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Kopplingsapparater för högst 1000 V – Del 1: Allmänna fordringar

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

Som svensk standard gäller europastandarden EN IEC 60947-1:2021. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60947-1:2021.

Nationellt förord

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Tidigare fastställd svensk standard SS-EN 60947-1, utgåva 5, 2008, SS-EN 60947-1/A1, utgåva 1, 2011 och SS-EN 60947-1/A2, utgåva 1, 2014, gäller ej fr o m 2024-02-19.

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(IEC 60947-1:2020)

Niederspannungsschaltgeräte - Teil 1: Allgemeine
Festlegungen
(IEC 60947-1:2020)

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European foreword

The text of document 121A/337/FDIS, future edition 6 of IEC 60947-1, 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 IEC 60947-1:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2021-08-19 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2024-02-19 document have to be withdrawn

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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 Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 60947-1:2020 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 60034-12:2016	NOTE	Harmonized as EN 60034-12:2017 (not modified)
IEC 60068 (series)	NOTE	Harmonized as EN 60068 (series)
IEC 60079 (series)	NOTE	Harmonized as EN IEC 60079 (series)
IEC 60112	NOTE	Harmonized as EN IEC 60112
IEC 60364-4-44:2007	NOTE	Harmonized as HD 60364-4-444:2010 (modified)
IEC 60364-4-44:2007/A1:2015	NOTE	Harmonized as HD 60364-4-443:2016 (modified)
IEC 60664-3	NOTE	Harmonized as EN 60664-3
IEC 60695-11-5:2016	NOTE	Harmonized as EN 60695-11-5:2017 (not modified)
IEC 60721 (series)	NOTE	Harmonized as EN 60721 (series)
IEC 60721-3 (series)	NOTE	Harmonized as EN 60721-3 (series)
IEC 60721-3-0	NOTE	Harmonized as EN IEC 60721-3-0
IEC 60947 (series)	NOTE	Harmonized as EN IEC 60947 (series)

IEC 60947-3	NOTE	Harmonized as EN 60947-3
IEC 60947-4-1	NOTE	Harmonized as EN IEC 60947-4-1
IEC 60947-4-3	NOTE	Harmonized as EN 60947-4-3
IEC 60947-5-2	NOTE	Harmonized as EN IEC 60947-5-2
IEC 60947-5-3	NOTE	Harmonized as EN 60947-5-3
IEC 60947-5-5	NOTE	Harmonized as EN 60947-5-5
IEC 60947-5-7	NOTE	Harmonized as EN 60947-5-7
IEC 60947-6-1	NOTE	Harmonized as EN 60947-6-1
IEC 60947-6-2	NOTE	Harmonized as EN 60947-6-2
IEC 60947-7-1:2009	NOTE	Harmonized as EN 60947-7-1:2009 (not modified)
IEC 60998-2-2:2002	NOTE	Harmonized as EN 60998-2-2:2004 (modified)
IEC 61095	NOTE	Harmonized as EN 61095
IEC 61293	NOTE	Harmonized as EN IEC 61293
IEC 61439-1:2011	NOTE	Harmonized as EN 61439-1:2011 (not modified)
IEC 61508 (series)	NOTE	Harmonized as EN 61508 (series)
IEC 61508-3	NOTE	Harmonized as EN 61508-3
IEC 61508-6	NOTE	Harmonized as EN 61508-6
IEC 62075:2012	NOTE	Harmonized as EN 62075:2012 (not modified)
IEC 62208:2011	NOTE	Harmonized as EN 62208:2011 (not modified)
IEC 62430:2009	NOTE	Harmonized as EN 62430:2009 (not modified)
IEC 62443 (series)	NOTE	Harmonized as EN IEC 62443 (series)
IEC/IEEE 82079-1	NOTE	Harmonized as EN IEC/IEEE 82079-1
ISO 13715:2017	NOTE	Harmonized as EN ISO 13715:2019 (not modified)
ISO 14001:2015	NOTE	Harmonized as EN ISO 14001:2015 (not modified)
ISO 14020	NOTE	Harmonized as EN ISO 14020
ISO 14021	NOTE	Harmonized as EN ISO 14021
ISO 14024	NOTE	Harmonized as EN ISO 14024
ISO 14025	NOTE	Harmonized as EN ISO 14025
ISO 14040:2006	NOTE	Harmonized as EN ISO 14040:2006 (not modified)
ISO 14063	NOTE	Harmonized as EN ISO 14063
ISO 50001:2018	NOTE	Harmonized as EN ISO 50001:2018 (not modified)

