

INTERNATIONAL STANDARD

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Third edition
2003-04

Low-voltage switchgear and controlgear –

Part 2: Circuit-breakers

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International Electrotechnical Commission
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 2: Circuit-breakers

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
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International Standard IEC 60947-2 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This third edition of IEC 60947-2 cancels and replaces the second edition published in 1995, amendment 1 (1997) and amendment 2 (2001).

The document 17B/1269/FDIS, circulated to the National Committees as amendment 3, led to the publication of this new edition.

The text of this standard is based on the second edition, its amendments 1 and 2 and the following documents:

FDIS	Report on voting
17B/1269/FDIS	17B/1278/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 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 2: Circuit-breakers

1 General

The provisions of the general rules dealt with in IEC 60947-1 (hereinafter referred to as Part 1) are applicable to this standard, where specifically called for. Clauses and subclauses, tables, figures and appendices of the general rules thus applicable are identified by reference to Part 1, for example, 1.2.3 of Part 1, table 4 of Part 1, or annex A of Part 1.

1.1 Scope and object

This standard applies to circuit-breakers, the main contacts of which are intended to be connected to circuits, the rated voltage of which does not exceed 1 000 V a.c. or 1 500 V d.c.; it also contains additional requirements for integrally fused circuit-breakers.

It applies whatever the rated currents, the method of construction or the proposed applications of the circuit-breakers may be.

The requirements for circuit-breakers which are also intended to provide earth-leakage protection are contained in annex B.

The additional requirements for circuit-breakers with electronic over-current protection are contained in annex F.

The additional requirements for circuit-breakers for IT systems are contained in annex H.

The requirements and test methods for electromagnetic compatibility of circuit-breakers are contained in annex J.

The requirements for circuit-breakers not fulfilling the requirements for overcurrent protection are contained in annex L.

The requirements for modular residual current devices (without integral current breaking device) are contained in annex M.

The requirements and test methods for electromagnetic compatibility of circuit-breaker auxiliaries are contained in annex N.

Supplementary requirements for circuit-breakers used as direct-on-line starters are given in IEC 60947-4-1, applicable to low-voltage contactors and starters.

The requirements for circuit-breakers for the protection of wiring installations in buildings and similar applications, and designed for use by uninstructed persons, are contained in IEC 60898.

The requirements for circuit-breakers for equipment (for example electrical appliances) are contained in IEC 60934.

For certain specific applications (for example traction, rolling mills, marine service) particular or additional requirements may be necessary.

NOTE Circuit-breakers which are dealt with in this standard may be provided with devices for automatic opening under predetermined conditions other than those of over-current and undervoltage as, for example, reversal of power or current. This standard does not deal with the verification of operation under such pre-determined conditions.

The object of this standard is to state:

- a) the characteristics of circuit-breakers;
- b) the conditions with which circuit-breakers shall comply with reference to:
 - 1) operation and behaviour in normal service;
 - 2) operation and behaviour in case of overload and operation and behaviour in case of short-circuit, including co-ordination in service (discrimination and back-up protection);
 - 3) dielectric properties;
- c) tests intended for confirming that these conditions have been met and the methods to be adopted for these tests;
- d) information to be marked on or given with the apparatus

1.2 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 60050(441):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear and fuses*

IEC 60051 (all parts) *Direct acting indicating analogue electrical measuring instruments and their accessories*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests. Test N: Change of temperature*

IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12+12-hour cycle)*

IEC 60364 (all parts), *Electric installations of buildings*

IEC 60364-4-41:1982, *Electric installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against shock*

IEC 60695-2-10:2000, *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*

IEC 60695-2-12:2000, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability test method for materials*

IEC 60695-2-13:2000, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignitability test method for materials*

IEC 60755:1983, *General requirements for residual current operated protective devices*

IEC 60898, *Circuit-breakers for over-current protection for household and similar installations*

IEC 60934, *Circuit-breakers for equipment (CBE)*

IEC 60947-1:1999, *Low-voltage switchgear and controlgear – Part 1: General rules*
Amendment 1 (2000)
Amendment 2 (2001)

