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|---|---|---|

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

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 02/18

Obsahuje: EN 60947-2:2017, IEC 60947-2:2016, IEC 60947-2:2016/COR1:2016

Oznámením tejto normy sa od 13.10.2020 ruší
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**126137**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 60947-2

October 2017

ICS 29.130.20

Supersedes EN 60947-2:2006

English Version

# Low-voltage switchgear and controlgear - Part 2: Circuit-breakers (IEC 60947-2:2016 + COR1:2016)

Appareillage à basse tension - Partie 2: Disjoncteurs
(IEC 60947-2:2016 + COR1:2016)

Niederspannungsschaltgeräte - Teil 2: Leistungsschalter
(IEC 60947-2:2016 + COR1:2016)

This European Standard was approved by CENELEC on 2016-07-12. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**



Ref. No. EN 60947-2:2017 E

**EN 60947-2:2017**

## European foreword

The text of document 121A/71/FDIS, future edition 5 of IEC 60947-2, prepared by SC 121A “Low-voltage switchgear and controlgear” of IEC/TC 121 “Switchgear and controlgear and their assemblies for low voltage” was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60947-2:2017.

The following dates are fixed:

| | | |
|---|---|---|
| • latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2018-04-13 |
| • latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2020-10-13 |

This document supersedes EN 60947-2:2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives.

For the relationship with EU Directives and the standardization requests see informative Annex ZZA and Annex ZZB, which are integral parts of this document.

## Endorsement notice

The text of the International Standard IEC 60947-2:2016 + COR1:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

| | | |
|---|---|---|
| IEC 60051 Series | NOTE | Harmonized as EN 60051 Series. |
| IEC 60112 | NOTE | Harmonized as EN 60112. |
| IEC 60898 Series | NOTE | Harmonized as EN 60898 Series. |
| IEC 60934 | NOTE | Harmonized as EN 60934. |
| IEC 60947-3 | NOTE | Harmonized as EN 60947-3. |
| IEC 60947-5-1 | NOTE | Harmonized as EN 60947-5-1. |
| IEC 61000-4-13 | NOTE | Harmonized as EN 61000-4-13. |
| IEC 61008-1:2010 | NOTE | Harmonized as EN 61008-1:2012 (modified). |
| IEC 61008-1:2010/A1:2012 | NOTE | Harmonized as EN 61008-1:2012/A1:2014 (modified). |
| IEC 61008-1:2010/A2:2013 | NOTE | Harmonized as EN 61008-1:2012/A2:2014 (modified). |
| IEC 61009-1:2010 | NOTE | Harmonized as EN 61009-1:2012 (modified). |
| IEC 61009-1:2010/A1:2012 | NOTE | Harmonized as EN 61009-1:2012/A1:2014 (modified). |
| IEC 61009-1:2010/A2:2013 | NOTE | Harmonized as EN 61009-1:2012/A2:2014 (modified). |
| IEC 61131-1:2003 | NOTE | Harmonized as EN 61131-1:2003 (not modified). |
| IEC 61439 Series | NOTE | Harmonized as EN 61439 Series. |

# Annex ZA
(normative)

## Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 60068-2-14 | - | Environmental testing - Part 2-14: Tests - Test N: Change of temperature | EN 60068-2-14 | 2009 |
| IEC 60068-2-30 | - | Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) | EN 60068-2-30 | 2005 |
| IEC 60269-1 | 2006 | Low-voltage fuses - Part 1: General requirements | EN 60269-1 | 2007 |
| IEC 60364 | Series | Low-voltage electrical installations | HD 60364 | Series |
| IEC 60664-1 | 2007 | Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests | EN 60664-1 | 2007 |
| IEC 60947-1 | 2007 | Low-voltage switchgear and controlgear - Part 1: General rules | EN 60947-1 | 2007 |
| +A1 | 2010 | | +A1 | 2011 |
| +A2 | 2014 | | +A2 | 2014 |
| IEC 60947-4-1 | - | Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters | EN 60947-4-1 | 2010 |
| IEC 61000-3-2 | - | Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase) | EN 61000-3-2 | 2014 |
| 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 | EN 61000-3-3 | 2013 |
| IEC 61000-4-2 | - | Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test | EN 61000-4-2 | 2009 |

**EN 60947-2:2017**

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 61000-4-3 | 2006 | Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test | EN 61000-4-3 | 2006 |
| +A1 | 2007 | | +A1 | 2008 |
| +A2 | 2010 | | +A2 | 2010 |
| IEC 61000-4-4 | 2012 | Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test | EN 61000-4-4 | 2012 |
| IEC 61000-4-5 | 2014 | Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test | EN 61000-4-5 | 2014 |
| IEC 61000-4-6 | 2013 | Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields | EN 61000-4-6 | 2014 |
| IEC 61000-4-11 | - | Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests | EN 61000-4-11 | 2004 |
| IEC 61140 | - | Protection against electric shock - Common aspects for installation and equipment | EN 61140 | 2016 |
| IEC 62475 | 2010 | High-current test techniques - Definitions and requirements for test currents and measuring systems | EN 62475 | 2010 |
| CISPR 11 | - | Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement | EN 55011 | 2016 |
| CISPR 22 | - | Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement | EN 55022<br>+ AC | 2010 [1)]<br>2011 [1)] |

[1)] Superseded by EN 50561-1:2013.