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60038 (mod)	2009	IEC standard voltages	EN 60038	2011
IEC 60068-1	2013	Environmental testing - Part 1: General and guidance	EN 60068-1	2014
IEC 60068-2-1	2007	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	2007
IEC 60068-2-2	2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	2007
IEC 60068-2-6	2007	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	2009
IEC 60068-2-27	2008	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-30	2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60068-2-52	1996	Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)	EN 60068-2-52	1996
IEC 60068-2-78	2012	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2013
IEC 60073	2002	Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators	EN 60073	2002
IEC 60085	2007	Electrical insulation - Thermal evaluation and designation	EN 60085	2008
IEC 60092-504	2016	Electrical installations in ships - Part 504: - Automation, control and instrumentation	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60216-2	-	Electrical insulating materials - Thermal endurance properties - Part 2: Determination of thermal endurance properties of electrical insulating materials - Choice of test criteria	EN 60216-2	2005
IEC 60228	2004	Conductors of insulated cables	EN 60228	2005
-	-		+AC	2005
IEC 60269-1	2006	Low-voltage fuses - Part 1: General requirements	EN 60269-1	2007
+ A1	2009		+ A1	2009
+ A2	2014		+ A2	2014
IEC 60300-3-5	2001	Dependability management - Part 3-5: Application guide - Reliability test conditions and statistical test principles	-	-
IEC/TR 60344	2007	Calculation of d.c. resistance of plain and coated copper conductors of low-frequency cables and wires – Application guide	-	-
IEC 60417	-	Graphical symbols for use on equipment	-	-
IEC 60445	2017	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors	EN 60445	2017
IEC 60447	2004	Basic and safety principles for man-machine interface, marking and identification – Actuating principles	EN 60447	2004
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
+ A1	1999		+ A1	2000
+ A2	2013		+ A2	2013
-	-		+ AC	1993
-	-		+ AC	2016
IEC 60617	-	Graphical symbols for diagrams	-	-
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007
IEC 60695-2-10	2013	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2013
IEC 60695-2-11	2014	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products (GWEPT) (IEC 60695-2-11:2014)	EN 60695-2-11	2014

EN IEC 60947-1:2021 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60695-2-12	-	Fire hazard testing - Part 2-12: Glowing/hot-wire based test methods - Glow-wire flammability index (GWFI) test method for materials	EN 60695-2-12	2010
-	-		+ A1	2014
IEC 60695-11-10	2013	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	2013
-	-		+ AC	2014
IEC 60947-2	2016	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	EN 60947-2	2017
+ CORR1	2016		-	-
+A1	2019		-	-
IEC 60947-4-2	-	Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters - AC semiconductor motor controllers and starters	EN 60947-4-2	2012
IEC 60947-5	all parts	Low-voltage switchgear and controlgear - Control circuit devices and switching elements	EN 60947-5	series
IEC 60947-5-1	-	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices	EN 60947-5-1	2017
IEC 60947-8	-	Low-voltage switchgear and controlgear - Part 8: Control units for built-in thermal protection (PTC) for rotating electrical machines	EN 60947-8	2003
-	-		+ A1	2006
-	-		+ A2	2012
IEC 60981	2019	Extra heavy-duty electrical rigid steel conduits	-	-
IEC 60999-1	1999	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm ² up to 35 mm ² (included)	EN 60999-1	2000
IEC 60999-2	2003	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 2: Particular requirements for clamping units for conductors above 35 mm ² up to 300 mm ² (included)	EN 60999-2	2003
IEC 61000-4-2	2008	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009

Publication	Year	Title	EN/HD	Year
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	2006
-	-		+ A1	2008
-	-		+ A2	2010
IEC 61000-4-4	-	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	-	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	2014
-	-		+ A1	2017
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	2014
-	-		+ AC	2015
IEC 61000-4-8	-	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8	2010
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
-	-		+ A1	2017
IEC 61000-4-34	-	Electromagnetic compatibility (EMC) - Part 4-34: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase	EN 61000-4-34	2007
			+ A1	2009
IEC 61000-6-2	2016	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments	EN IEC 61000-6-2	2019
IEC 61000-6-5	-	Electromagnetic compatibility (EMC) - Part 6-5: Generic standards - Immunity for equipment used in power station and substation environment	EN 61000-6-5	2015
-	-		+ AC	2018
IEC 61131-2	2017	Programmable controllers - Part 2: Equipment requirements and tests	EN 61131-2	2007
IEC 61140	2016	Protection against electric shock - Common aspects for installation and equipment	EN 61140	2016

