

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

Appareillage à basse tension –
Partie 2: Disjoncteurs

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**Low-voltage switchgear and controlgear –
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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/1636/FDIS	17B/1651/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 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- withdrawn;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.

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IEC 60947-2:2006/AMD1:2009

Replace in the whole document "Utilization category" by "Selectivity category" except in Annex L.

CONTENTS

Add the following:

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

Insert the following:

Figure K.2 – Template for characteristics of cut-off current versus prospective current from 1 kA to 200 kA

Figure K.3 – Template for characteristics of cut-off current versus prospective current from 0,01 kA to 200 kA

Figure K.4 – Template for characteristics of let-through energy versus prospective current from 1 kA to 200 kA

Figure K.5 – Template for characteristics of let-through energy versus prospective current from 0,01 kA to 200 kA

Figure K.6 – Example of the use of template K.2

Figure K.7 – Example of the use of template K.4

Insert the following:

Table 9b – Applicability of tests or test sequences to four-pole circuit-breakers in a given frame size and design when tested according to the alternative programme 1 of 8.3.1.4

Table 9c – Applicability of tests or test sequences to 3-pole circuit-breakers in a given frame size and design when tested according to the alternative programme 2 of 8.3.1.4

1.2 Normative references

Delete the reference to IEC 60364-4-41:2001.

Add the following reference:

IEC 60417, *Graphical symbols for use on equipment*

IEC 60617, *Graphical symbols for diagrams*

Replace “IEC 60755:1983” by “IEC/TR 60755:1983”.

Replace the reference to IEC 60947-1:2004 by the following:

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*

Add, after IEC 60947-4-1:2000, the following reference:

Amendment 2 (2005)

Replace the reference to IEC 61000-3-2:2000 by the following:

IEC 61000-3-2:2005, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

Add, after IEC 61000-3-3:1994, the following reference:

Amendment 2 (2005)

Replace the reference to IEC 61000-4-3:2002 by the following:

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

Replace the reference to IEC 61000-4-4:1995 by the following:

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

Replace the reference to IEC 61000-4-5:1995 by the following:

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

Add, after IEC 61000-4-6:2003, the following reference:

Amendment 2 (2006)

Replace “IEC 61000-5-2:1997” by “IEC/TR 61000-5-2:1997”

Add, after IEC 61008-1:1996, the following reference:

Amendment 2 (2006)

Add, after IEC 61009-1:1996, the following reference:

Amendment 2 (2006)

Add, after IEC 61009-1:1996, the following reference:

IEC 61131-1:2003, *Programmable controllers – Part 1: General information*

Add, after CISPR 11:2003, the following reference:

Amendment 2 (2006)

Add, after CISPR 22:2005, the following reference:

Amendment 2 (2006)

2.3 current-limiting circuit-breaker

Replace the existing definition by the following:

circuit-breaker that, within a specified range of current, prevents the let-through current reaching the prospective peak value and which limits the let-through energy (I^2t) to a value less than the let-through energy of a half-cycle wave of the symmetrical prospective current

NOTE 1 Reference may be made to either the symmetrical or asymmetrical prospective peak value of let-through current.

NOTE 2 The let-through current is also referred to as the cut-off current (see IEC 441-17-12).

NOTE 3 Templates for the graphical representation of the cut-off current characteristic and the let-through energy characteristic are given in Figures K.2 to K.5 and examples of the use of the templates in Figures K.6 and K.7.

Add, after definition 2.20, the following new definition 2.21:

2.21

programmable logic controller

PLC

digitally operating electronic system, designed for use in an industrial environment, which uses a programmable memory for the internal storage of user-oriented instructions for implementing specific functions such as logic, sequencing, timing, counting and arithmetic, to control, through digital or analogue inputs and outputs, various types of machines or processes. Both the PLC and its associated peripherals are designed so that they can be easily integrated into an industrial control system and easily used in all their intended functions

[IEC 61131-1, definition 3.5]

3.8

Replace the reference to 7.1.11 of IEC 60947-1 by the reference to 7.1.12 of IEC 60947-1.