# Annex ZZA
(informative)

## Relationship between this European standard and the essential requirements of Directive 2014/30/EU [2014 OJ L96] aimed to be covered and the standardisation request M/552

This European standard has been prepared under the European Commission standardisation request C(2016) 7641 final of 30.11.2016[1], ('M/552'), as regards harmonised standards in support of Directive 2014/30/EU relating to electromagnetic compatibility, to provide one voluntary means of conforming to essential requirements of Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

## Table ZZA.1 – Correspondence between this European standard and the Essential Requirements set out in Directive 2014/30/EU [2014 OJ L96]

| Essential requirements of Directive 2014/30/EU | Clause(s) / sub-clause(s) of this EN | Remarks / Notes |
|---|---|---|
| Annex I. 1(a) (electromagnetic disturbances) | 7.3, B.7.3, B.8.12.2, F.5, J.1, J.3, M.7.2.12, M.8.16.2, N.3, P.7.3 and no others. | |
| Annex I. 1(b) (electromagnetic immunity) | 7.3, B.7.3, B.8.12.1, F.2.2, F.3, F.4, J.1, J.2, M.7.2.12, M.8.16.1, N.1, N.2, P.7.3 and no others. | Full coverage of requirements for conducted and radiated disturbances in the range 150 kHz to 2,7 GHz |

**WARNING 1:** Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

**WARNING 2:** Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

[1] COMMISSION IMPLEMENTING DECISION C(2016) 7641 final of 30.11.2016 on a standardisation request to the European Committee for Standardisation, to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards harmonised standards in support of Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.

# Annex ZZB
(informative)

## Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered

This European Standard has been prepared under a Commission's standardization request relating to harmonized standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations.

**Table ZZB.1 – Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]**

| Safety objectives of Directive 2014/35/EU | Clause(s) / sub-clause(s) of this EN | Remarks/note |
|---|---|---|
| 1 a) | Foreword, 1.1, 4, 5, B.5, H.5, L.5, M.5, O.5, P.5, R.5 | |
| 1 b) | 5, L.5, M.5, O.4, P.5 | |
| 1 c) | 5.3 | |
| 2 a) | 5.2, 5.3, 7.1.3, 7.1.4, 7.2.3, 8.3, 8.4 | |
| 2 b) | 7.2.2, 7.3, 8.3.2, F.1, J.3 | |
| 2 c) | 5.3, 7.1, 7.1.2, 7.1.3, 7.1.5, 7.2.1, 7.3, 8.3.3 to 8.3.6, 8.4, 8.5, F.1, J.2, J.3 | |
| 2 d) | 5.2, 7.1.3, 7.1.4, 7.2.3, 8.3.2, F.2.2 | |
| 3 a) | 5.3, 7.1.2, 7.1.5, 7.2.1, 8.3.3 to 8.3.6, 8.4, 8.5 | |
| 3 b) | 7.3, F.1, J.3 | |
| 3 c) | 1.1, 7.2, 8.3 | |

**WARNING 1 —** Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

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IEC 60947-2

Edition 5.0 2016-06

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

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

## Appareillage à basse tension – Partie 2: Disjoncteurs

IEC 60947-2:2016-06(en-fr)

IEC 60947-2

Edition 5.0 2016-06

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

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

## Appareillage à basse tension – Partie 2: Disjoncteurs

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.130.20

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# CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

# Part 2: Circuit-breakers

## FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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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 cancels and replaces the fourth edition published in 2006, Amendment 1:2009 and Amendment 2:2013. This 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.

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

| FDIS | Report on voting |
|---|---|
| 121A/71/FDIS | 121A/83/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 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 this publication will remain unchanged until the stability date indicated on the IEC website 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, 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) 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 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, *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, *Protection against electric shock – Common aspects for installation and equipment*

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

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

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

## 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

[SOURCE: IEC 60050-441:1984, 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.

Note 1 to entry: Frame size is expressed in amperes corresponding to the highest current rating of the group.

Note 2 to entry: Within a frame size, the width may vary according to the number of poles.

Note 3 to entry: 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

**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

[SOURCE: IEC 60050-441:1984, 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 to entry: Reference may be made to either the symmetrical or asymmetrical prospective peak value of let-through current.

Note 2 to entry: The let-through current is also referred to as the cut-off current (see IEC 60050-441:1984, 441-17-12).