IEC 60947-4-1:2000, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 61000-3-2:2000, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-3-3:1994, *Electromagnetic compatibility (EMC) – Part 3: Limits – Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤ 16 A*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test*
Amendment 1 (1998)
Amendment 2 (2000)

IEC 61000-4-3:2002, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated radio-frequency electromagnetic field immunity test*
Amendment 1 (2002)

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test*
Amendment 1 (2000)
Amendment 2 (2001)

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*
Amendment 1 (2000)

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radiofrequency fields*
Amendment 1 (2000)

IEC 61000-4-11:1994, *Electromagnetic compatibility (EMC) – Part 4: Testing and measuring techniques – Section 11: Voltage dips, short interruptions and voltage variation immunity tests*
Amendment 1 (2000)

IEC 61000-5-2:1997, *Electromagnetic compatibility (EMC) – Part 5: Installation and mitigation guidelines – Section 2: Earthing and cabling*

IEC 61008-1:1990, *Residual current operated circuit-breakers without integral over-current protection for household and similar uses (RCCB's) – Part 1: General rules*

IEC 61009-1:1991, *Residual current operated circuit-breakers with integral over-current protection for household and similar uses (RCBO's) – Part 1: General rules*

CISPR 11:1997, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electro-magnetic disturbance characteristics – Limits and methods of measurement*
Amendment 1 (1999)

CISPR 22:1997, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

2 Definitions

For the majority of the definitions required in connection with this standard, see Clause 2 of Part 1.

For the purpose of this standard, the following additional definitions shall apply:

NOTE Where these definitions are taken unchanged from the *International Electrotechnical Vocabulary (IEV)*, IEC 60050(441), the IEV reference is given in brackets.

2.1

circuit-breaker

a mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short-circuit

[IEV 441-14-20]

2.1.1

frame size

a term designating a group of circuit-breakers, the external physical dimensions of which are common to a range of current ratings. Frame size is expressed in amperes corresponding to the highest current rating of the group. Within a frame size, the width may vary according to the number of poles

NOTE This definition does not imply dimensional standardization.

2.1.2

construction break

a significant difference in construction between circuit-breakers of a given frame size, requiring additional type testing (see 7.1.5)

2.2

integrally fused circuit-breaker

a combination, in a single device, of a circuit-breaker and fuses, one fuse being placed in series with each pole of the circuit-breaker intended to be connected to a phase conductor

[IEV 441-14-22]

2.3

current-limiting circuit-breaker

a circuit-breaker with a break-time short enough to prevent the short-circuit current reaching its otherwise attainable peak value

[IEV 441-14-21]

2.4**plug-in circuit-breaker**

a circuit-breaker which, in addition to its interrupting contacts, has a set of contacts which enable the circuit-breaker to be removed

NOTE Some circuit-breakers may be of the plug-in type on the line side only, the load terminals being usually suitable for wiring connection.

2.5**withdrawable circuit-breaker**

a circuit-breaker which, in addition to its interrupting contacts, has a set of isolating contacts which enable the circuit-breaker to be disconnected from the main circuit, in the withdrawn position, to achieve an isolating distance in accordance with specified requirements

2.6**moulded-case circuit-breaker**

a circuit-breaker having a supporting housing of moulded insulating material forming an integral part of the circuit-breaker

[IEV 441-14-24]

2.7**air circuit-breaker**

a circuit-breaker in which the contacts open and close in air at atmospheric pressure

[IEV 441-14-27]

2.8**vacuum circuit-breaker**

a circuit-breaker in which the contacts open and close within a highly evacuated envelope

[IEV 441-14-29]

2.9**gas circuit-breaker**

a circuit-breaker in which the contacts open and close in a gas other than air at atmospheric or higher pressure

2.10**making-current release**

a release which permits a circuit-breaker to open, without any intentional time-delay, during a closing operation, if the making current exceeds a predetermined value, and which is rendered inoperative when the circuit-breaker is in the closed position

2.11**short-circuit release**

an over-current release intended for protection against short circuits

2.12**short-time delay short-circuit release**

an over-current release intended to operate at the end of the short-time delay (see 2.5.26 of Part 1)

2.13**alarm switch**

an auxiliary switch which operates only upon the tripping of the circuit-breaker with which it is associated