4.3.2.4 **Current rating for four-pole circuit-breakers**

Replace the reference to 7.1.8 of IEC 60947-1 by the reference to 7.1.9 of IEC 60947-1.

5.2 **Marking**

Replace, under item a), last bullet, the reference to 7.1.5.1 of IEC 60947-1 by the reference to 7.1.6.1 of IEC 60947-1.

Correct, under item b), 7th bullet, the symbol ----- with the symbol ===

Replace, under item b), 13th bullet, the reference to 7.1.9.3 of IEC 60947-1 by the reference to 7.1.10.3 of IEC 60947-1.

Replace, under item e), the reference to 7.1.7.4 of IEC 60947-1 by the reference to 7.1.8.4 of IEC 60947-1.

7.1 Constructional requirements

Replace the five first paragraphs of the subclause by the following:

Subclause 7.1 of IEC 60947-1 applies. Where, in Subclause 7.1.2.2 of IEC 60947-1, the test temperature is to be specified, the test temperature required by this standard is 960°C.

7.1.2 Additional requirements for circuit-breakers suitable for isolation

Replace, in the second paragraph, the reference to 7.1.6 of IEC 60947-1 by the reference to 7.1.7 of IEC 60947-1.

7.1.5 List of construction breaks

Add a new item f).

- f) in the case of the 4-pole variant, replacement of the trip unit in the 4th pole by a link, to provide an unprotected neutral.

7.1.6 Additional requirements for circuit-breakers provided with a neutral pole

Replace, in the first paragraph, the reference to 7.1.8 of IEC 60947-1 by the reference to 7.1.9 of IEC 60947-1.

Add, after Subclause 7.1.6, the following new Subclause 7.1.7:

7.1.7 Digital inputs and outputs for use with programmable logic controllers (PLCs)

Annex S of IEC 60947-1 applies. For the purposes of this standard this requirement does not apply to digital inputs and outputs dedicated to devices other than PLCs.

8.1.1

Add, after the second dashed item, the following new third dashed item:

- special tests (see 8.5).

8.3.1 Test sequences

Replace the first four paragraphs of this subclause by the following:

8.3.1.1 General

Type tests are grouped together in a number of sequences, as shown in Table 9.

For each sequence, tests shall be made in the order listed unless otherwise specified in this standard.

8.3.1.2 Tests omitted from sequence I and made separately

With reference to 8.1.1 of IEC 60947-1, the following tests of test sequence I (see 8.3.3) may be omitted from the sequence and made on separate samples:

- 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, at the maximum setting only and without the additional test of item b) to verify the time-current characteristic;
- test of dielectric properties (8.3.3.2);
- test of under-voltage releases of 8.3.3.3.2 (item c) and 8.3.3.3.3, to verify the requirements of 7.2.1.3 of IEC 60947-1, and tests of under-voltage releases at alternative frequencies (see 8.3.2.1);
- test of shunt releases of 8.3.3.3.2 (item d) and 8.3.3.3.3, to verify the requirements of 7.2.1.4 of IEC 60947-1, and tests of shunt releases at alternative frequencies (see 8.3.2.1);
- additional tests for operational capability without current for withdrawable circuit-breakers (8.3.3.3.5).

8.3.1.3 Applicability of sequences according to the relationship between short-circuit ratings

The applicability of test sequences according to the relationship between I_{CS} , I_{CU} and I_{CW} is given in Table 9a.

Table 9 – Overall schema of test sequences ^a

Replace, in the fifth row (sequence V), third column:

- “Short-circuit at take-over current” by “Short-circuit at 1,1 times the take-over current”, and
- “Short-circuit at rated ultimate short-circuit braking capacity” by “Short-circuit at rated ultimate short-circuit breaking capacity”.

Replace footnote b by:

- b Except where Sequence VI is applied.

Replace, in footnote c, the 2nd dashed item by:

- where Sequence VI is applied

Add, after Table 9a, the following new Subclause 8.3.1.4, Table 9b and Table 9c:

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

These alternative test programmes may be applied when there is no construction break (see 7.1.5) between the poles of the four-pole variant and the poles of the three-pole variant.