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

**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 1 to entry: 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**
circuit-breaker which, in addition to its interrupting contacts, has a set of isolating contacts which enable the circuit-breaker to be withdrawn from the main circuit, and, in the disconnected 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

[SOURCE: IEC 60050-441:1984, 441-14-24]

**2.7**
**air circuit-breaker**
a circuit-breaker in which the contacts open and close in air at atmospheric pressure

[SOURCE: IEC 60050-441:1984, 441-14-27]

**2.8**
**vacuum circuit-breaker**
a circuit-breaker in which the contacts open and close within a highly evacuated envelope

[SOURCE: IEC 60050-441:1984, 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

**2.13**
**alarm switch**
an auxiliary switch which operates only upon the tripping of the circuit-breaker with which it is associated

**2.14**
**circuit-breaker with lock-out device preventing closing**
a circuit-breaker in which each of the moving contacts is prevented from closing sufficiently to be capable of passing current if the closing command is initiated while specified conditions remain established

**2.15**
**short-circuit breaking (or making) capacity**
a breaking (or making) capacity for which the prescribed conditions include a short circuit

**2.15.1**
**ultimate short-circuit breaking capacity**
a breaking capacity for which the prescribed conditions according to a specified test sequence do not include the capability of the circuit-breaker to carry its rated current continuously

**2.15.2**
**service short-circuit breaking capacity**
a breaking capacity for which the prescribed conditions according to a specified test sequence include the capability of the circuit-breaker to carry its rated current continuously

**2.16**
**opening time**
interval of time between the specified instant of initiation of the opening operation and the instant when the arcing contacts have separated in all poles

Note 1 to entry:

– in the case of a directly operated circuit-breaker, the instant of initiation of the opening time is the instant of initiation of a current large enough to cause the circuit-breaker to operate;

– in the case of a circuit-breaker operated by any form of auxiliary power, the instant of initiation of the opening time is the instant of application or removal of the auxiliary power to the opening release.

Note 2 to entry: For circuit-breakers "opening time" is commonly referred to as "tripping time", although, strictly speaking, tripping time applies to the time between the instant of initiation of the opening time and the instant when the opening command becomes irreversible.

[SOURCE: IEC 60947-1:2007, 2.5.39, modified – addition of Notes to entry.]

**2.17**
**over-current protective co-ordination**

**2.17.1**
**over-current selectivity**
co-ordination of the operating characteristics of two or more over-current protective devices such that, on the incidence of over-currents within stated limits, the device intended to operate within these limits does so, while the other(s) does (do) not

**2.17.2**
**total selectivity**
over-current selectivity where, in the presence of two over-current protective devices in series, the protective device on the load side effects the protection without causing the other protective device to operate

**2.17.3**
**partial selectivity**
over-current selectivity where, in the presence of two over-current protective devices in series, the protective device on the load side effects the protection up to a given level of over-current, without causing the other protective device to operate

**2.17.4**
**selectivity limit current**
**$I_s$**
current co-ordinate of the intersection between the total time-current characteristic of the protective device on the load side and the pre-arcing (for fuses), or tripping (for circuit-breakers) time-current characteristic of the other protective device

Note 1 to entry: The selectivity limit current (see Figure A.1) is a limiting value of current:

– below which, in the presence of two over-current protective devices in series, the protective device on the load side completes its breaking operation in time to prevent the other protective device from starting its operation (i.e. selectivity is ensured);

– above which, in the presence of two over-current protective devices in series, the protective device on the load side may not complete its breaking operation in time to prevent the other protective device from starting its operation (i.e. selectivity is not ensured).

**2.17.5**
**take-over current**
**$I_B$**
current co-ordinate of the intersection between the maximum break time current characteristics of two over-current protective devices in series

Note 1 to entry: This applies to two over-current protective devices in series for operating times ≥ 0,05 s. For operating times < 0,05 s, the two over-current devices in series are considered as an association (see Annex A).

**2.18**
**$I^2t$ characteristic of a circuit-breaker**
information (usually a curve) giving the maximum values of $I^2t$ related to break time as a function of prospective current (r.m.s. symmetrical for a.c.) up to the maximum prospective current corresponding to the rated short-circuit breaking capacity and associated voltage

**2.19**
**resetting time**
time elapsed between a circuit-breaker tripping due to an overcurrent and subsequently reaching a condition where it can be reclosed

**2.20**
**rated instantaneous short-circuit current setting**
**$I_i$**
rated value of the current causing the operation of a release without any intentional time-delay

**2.21**
**overload current setting**
**$I_r$**
current setting of an adjustable overload release

Note 1 to entry: In case of a non-adjustable overload release, this value is equal to the rated current $I_n$.

**2.22**
**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

[SOURCE: IEC 61131-1:2003, 3.5, modified – deletion of the note.]