EN IEC 60947-1:2021 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61180	2016	High-voltage test techniques for low-voltage equipment - Definitions, test and procedure requirements, test equipment	EN 61180	2016
IEC 61439	all parts	Low-voltage switchgear and controlgear assemblies	EN 61439	series
IEC 61508	all parts	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	series
IEC 61557-2	-	Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 2: Insulation resistance	EN 61557-2	2007
IEC 61649	2008	Weibull analysis	EN 61649	2008
IEC 62061	2005	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems	EN 62061	2005
+ A1	2012		+ A1	2013
+ A2	2015		+ A2	2016
IEC 62474	2018	Material declaration for products of and for the electrotechnical industry	EN IEC 62474	2019
CISPR 11 (mod)	-	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	2016
			+ A1	2017
CISPR 32	-	Electromagnetic compatibility of multimedia equipment - Emission Requirements	EN 55032	2015
-	-		+ AC	2016
ISO 3864-2	2016 ¹	Graphical symbols - Safety colours and safety signs - Part 2: Design principles for product safety labels	-	-
ISO 7000	2019	Graphical symbols for use on equipment -- Registered symbols	-	-
ISO 13849-1	2015	Safety of machinery -- Safety-related parts of control systems -- Part 1: General principles for design	-	-

¹ Dated, as no equivalent European Standard exists.

CONTENTS

FOREWORD	13
INTRODUCTION	16
1 Scope	17
2 Normative references	17
3 Terms, definitions, symbols and reference clauses	21
3.1 General	21
3.2 Alphabetical index of definitions	21
3.3 General terms and definitions	26
3.4 Switching devices	30
3.5 Parts of switching devices	33
3.6 Operation of switching devices	39
3.7 Characteristic quantities	44
3.8 Tests	54
3.9 Ports	54
3.10 Symbols and references clauses for characteristics described in this document	54
4 Classification	55
5 Characteristics	55
5.1 Summary of the characteristics	55
5.2 Type of equipment	56
5.3 Rated and limiting values for the main circuit	56
5.3.1 Rated voltages	56
5.3.2 Currents	57
5.3.3 Rated frequency	58
5.3.4 Rated duties	58
5.3.5 Characteristics under normal load and overload conditions (see 8.2.4)	60
5.3.6 Short-circuit characteristics	61
5.3.7 Pole impedance of the switching device (Z)	62
5.4 Utilization category	62
5.5 Control circuits	62
5.5.1 Electrically or electronically controlled circuits	62
5.5.2 Air-supply control circuits (pneumatic or electro-pneumatic)	63
5.6 Auxiliary circuits	63
5.7 Relays and releases	63
5.8 Co-ordination with short-circuit protective devices (SCPD)	63
6 Product information	63
6.1 Nature of information	63
6.2 Marking	64
6.3 Instructions for installation, operation and maintenance, decommissioning and dismantling	65
6.4 Environmental information	66
7 Normal service, mounting and transport conditions	66
7.1 Normal service conditions	66
7.1.1 Ambient air temperature	66
7.1.2 Altitude	67
7.1.3 Atmospheric conditions	67

7.1.4	Shock and vibration	68
7.2	Conditions during transport and storage.....	68
7.3	Mounting.....	68
8	Constructional and performance requirements	68
8.1	Constructional requirements	68
8.1.1	General	68
8.1.2	Materials	69
8.1.3	Current-carrying parts and their connections	70
8.1.4	Clearances and creepage distances	70
8.1.5	Actuator.....	70
8.1.6	Indication of the contact position	71
8.1.7	Additional requirements for equipment suitable for isolation.....	71
8.1.8	Terminals	73
8.1.9	Additional requirements for equipment provided with a neutral pole	74
8.1.10	Provisions for protective earthing.....	74
8.1.11	Dedicated enclosures for equipment.....	76
8.1.12	Degrees of protection of enclosed equipment	76
8.1.13	Conduit pull-out, torque and bending with metallic conduits	76
8.2	Performance requirements	77
8.2.1	Operating conditions.....	77
8.2.2	Temperature-rise	78
8.2.3	Dielectric properties.....	79
8.2.4	Ability to make, carry and break currents under no-load, normal load and overload conditions.....	82
8.2.5	Ability to make, carry and break short-circuit currents.....	83
8.2.6	Pole impedance	83
8.2.7	Leakage currents of equipment suitable for isolation.....	84
8.3	Electromagnetic compatibility (EMC).....	84
8.3.1	General	84
8.3.2	Immunity.....	84
8.3.3	Emission.....	85
9	Tests	85
9.1	Kinds of test.....	85
9.1.1	General	85
9.1.2	Type tests.....	85
9.1.3	Routine tests	86
9.1.4	Sampling tests.....	86
9.1.5	Special tests.....	86
9.2	Compliance with constructional requirements.....	87
9.2.1	General	87
9.2.2	Test of materials to abnormal heat and fire	87
9.2.3	Equipment	87
9.2.4	Enclosures for equipment	87
9.2.5	Mechanical and electrical properties of terminals.....	88
9.2.6	Verification of the effectiveness of indication of the main contact position of equipment suitable for isolation	90
9.2.7	Vacant.....	93
9.2.8	Conduit pull-out test, torque test and bending test with metallic conduits	93
9.2.9	Test of earth continuity for protective earth.....	94

