstand | X | X |
| | 8.3.3.6 | Verification of temperature-rise | X | X |
| | 8.3.3.7 | Verification of overload releases | | |
| | 8.3.3.8 | Verification of undervoltage and shunt releases | X | X |
| | 8.3.3.9 | Verification of the main contact position | X | X |
| | II | 8.3.4 | Rated service short-circuit breaking capacity | |
| III | 8.3.5 ^{b, c} | Rated ultimate short-circuit breaking capacity | X | X |
| IV | 8.3.6 | Rated short-time withstand current | | |
| V | 8.3.7 | Performance of integrally fused circuit-breakers | X | X |
| VI | 8.3.8 | Combined test sequence | | |
| Annex C | | Individual pole short-circuit test sequence | | |
| Annex H | | Test sequence for circuit-breaker for IT systems | | |

NOTE The applicability of a test or test sequence is indicated by X in the relevant space.

- ^a Vacant.
- ^b This test sequence also applies when, for the 4-poles testing, Sequence III on the 4-poles variant is replaced by Sequence II or Sequence VI (see Table 9).
- ^c One sample of maximum current rating only, tested at max kVA rating ($I_{cu} \times$ corresponding U_e).
- ^d Without verification tests of items c) (undervoltage releases) and d) (shunt releases).
- ^e Applicable only to 1-pole variant ; not required for 2-poles variants.
- ^f Vacant.
- ^g One sample of maximum current rating only, for each test sequence.
- ^h Vacant.
- ⁱ Vacant.
- ^j Vacant.
- ^k This test is not required for electronic trip units.

8.3.2.1 General requirements

Add at the end of the existing second paragraph the following new text:

or, where applicable, for the alternative test programmes in Table 9b and Table 9c (see 8.3.1.4).

Replace the existing fifth paragraph, introduced by Amendment 1, by the following new text:

In the case of one or more construction breaks (see 2.1.2 and 7.1.5) within the frame size, further samples shall be tested in accordance with Table 9b and/or Table 10 as applicable.

Replace the existing seventeenth paragraph by the following new paragraph:

The tightening torques to be applied to the terminal screws shall be in accordance with the manufacturer's instructions (see 5.2 e)).

Table 10 – Number of samples for test

Add, between the existing title of the table and the existing table, the following new paragraph:

Table 10 applies to the test programmes of Table 9. In the case of the alternative test programmes (see 8.3.1.4), Table 9b and Table 9c are applicable.

The correction concerning I_{cu} , I_{cs} and I_{cw} introduced in the French text of this amendment does not apply to the English text.

8.3.2.6.4.2 Tests on one-, two- and three-pole circuit-breakers

Add, after the second dashed item of this existing paragraph, introduced by Amendment 1, the following new paragraph:

For ratings ≤ 20 A, the manufacturer may specify a larger cross-section, in which case this cross-section shall be used for all relevant short-circuit tests, and stated in the test report. In addition, a verification of inverse-time delay releases according to 8.3.3.1.3 b) shall be made with this cross-section.

8.3.2.6.4.3 Tests on four-pole circuit-breakers

Reformat the first sentence of the existing second paragraph, introduced by Amendment 1, as follows:

An additional sequence of operations on one or more new samples, in accordance with Table 10, shall be made on the fourth pole and its adjacent pole for sequences:

- III and IV, or
- IV and V, or
- VI,

as applicable.

8.3.2.6.7 Verification after short-circuit tests

Replace the whole existing item a) by the following new item a) and new note:

a) After the opening operations of the short-circuit making and breaking capacity tests of 8.3.4.1, 8.3.5.2, 8.3.6.4, 8.3.7.1, 8.3.7.6, 8.3.8.3, as applicable, the following conditions shall be met:

- there shall be no damage to the insulation on conductors used to wire the device;
- the polyethylene sheet shall show no holes visible with normal or corrected vision without additional magnification. Minuscule holes of less than 0,26 mm diameter can be ignored;
- the case shall not be broken but hairline cracks are acceptable.

NOTE Hairline cracks are a consequence of high gas pressure or thermal stresses due to arcing when interrupting very high fault currents and are of superficial nature. Consequently, they do not develop through the entire thickness of the moulded case of the device.

8.3.3.2 Test of dielectric properties

This correction does not apply to the English version.

8.3.3.3.4 Operational performance capability with current

This correction does not apply to the English version.

8.3.3.4 Overload performance

Replace the existing third paragraph of this subclause by the following new paragraph:

The test shall be made at a voltage corresponding to the maximum operational voltage $U_{e \max}$ assigned by the manufacturer to the circuit-breaker, taking into account the requirement for recovery voltage of Table 12 (see also 8.3.2.2.3 a) of IEC 60947-1).

Table 12 – Test circuit characteristics for overload performance

This correction does not apply to the English version.

8.3.7 Test sequence V: Performance of integrally fused circuit-breakers

This correction does not apply to the English version.

8.3.8.2 Test of rated short-time withstand current

Add, at the end of the existing subclause, the following new paragraph:

This test does not need to be made on the sample of minimum I_n specified in Table 10.

8.5 Special tests – Damp heat, salt mist, vibration and shock

Add, at the end of the existing subclause, introduced by Amendment 1, before Figure 1, the two following new paragraphs:

With reference to footnote e) of Table Q.1 of IEC 60947-1, for dry heat test, the circuit-breaker shall not carry current. Where an under-voltage release is fitted it shall be energised with rated voltage. The circuit-breaker shall be operated according to 8.4.1 during the last hour of the test.

With reference to footnote g) of Table Q.1 of IEC 60947-1, during damp heat test, the functional test shall consist of the mechanical operations of 8.4.1 of this standard. When only manual operating means are available, this test can be done during the beginning of the following cold period.

Annex A – Co-ordination under short-circuit conditions between a circuit-breaker and another short-circuit protective device associated in the same circuit

Replace, throughout the annex (including Figure A.2), "discrimination" by "selectivity".

Delete "(or I_{CS})" in each of the following locations:

- A.3.1, in the first existing paragraph;
- new A.5.1 in the first existing paragraph;
- A.6.2 b) in the second existing paragraph;
- A.6.3 in the sixth and eighth existing paragraphs;
- existing Figure A.2 and Figure A.3.

A.1 Introduction

Replace the existing eighth paragraph by the following new paragraph:

Consideration of selectivity can either be carried out by desk study or by test (see Clause A.5), whereas the verification of back-up protection normally requires the use of tests (see Clause A.6).

A.4 Type and characteristics of the associated SCPD

This correction does not apply to the English version.

A.5 Verification of discrimination

Replace the existing title by the following new title and subclause title:

A.5 Verification of selectivity

A.5.1 General

Replace the sentence before the existing dashed list by the following new sentence:

In certain cases, tests at I_s may be performed on the association, for example: