

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



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

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



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Partie 2: Disjoncteurs**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 2: Circuit-breakers

FOREWORD

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DISCLAIMER

This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 60947-2 bears the edition number 5.1. It consists of the fifth edition (2016-06) [documents 121A/71/FDIS and 121A/83/RVD], its corrigendum (2016-11) and its amendment 1 (2019-07) [documents 121A/286/FDIS and 121A/302/RVD]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60947-2 has been prepared by subcommittee 121A: Low-voltage switchgear and controlgear, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low-voltage.

This fifth edition constitutes a technical revision.

This edition includes the following significant additions with respect to the previous edition:

- tests for verification of selectivity in Annex A (see A.5.3);
- critical load current tests for d.c. circuit-breakers (see 8.3.9);
- new Annex P for circuit-breakers for use in photovoltaic applications;
- new Annex R for residual-current circuit-breakers with automatic reclosing functions.

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

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

This International Standard is to be used in conjunction with IEC 60947-1:2007 and its Amendment 1:2010 and Amendment 2:2014.

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 and its amendments when applicable, for example, 1.2.3 of IEC 60947-1:2007, Table 4 of IEC 60947-1:2007/AMD1:2010, or Annex A of IEC 60947-1:2007/AMD1:2010/AMD2:2014.

The committee has decided that the contents of the base publication and its amendment 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 publication using a colour printer.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 2: Circuit-breakers

1 General

1.1 Scope and object

This part of IEC 60947 series applies to circuit-breakers, intended to be installed and operated by instructed or skilled persons, 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.

Circuit-breakers rated above 1 000 V a.c. but not exceeding 1 500 V a.c. may also be tested to this standard.

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.

The requirements and test methods for d.c. circuit-breakers for use in photovoltaic (PV) applications are contained in Annex P.

The requirements and test methods for circuit-breakers incorporating residual current protection with automatic reclosing functions are contained in Annex R.

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, *downstream of variable frequency drives, use in explosive atmospheres*) particular or additional requirements may be necessary.

NOTE Circuit-breakers which are dealt with in this standard can 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

IEC 60228, *Conductors of insulated cables*

IEC 60269-1:2006, *Low-voltage fuses – Part 1: General requirements*

~~IEC 60364 (all parts), Low-voltage electrical installations~~

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

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

IEC 60947-1:2007/AMD1:2010

IEC 60947-1:2007/AMD2:2014

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

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

~~IEC 61000-3-3, Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection~~

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

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

IEC 61000-4-3:2006/AMD1:2007

IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

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

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61545, *Connecting devices – Devices for the connection of aluminium conductors in clamping units of any material and copper conductors in aluminium bodied clamping units*

IEC 62475:2010, *High-current test techniques – Definitions and requirements for test currents and measuring systems*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 11:2015/AMD1:2016

~~CISPR 22, Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement~~

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

2 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60947-1, as well as the following apply.

NOTE Where these definitions are taken unchanged from the *International Electrotechnical Vocabulary (IEV)*, IEC 60050-441, the reference to this publication 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