9.3	Performance	94
9.3.1	Test sequences	94
9.3.2	General test conditions	94
9.3.3	Performance under no-load, normal load and overload conditions	96
9.3.4	Performance under short-circuit conditions	109
9.4	Tests for EMC	114
9.4.1	General	114
9.4.2	Immunity	114
9.4.3	Emission	115
Annex A (informative) Harmonisation of utilization categories for low-voltage switchgear and controlgear		146
Annex B (Vacant)		149
Annex C (normative) Degrees of protection of enclosed equipment		150
C.1	General	150
C.2	Object	150
C.3	Definitions	150
C.4	Designation	150
C.5	Degrees of protection against access to hazardous parts and against ingress of solid foreign objects indicated by the first characteristic numeral	150
C.6	Degrees of protection against ingress of water indicated by the second characteristic numeral	150
C.7	Degrees of protection against access to hazardous parts indicated by the additional letter	151
C.8	Supplementary letters	151
C.9	Examples of designations with IP Code	151
C.10	Marking	151
C.11	General requirements for tests	151
C.12	Tests for protection against access to hazardous parts indicated by the first characteristic numeral	152
C.13	Tests for protection against ingress of solid foreign objects indicated by the first characteristic numeral	152
C.14	Tests for protection against water indicated by second characteristic numeral	153
C.14.1	Test means	153
C.14.2	Test conditions	153
C.14.3	Acceptance conditions	153
C.15	Tests for protection against access to hazardous parts indicated by additional letter	153
C.16	Summary of responsibilities of relevant technical committees	153
Annex D (informative) Examples of clamping units and relationship between clamping unit and connecting device		157
D.1	Clamping unit in a connecting device	157
D.2	Examples of clamping units	158
Annex E (informative) Description of a method for adjusting the load circuit		165
Annex F (informative) Determination of short-circuit power-factor or time-constant		167
F.1	Determination of short-circuit power-factor	167
F.1.1	Method I – Determination from DC component	167
F.1.2	Method II – Determination with pilot generator	167
F.2	Determination of short-circuit time-constant (oscillographic method)	168
Annex G (informative) Measurement of creepage distances and clearances		169

G.1	Basic principles.....	169
G.2	Use of ribs	169
Annex H (informative)	Correlation between the nominal voltage of the supply system and the rated impulse withstand voltage of equipment	176
Annex J (informative)	Items subject to agreement between manufacturer and user.....	178
Annex K (normative)	Procedure to determine reliability data for electromechanical devices used in functional safety applications	179
K.1	General.....	179
K.1.1	Overview	179
K.1.2	Object.....	179
K.1.3	General requirements	179
K.2	Terms, definitions and symbols	180
K.2.1	Terms and definitions	180
K.2.2	Symbols	181
K.3	Method based on durability test results	181
K.3.1	General method.....	181
K.3.2	Test requirements.....	181
K.3.3	Number of samples.....	181
K.3.4	Characterization of a failure mode	181
K.3.5	Weibull modelling	182
K.3.6	Useful life and upper limit of failure rate.....	184
K.3.7	Reliability data.....	185
K.4	Data information	185
K.5	Example.....	186
K.5.1	Test results.....	186
K.5.2	Weibull distribution and median rank regression	186
K.5.3	Useful life and failure rate.....	187
Annex L (normative)	Terminal marking and distinctive number	189
L.1	General.....	189
L.2	Terminal marking of impedances (alphanumeric).....	189
L.2.1	Coils	189
L.2.2	Electromagnetic releases.....	190
L.2.3	Interlocking electromagnets	190
L.2.4	Indicating light devices	191
L.3	Terminal marking of contact elements for switching devices with two positions (numerical).....	191
L.3.1	Contact elements for main circuits (main contact elements).....	191
L.3.2	Contact elements for auxiliary circuit (auxiliary contact elements).....	191
L.4	Terminal marking of overload protection devices.....	193
L.5	Distinctive number	194
L.6	Marking of terminals for external associated electronic circuit components, contacts and complete devices	194
L.6.1	Marking of terminals for external associated electronic circuit components and contacts	194
L.6.2	Marking of terminals for external complete devices.....	197
Annex M (normative)	Flammability test	200
M.1	Hot wire ignition test (HWI)	200
M.1.1	Test sample.....	200
M.1.2	Description of test apparatus	200