Compliance with the test requirements may be 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 of the circuit-breaker. In addition, the tests or test sequences listed in Table 9b shall be carried out on the four-pole variant.
- Programme 2: The applicable test sequences according to Table 9 shall be carried out on the four-pole variant of the circuit-breaker. In addition, the tests or test sequences listed in Table 9c shall be carried out on the three-pole variant.

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Table 9b – Applicability of tests or test sequences to four-pole circuit-breakers in a given frame size and design when tested according to the alternative programme 1 of 8.3.1.4

Test sequence	Test clause	Test	Four identical poles, neutral identified or not	Fourth pole identified, neutral unprotected (See Note 2 to 8.3.1.4)	Fourth pole identified, neutral protected rated differently to the phase poles
I	8.3.3.1	Test of tripping limits and characteristics			
	8.3.3.1.1	General			
	8.3.3.1.2	Short-circuit releases	X one test on one pair of poles chosen at random ^a	X one test on one pair of phase poles chosen at random ^a	X i) one test on one pair of phase poles chosen at random ^a X ii) one test on N + one phase pole at random
	8.3.3.1.3 a) or 8.3.3.1.3 b) (as applicable)	Overload releases: – instantaneous/definite time-delay – inverse time-delay	X 3-phase	X 3-phase	X i) 3-phase poles X ii) N
	8.3.3.1.4	Additional test for definite time-delay releases: – overload releases – short-circuit releases	X 3-phase	X 3-phase	X i) 3-phase poles X ii) N X i) one test on one pair of phase poles chosen at random ^a X ii) one test on N + one phase pole chosen at random

Table 9b (continued)

Test sequence	Test clause	Test	Four identical poles, neutral identified or not	Fourth pole identified, neutral unprotected (See Note 2 to 8.3.1.4)	Fourth pole identified, neutral protected rated differently to the phase poles
	8.3.3.2	Dielectric properties	X	X	X
	8.3.3.3	Mechanical operation and operational performance capability			
	8.3.3.3.1	General			
	8.3.3.3.2	Construction and mechanical operation	X	X	X
	8.3.3.3.3	Operational performance capability without current	X	X	X
	8.3.3.3.4	Operational performance capability with current	X	X	X
	8.3.3.3.5	Withdrawable circuit-breakers	X	X	X
	8.3.3.4	Overload performance	X	X	X
	8.3.3.5	Verification of dielectric withstand	X	X	X
	8.3.3.6	Verification of temperature-rise	X	X	X
	8.3.3.7	Verification of overload releases			
	8.3.3.8	Verification of undervoltage and shunt releases	X	X	X
	8.3.3.9	Verification of the main contact position	X	X	X
II	8.3.4	Rated service short-circuit breaking capacity			
III	8.3.5 ^b	Rated ultimate short-circuit breaking capacity	X	X	X
IV	8.3.6	Rated short-time withstand current	X 4th pole and adjacent pole only (see 8.3.2.6.4)	X 4th pole and adjacent pole only (see 8.3.2.6.4)	X 4th pole and adjacent pole only (see 8.3.2.6.4)
V	8.3.7	Performance of integrally fused circuit-breakers			
VI	8.3.8	Combined test sequence			

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

^a In the case of an electronic trip unit, these tests 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-pole variant is replaced by Sequence II or Sequence VI (see Table 9).

Table 9c – Applicability of tests or test sequences to 3-pole circuit-breakers in a given frame size and design when tested according to the alternative programme 2 of 8.3.1.4

