

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Low-voltage switchgear and controlgear –  
Part 1: General rules**

**Appareillage à basse tension –  
Partie 1: Règles générales**



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**LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –****Part 1: General rules**

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International Standard IEC 60947-1 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This fifth edition of IEC 60947-1 cancels and replaces the fourth edition published in 2004. This edition incorporates Amendment 1 which was not published separately due to the number of changes and pages.

The main changes with respect to the previous edition are as follows:

- modification and restructuration of 7.1;
- introduction of new figures concerning EMC tests;
- introduction of new Annexes Q, R and S.

The text of this standard is based on the fourth edition and the following documents:

FDIS	Report on voting
17B/1550/FDIS	17B/1563/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.

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

A list of all the parts in the IEC 60947 series, under the general title *Low-voltage switchgear and controlgear* can be found on the IEC website.

The committee has decided that the contents of this 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- withdrawn,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.

## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 1: General rules

#### 1 General

The purpose of this standard is to harmonize as far as practicable all rules and requirements of a general nature applicable to low-voltage switchgear and controlgear in order to obtain uniformity of requirements and tests throughout the corresponding range of equipment and to avoid the need for testing to different standards.

All those parts of the various equipment standards which can be considered as general have therefore been gathered in this standard together with specific subjects of wide interest and application, e.g. temperature-rise, dielectric properties, etc.

For each type of low-voltage switchgear and controlgear, only two main documents are necessary to determine all requirements and tests:

- 1) this basic standard, referred to as "Part 1" in the specific standards covering the various types of low-voltage switchgear and controlgear;
- 2) the relevant equipment standard hereinafter referred to as the "relevant product standard" or "product standard".

For a general rule to apply to a specific product standard, it shall be explicitly referred to by the latter, by quoting the relevant clause or subclause number of this standard followed by "IEC 60947-1" e.g. "7.2.3 of IEC 60947-1".

A specific product standard may not require, and hence may omit, a general rule (as being not applicable), or it may add to it (if deemed inadequate in the particular case), but it may not deviate from it, unless there is a substantial technical justification.

NOTE The product standards due to be part of the series of IEC standards covering low-voltage switchgear and controlgear are:

60947-2: Part 2: Circuit-breakers

60947-3: Part 3: Switches, disconnectors, switch-disconnectors and fuse combination units

60947-4: Part 4: Contactors and motor-starters

60947-5: Part 5: Control-circuit devices and switching elements

60947-6: Part 6: Multiple function equipment

60947-7: Part 7: Ancillary equipment

#### 1.1 Scope and object

This standard applies, when required by the relevant product standard, to switchgear and controlgear hereinafter referred to as "equipment" and 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 does not apply to low-voltage switchgear and controlgear assemblies which are dealt with in IEC 60439.

NOTE In certain clauses or subclauses of this standard, the equipment covered by this standard is also referred to as "device", to be consistent with the text of such clauses or subclauses.

The object of this standard is to state those general rules and requirements which are common to low-voltage equipment as defined in 1.1, including for example:

- definitions;
- characteristics;
- information supplied with the equipment;
- normal service, mounting and transport conditions;
- constructional and performance requirements;
- verification of characteristics and performance.

Digital inputs and/or digital outputs contained in switchgear and controlgear, and intended to be compatible with programmable controllers (PLCs) are covered by Annex S.

## 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(151):2001, *International Electrotechnical Vocabulary (IEV) – Chapter 151: Electrical and magnetic devices*

IEC 60050(441):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear and fuses*  
Amendment 1 (2000)

IEC 60050(604):1987, *International Electrotechnical Vocabulary (IEV) – Chapter 604: Generation, transmission and distribution of electricity – Operation*  
Amendment 1 (1998)

IEC 60050(826):2004, *International Electrotechnical Vocabulary (IEV) – Chapter 826: Electrical installations*

IEC 60060, *High-voltage test techniques*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*  
Amendment 1 (1992)

IEC 60068-2-1:1990, *Environmental testing – Part 2-1: Tests – Tests A: Cold*  
Amendment 1 (1993)  
Amendment 2 (1994)

IEC 60068-2-2:1974, *Environmental testing – Part 2-2: Tests – Tests B: Dry heat*  
Amendment 1 (1993)  
Amendment 2 (1994)

IEC 60068-2-6:1995, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:1987, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

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

IEC 60068-2-52:1996, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60071-1:1993, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators*

IEC 60085:2004, *Electrical insulation – Thermal classification*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60216, *Guide for the determination of thermal endurance properties of electrical insulating materials*

IEC 60228:2004, *Conductors of insulated cables*

IEC 60269-1:1998, *Low-voltage fuses – Part 1: General requirements*  
Amendment 1 (2005)

IEC 60269-2:1986, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)*  
Amendment 1 (1995)  
Amendment 2 (2001)

IEC 60344:1980, *Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires*  
Amendment 1 (1985)

IEC 60364-4-44:2001, *Electrical installations of buildings – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*  
Amendment 1 (2003)

IEC 60417-DB:2002<sup>1</sup>, *Graphical symbols for use on equipment*

IEC 60439-1:1999, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*  
Amendment 1 (2004)

IEC 60445:1999, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals and of terminations of certain designated conductors, including general rules of an alphanumeric system*

IEC 60447:2004, *Basic and safety principles for man-machine interface, marking and identification – Actuating principles*

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<sup>1</sup> “DB” refers to the IEC on-line database.

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*  
Amendment 1 (1999)

IEC 60617-DB:2001<sup>1</sup>, *Graphical symbols for diagrams*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests* – Basic safety publication  
Amendment 1 (2000)  
Amendment 2 (2002)

IEC 60695-2-2:1991, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*  
Amendment 1 (1994)

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 60695-11-10:1999, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*  
Amendment 1 (2003)

IEC 60947-5-1:2003, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 60947-8:2003, *Low-voltage switchgear and controlgear – Part 8: Control units for built-in thermal protection (PTC) for rotating electrical machines*  
Amendment 1 (2006)

IEC 60981:2004, *Extra heavy-duty electrical rigid steel conduits*

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* – Basic EMC publication  
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 test 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 – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*

Amendment 1 (2004)

Amendment 2 (2006)

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test* – Basic EMC Publication  
Amendment 1 (2000)

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 61000-6-2:2005, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61131-2:2003, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*

Amendment 1 (2004)

IEC 61180 (all parts), *High-voltage test techniques for low voltage equipment*

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)

## 2 Definitions

NOTE 1 Most of the definitions listed in this clause are taken unchanged from the IECV (IEC 60050). When this is the case, the IECV reference is given in brackets with the title (the first group of 3 figures indicates the IECV chapter reference).

When an IECV definition is amended, the IECV reference is not indicated with the title, but in an explanatory note.

### *Alphabetical index of definitions*

NOTE 2 The alphabetical list of ratings, characteristics and symbols is given in Clause 4.

	Reference
A	
"a" contact .....	2.3.12
Actuating force (moment) .....	2.4.17
Actuating system (of a mechanical switching device) .....	2.3.16
Actuator .....	2.3.17
Ambient air temperature .....	2.1.9
Anti-pumping device .....	2.3.20
Applied voltage (for a switching device) .....	2.5.32
Arcing contact .....	2.3.8
Arcing time (of a multipole switching device) .....	2.5.41
Arcing time (of a pole or a fuse) .....	2.5.40
Automatic control .....	2.4.5
Auxiliary circuit (of a switching device) .....	2.3.4