M.1.3	Conditioning	201
M.1.4	Test procedure	201
M.2	Arc ignition test (AI)	201
M.2.1	Test sample	201
M.2.2	Description of test apparatus	201
M.2.3	Conditioning	202
M.2.4	Test procedure	202
M.3	HWI and AI requirements	203
Annex N (normative)	Requirements and tests for equipment with protective separation	204
N.1	General	204
N.2	Terms and definitions	204
N.3	Requirements	206
N.3.1	General	206
N.3.2	Dielectric requirements	206
N.3.3	Construction requirements	206
N.4	Tests	207
N.4.1	General	207
N.4.2	Dielectric tests	207
N.4.3	Examples of constructional measures	207
Annex O (informative)	Environmentally conscious design	209
O.1	General	209
O.2	Object	209
O.3	Terms and definitions	210
O.4	General considerations	212
O.5	Fundamentals requirements of environmentally conscious design (ECD)	215
O.6	Environmentally conscious design process (ECD process)	216
O.6.1	General	216
O.6.2	Process steps of ECD	216
O.7	Tools for including ECD in product design and development	217
O.8	Relevant ISO technical committees	217
Annex P (informative)	Terminal lugs for low voltage switchgear and controlgear connected to copper conductors	218
Annex Q (normative)	Special tests – Tests for environmental categories	219
Q.1	General	219
Q.2	Classification of equipment	219
Q.3	Tests	220
Q.3.1	General test conditions	220
Q.3.2	Test sequences	220
Annex R (normative)	Application of the metal foil for dielectric testing on accessible parts during operation or adjustment	225
R.1	General	225
R.2	Object	225
R.3	Definition of zones	226
R.3.1	General	226
R.3.2	Application of metal foil on accessible parts during normal operation or adjustment	226
Annex S (normative)	Digital inputs and outputs	233
S.1	General	233
S.2	Terms and definitions	233

S.3	Functional requirements.....	233
S.3.1	Rated values and operating ranges	233
S.3.2	Digital I/Os	234
S.4	Verification of input/output requirements	242
S.4.1	General	242
S.4.2	Verification of digital inputs.....	243
S.4.3	Verification of digital outputs.....	243
S.4.4	Behaviour of the equipment	244
S.5	General information to be provided by the manufacturer	245
S.5.1	Information on digital inputs (current sinking).....	245
S.5.2	Information on digital outputs for alternating currents (current sourcing)	245
S.5.3	Information on digital outputs for direct current (current sourcing).....	246
S.6	Digital input standard operating range equations.....	246
Annex T (normative)	Extended functions within electronic overload relays	248
T.1	Object.....	248
T.1.1	General	248
T.1.2	Ground/earth fault detection function	248
T.2	Terms and definitions.....	248
T.3	Classification of electronic overload relays.....	249
T.4	Types of relays with ground/earth fault detection function	249
T.5	Performance requirements	249
T.5.1	Limits of operation of ground/earth fault electronic overload relays	249
T.5.2	Limits of operation of ground/earth fault current sensing electronic relays Type CII(-A and -B)	250
T.5.3	Limits of operation of voltage asymmetry relays.....	250
T.5.4	Limits of operation of phase reversal relays	250
T.5.5	Limits of operation of current imbalance relays	250
T.5.6	Limits of operation of over-voltage relays and releases.....	250
T.6	Tests	251
T.6.1	Limits of operation of ground/earth fault current sensing electronic relays Types CI and CII (-A and -B)	251
T.6.2	Verification of inhibit function of ground/earth fault current sensing electronic relays Type CII (-A and -B)	251
T.6.3	Current asymmetry relays.....	251
T.6.4	Voltage asymmetry relays.....	251
T.6.5	Phase reversal relays	251
T.6.6	Over-voltage relays	252
T.7	Routine and sampling tests	252
Annex U (informative)	Examples of control circuit configurations	253
U.1	External control device.....	253
U.1.1	Definition	253
U.1.2	Diagrammatic representation of an external control device	253
U.1.3	Parameters of an external control device	253
U.2	Control circuit configurations.....	254
U.2.1	Equipment with external control supply	254
U.2.2	Equipment with several external control supplies	254
U.2.3	Equipment with bus interface (may be combined with other circuit configurations).....	255
Annex V (informative)	Power management with switchgear and controlgear for electrical energy efficiency.....	256

