

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



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

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

IEC 60947-2:2006

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ELECTROTECHNICAL  
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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 2: Circuit-breakers

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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.

The main changes introduced in this new edition are an amendment to the verification of dielectric properties, the improvement of EMC clauses in Annexes B, F, J and M, and the addition of a new Annex O regarding instantaneous trip circuit-breakers.

This consolidated version of IEC 60947-2 consists of the fourth edition (2006) [documents 17B/1455/FDIS and 17B/1463/RVD], its amendment 1 (2009) [documents 17B/1636/FDIS and 17B/1651/RVD] and its amendment 2 (2013) [documents 17B/1796/FDIS and 17B/1807/RVD].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 4.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The IEC 60947 series comprises the following parts under the general title *Low-voltage switchgear and controlgear*:

- Part 1: General rules
- Part 2: Circuit-breakers
- Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units
- Part 4: Contactors and motor-starters
- Part 5: Control circuit devices and switching elements
- Part 6: Multiple function equipment
- Part 7: Ancillary equipment
- Part 8: Control units for built-in thermal protection (PTC) for rotating electrical machines

The committee has decided that the contents of the base publication and its amendments 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

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## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 2: Circuit-breakers

#### 1 General

The provisions of the general rules dealt with in IEC 60947-1 are applicable to this standard, where specifically called for. Clauses and subclauses, tables, figures and annexes of the general rules thus applicable are identified by reference to IEC 60947-1, for example, 1.2.3 of IEC 60947-1, Table 4 of IEC 60947-1, or Annex A of IEC 60947-1.

##### 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 over-current 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 (selectivity 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*  
Amendment 1 (2000)

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*  
Amendment 1 (1986)

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

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

IEC 60417, *Graphical symbols for use on equipment*

IEC 60617, *Graphical symbols for diagrams*

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/TR 60755:1983, *General requirements for residual current operated protective devices*  
Amendment 1 (1988)  
Amendment 2 (1992)

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

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

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

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

Amendment 1 (2002)

Amendment 2 (2005)

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

Amendment 1 (2001)

Amendment 2 (2005)

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

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

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

IEC 61000-4-6:2003, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radiofrequency fields*

Amendment 1 (2004)

Amendment 2 (2006)

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

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

IEC 61008-1:1996, *Residual current operated circuit-breakers without integral over-current 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 over-current protection for household and similar uses (RCBOs) – Part 1: General rules*

Amendment 1 (2002)

Amendment 2 (2006)

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

CISPR 11:2003, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*  
Amendment 1 (2004)  
Amendment 2 (2006)

CISPR 22:2005, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*  
Amendment 1 (2005)  
Amendment 2 (2006)

## 2 Definitions

For the majority of the definitions required in connection with this standard, see Clause 2 of IEC 60947-1.

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

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.