Test sequence	Test clause	Test	Test or sequence of tests on 3-pole variant
I	8.3.3.1	Test of tripping limits and characteristics	
	8.3.3.1.1	General	
	8.3.3.1.2	Short-circuit releases	
	8.3.3.1.3 a) or 8.3.3.1.3 b) (as applicable)	Overload releases: – instantaneous/definite time-delay – inverse time-delay	
	8.3.3.1.4	Additional test for definite time-delay releases: – overload release – short-circuit releases	
	8.3.3.2	Dielectric properties	X
	8.3.3.3	Mechanical operation and operational performance capability	
	8.3.3.3.1	General	
	8.3.3.3.2	Construction and mechanical operation	
	8.3.3.3.3	Operational performance capability without current	X
	8.3.3.3.4	Operational performance capability with current	X
	8.3.3.3.5	Withdrawable circuit-breakers	
	8.3.3.4	Overload performance	X
8.3.3.5	Verification of dielectric withstand	X	
8.3.3.6	Verification of temperature-rise	X	
8.3.3.7	Verification of overload releases		
8.3.3.8	Verification of undervoltage and shunt releases		
8.3.3.9	Verification of the main contact position		
II	8.3.4	Rated service short-circuit breaking capacity	
III	8.3.5^b	Rated ultimate short-circuit breaking capacity	X
IV	8.3.6	Rated short-time withstand current	
V	8.3.7	Performance of integrally fused circuit-breakers	
VI	8.3.8	Combined test sequence	
NOTE The applicability of a test or test sequence is indicated by X in the relevant space.			
^a In the case of an electronic trip unit, these tests may be made on one pole chosen at random.			
^b This test sequence also applies when, for the 4-pole testing, Sequence III on the 4-pole variant is replaced by Sequence II or Sequence VI (see Table 9).			

8.3.2 General test conditions

Delete NOTE 1.

Renumber NOTE 2 as NOTE.

8.3.2.1 General requirements

Replace in the fifth paragraph the reference to Note 8 by Footnote g.

Replace the existing text of the eighth paragraph by the following:

Unless otherwise stated, the tests shall be made with the same kind of current and, in the case of a.c., at the same rated frequency and with the same number of phases as in the intended service. Tests performed at 50 Hz cover 60 Hz applications and vice-versa, except for the performance of under-voltage and shunt releases (see 7.2.2 and 7.2.2.6 of IEC 60947-1).

Replace in the 12th paragraph the reference to Note 1 by Footnote a.

Replace the existing Table 10 by the following new Table 10:

Table 10 – Number of samples for test

Test sequence	Number of marked U_e ratings			Terminals marked line/load		Number of samples	Sample No.	Current setting ^a		Test voltage	Test current		Temperature-rise verification	Foot-notes
	1	2	Mul.	Yes	No			Min.	Max.		Corr.	Max.		
I	X	X	X	X	X	1	1		X	U_e max	See 8.3.3		X	g
II (I_{cs}) and VI (combined)	X			X		2	1		X	U_e	X		X	h
							2	X		U_e	X			b
	X				X	3	1		X	U_e	X		X	h
							2	X		U_e	X			b
							3		X	U_e	X		X	j
		X		X	X	3	1		X	U_e max corr.		X	X	h
							2	X		U_e max corr.		X		b
							3		X	U_e max	X		X	k
			X	X	X	4	1		X	U_e max corr.		X	X	h
							2	X		U_e max corr.		X		b
						3		X	U_e intermed.	X		X	e	
						4		X	U_e max	X		X	k	
III (I_{cu})	X			X		2	1		X	U_e	X			g
							2	X		U_e	X			b
	X				X	3	1		X	U_e	X			g
							2	X		U_e	X			b
							3		X	U_e	X			c
		X		X	X	3	1		X	U_e max corr.		X		g
							2	X		U_e max corr.		X		b
							3		X	U_e max	X			d
			X	X	X	4	1		X	U_e max corr.		X		g
							2	X		U_e max corr.		X		b
						3		X	U_e intermed.	X			e	
						4		X	U_e max	X			d	

Test sequence	Number of marked I_{cw} ratings			Terminals marked line/load		Number of samples	Sample No.	Current setting ^a		Test voltage	Rated I_{cw}				Temperature-rise verification	Foot-notes
	1	2	Mul.	Yes	No			Min.	Max.		Test current		Time delay			
											Corr.	Max.	Corr.	Max.		
IV (I_{cw}) ¹	X			X	X	2	1		X	U_e max		X		X	g	
							2		X	U_e max		X		X	m	
			X	X	X	3	1		X	U_e max corr.		X	X		g	
							2		X	U_e max corr.	X		X		i	
						3		X	U_e max	X		X		m		