V.1	General.....	256
V.2	Object.....	256
V.3	Terms and definitions.....	256
V.4	Electrical energy efficiency and safety	257
V.5	Principles on electrical energy efficiency (system approach).....	257
V.5.1	General	257
V.5.2	Strategy of energy management	257
V.5.3	Power management with automation and control	257
V.6	Energy efficiency application.....	258
V.6.1	Saving of semiconductor losses.....	258
V.6.2	Power factor correction.....	258
V.6.3	Load shedding.....	258
V.6.4	Motor control for fixed speed applications.....	258
Annex W	(normative) Procedure to establish material declaration	259
W.1	General.....	259
W.2	Object.....	259
W.3	Reference document.....	259
W.4	Terms and definitions.....	259
W.5	Material declaration requirements	260
W.5.1	General reporting requirements	260
W.5.2	Additional reporting requirements	261
W.6	Example of material declaration made according to W.5	261
Annex X	(normative) Co-ordination between circuit-breaker or CPS and another short-circuit protective device associated in the same circuit	267
X.1	General.....	267
X.2	Object.....	267
X.3	General requirements for the co-ordination of a circuit-breaker or CPS with another SCPD.....	268
X.3.1	General considerations	268
X.3.2	Take-over current (I_B)	268
X.3.3	Behaviour of C_1 in association with another SCPD	268
X.4	Type and characteristics of the associated SCPD	268
X.5	Verification of selectivity	269
X.5.1	General	269
X.5.2	Consideration of selectivity by desk study.....	269
X.5.3	Selectivity determined by test.....	270
X.6	Verification of back-up protection.....	271
X.6.1	Determination of the take-over current.....	271
X.6.2	Verification of back-up protection.....	271
X.6.3	Tests for verification of back-up protection	271
X.6.4	Results to be obtained	272
Bibliography	278
Figure 1	– Test equipment for flexion test (see 9.2.5.3 and Table 5)	131
Figure 2	– Gauges of form A and form B (see 9.2.5.5.2 and Table 7).....	131
Figure 3	– Diagram of the test circuit for the verification of making and breaking capacities of a single-pole equipment on single-phase AC or on direct current (see 9.3.3.5.2).....	132

Figure 4 – Diagram of the test circuit for the verification of making and breaking capacities of a two-pole equipment on single-phase AC or on direct current (see 9.3.3.5.2)	133
Figure 5 – Diagram of the test circuit for the verification of making and breaking capacities of a three-pole equipment (see 9.3.3.5.2)	134
Figure 6 – Diagram of the test circuit for the verification of making and breaking capacities of a four-pole equipment (see 9.3.3.5.2)	135
Figure 7 – Schematic illustration of the recovery voltage across contacts of the first phase to clear under ideal conditions (see 9.3.3.5.2, item e)).....	136
Figure 8 – Diagram of a load circuit adjustment method	137
Figure 9 – Diagram of the test circuit for the verification of short-circuit making and breaking capacities of a single-pole equipment on single-phase AC or on direct current (see 9.3.4.1.2)	138
Figure 10 – Diagram of the test circuit for the verification of short-circuit making and breaking capacities of a two-pole equipment on single-phase AC or on direct current (see 9.3.4.1.2)	139
Figure 11 – Diagram of the test circuit for the verification of short-circuit making and breaking capacities of a three-pole equipment (see 9.3.4.1.2).....	140
Figure 12 – Diagram of the test circuit for the verification of short-circuit making and breaking capacities of a four-pole equipment (see 9.3.4.1.2)	141
Figure 13 – Example of short-circuit making and breaking test record in the case of a single-pole equipment on single-phase AC (see 9.3.4.1.8).....	142
Figure 14 – Verification of short-circuit making and breaking capacities on direct current (see 9.3.4.1.8)	143
Figure 15 – Determination of the prospective breaking current when the first calibration of the test circuit has been made at a current lower than the rated breaking capacity (see 9.3.4.1.8, item b)).....	144
Figure 16 – Actuator test force (see 9.2.6.2.1 and Table 17)	145
Figure D.1 – Clamping unit in a connecting device	157
Figure D.2 – Screw clamping units	158
Figure D.3 – Pillar clamping units	159
Figure D.4 – Stud clamping units	160
Figure D.5 – Saddle clamping units.....	161
Figure D.6 – Lug clamping units.....	162
Figure D.7 – Mantle clamping units	163
Figure D.8 – Screwless-type clamping units (sketches).....	164
Figure E.1 – Determination of the actual value of the factor γ	166
Figure G.1 – Measurement of ribs	170
Figure G.2 – Creepage distance across the fixed and moving insulation of contact carriers	170
Figure G.3 – Example 1	171
Figure G.4 – Example 2	171
Figure G.5 – Example 3	171
Figure G.6 – Example 4	172
Figure G.7 – Example 5	172
Figure G.8 – Example 6	172
Figure G.9 – Example 7	173
Figure G.10 – Example 8	173

Figure G.11 – Example 9	174
Figure G.12 – Example 10	174
Figure G.13 – Example 11	175
Figure K.1 – Plot of Weibull median rank regression	188
Figure M.1 – Test fixture for hot wire ignition test.....	200
Figure M.2 – Circuit for arc ignition test	202
Figure N.1 – Example of application with component connected between separated circuits	208
Figure O.1 – Conceptual relationship between provisions in product standards and the environmental impacts associated with the product during its life cycle	214
Figure O.2 – Overview of ECD process	215
Figure P.1 – Dimensions	218
Figure R.1 – Operating mechanism outside the enclosure.....	227
Figure R.2 – Application of the metallic foil to operating areas around switch actuator	228
Figure R.3 – Example of finger protected location for hazardous-live-parts in push-button vicinity	229
Figure R.4 – Example I of application of the foil	229
Figure R.5 – Example II of application of the foil	230
Figure R.6 – Example III of application of the foil	230
Figure R.7 – Application of metal foil on holes and grooves	231
Figure R.8 – Operating space for actuation by rotary means	232
Figure S.1 – I/O parameters.....	235
Figure S.2 – <i>U-I</i> operation regions of current-sinking inputs.....	236
Figure S.3 – Temporary overload waveform for digital AC outputs	239
Figure S.4 – Temporary overload waveform for digital DC outputs	242
Figure T.1 – Test circuit for the verification of the operating characteristic of a ground/earth fault current sensing electronic relay	252
Figure U.1 – Diagrammatic representation of an external control device	253
Figure U.2 – Single supply and control input	254
Figure U.3 – Separate supply and control inputs	254
Figure U.4 – Equipment with several external control supplies	254
Figure U.5 – Equipment with bus interface	255
Figure W.1 – Example of Main and Business information, graphical representation of the XML code.....	263
Figure W.2 – Example of product information, graphical representation of the XML code	264
Figure W.3 – Example of declarable substances information, graphical representation of the XML code.....	265
Figure W.4 – Example of material classes information, graphical representation of the XML code	266
Figure X.1 – Overcurrent co-ordination between a circuit-breaker or CPS and a fuse or back-up protection by a fuse: operating characteristics	273
Figure X.2 – Total selectivity between two circuit-breakers or a circuit-breaker and a CPS	274
Figure X.3 – Back-up protection by a circuit-breaker or CPS – Operating characteristics	275

Figure X.4 – Example of test circuit for conditional short-circuit breaking capacity tests showing cable connections for a 3-pole circuit-breaker or CPS (C ₁)	276
Figure X.5 – Example of test circuit for the verification of selectivity	277
Table 1 – Nominal cross-sections of round copper conductors and approximate relationship between mm ² and AWG/kcmil sizes (see 8.1.8.2)	116
Table 2 – Temperature-rise limits of terminals (see 8.2.2.2 and 9.3.3.3.4)	117
Table 3 – Temperature-rise limits of accessible parts (see 8.2.2.3 and 9.3.3.3.4).....	117
Table 4 – Tightening torques for the verification of the mechanical strength of screw-type terminals (see 9.2.5.2 and 9.3.2.1)	118
Table 5 – Test values for flexion and pull-out tests for round copper conductors (see 9.2.5.4.1)	119
Table 6 – Test values for pull-out test for flat copper conductors (see 9.2.5.4.2)	119
Table 7 – Maximum conductor cross-sections and corresponding gauges (see 9.2.5.5.1)	120
Table 8 – Relationship between conductor cross-section and diameter	121
Table 9 – Test copper conductors for test currents up to 400 A inclusive (see 9.3.3.3.4).....	122
Table 10 – Test copper conductors for test currents above 400 A and up to 800 A inclusive (see 9.3.3.3.4)	123
Table 11 – Test copper bars for test currents above 400 A and up to 3 150 A inclusive (see 9.3.3.3.4)	123
Table 12 – Impulse withstand test voltages	124
Table 13 – Minimum clearances in air	124
Table 14 – Test voltages across the open contacts of equipment suitable for isolation	125
Table 15 – Minimum creepage distances	125
Table 16 – Values of power-factors and time-constants corresponding to test currents, and ratio <i>n</i> between peak and RMS values of current (see 9.3.4.3, item a)).....	126
Table 17 – Actuator test force (see 9.2.6.2.1)	127
Table 18 – Tolerances on test quantities (see 9.3.4.3, item a))	127
Table 19 – Dielectric test voltage corresponding to the rated insulation voltage	127
Table 20 – Test values for conduit pull-out test (see 9.2.8.2)	128
Table 21 – Test values for conduit bending test (see 9.2.8.3).....	128
Table 22 – Test values for conduit torque test (see 9.2.8.2 and 9.2.8.4)	128
Table 23 – Tests for EMC – Immunity (see 9.4.1).....	129
Table 24 – Acceptance criteria when EM disturbances are present	130
Table 25 – Cross-sectional area of a copper protective conductor.....	130
Table A.1 – Utilization categories used in the IEC 60947 series	146
Table C.1 – IP Codes (1 of 3)	154
Table G.1 – Minimum widths of grooves.....	169
Table H.1 – Correspondence between the nominal voltage of the supply system and the equipment rated impulse withstand voltage, in case of overvoltage protection by surge-arresters according to IEC 60099-1	177
Table K.1 – Failure modes of devices	182
Table K.2 – Example of 15 sorted ascending times to failure of contactors	186
Table K.3 – Example median rank calculation	187

Table M.1 – HWI and AI characteristics for materials necessary to retain current carrying parts in position.....	203
Table M.2 – HWI and AI characteristics for materials other than those covered by Table M.1	203
Table P.1 – Examples of terminal lugs for low voltage switchgear and controlgear connected to copper conductors	218
Table Q.1 – Test sequences (1 of 4)	221
Table S.1 – Rated values and operating ranges of incoming power supply.....	234
Table S.2 – Standard operating ranges for digital inputs (current sinking)	237
Table S.3 – Rated values and operating ranges for current sourcing digital AC outputs	238
Table S.4 – Rated values and operating ranges (direct current) for current-sourcing digital DC outputs	241
Table S.5 – Overload and short-circuit tests for digital outputs.....	244
Table T.1 – Tripping time of ground/earth fault electronic overload relays	249
Table W.1 – Example of main and business information in tabular form	262
Table W.2 – Example of product information in tabular form.....	263
Table W.3 – Example of declarable substances information in tabular form	264
Table W.4 – Example of material classes information in tabular form	266

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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 60947-1 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 sixth edition cancels and replaces the fifth edition published in 2007, Amendment 1:2010 and Amendment 2:2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- DC values testing improvement;
- update of EMC tests;
- Annex B deletion;
- update of requirements for environmental tests (Table Q.1);
- improvement of Annex R (new examples);

- deletion of digital input Type 2, and introduction of Type 3 in Annex S;
- example for materials declaration (Annex W);
- new Annex X (co-ordination between short-circuit protective devices associated in the same circuit) created.

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

FDIS	Report on voting
121A/337/FDIS	121A/344/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 the parts in the IEC 60947 series, under the general title *Low-voltage switchgear and controlgear*, can be found on the IEC website.

The following differing practices of a less permanent nature exist in the countries indicated below.

5.3.6.4 Rated conditional short-circuit current (I_q , alternatively I_{cc}) (North America)

6.2 Marking (USA and Canada)

8.1.3 Current-carrying parts and their connections (USA)

8.1.7.1 Additional constructional requirements (USA)

8.1.10.1 (North America)

9.2.6.2.2 Dependent power operation (USA)

9.2.6.2.3 Independent power operation (Canada and USA)

Figure 4 (USA and Canada)

Figure 5 (USA and Canada)

Figure 10 (USA and Canada)

Figure 11 (USA and Canada)

Figure X.4 (USA and Canada)

Figure X.5 (USA and Canada)

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.

INTRODUCTION

The purpose of this document 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 document 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 document, referred to as "Part 1" or "IEC 60947-1" 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 of this series".

For a general rule to apply to a specific product standard, it will be explicitly referred to by the latter, by quoting the relevant clause or subclause number of this document followed by "IEC 60947-1" e.g. "7.2.3 of IEC 60947-1:20xx".

A specific product standard will only deviate from the general rules when there is substantial technical justification.

NOTE All references to "product standards" in this document means "product standards of IEC 60947 series".

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 1: General rules

1 Scope

This document applies, when required by the relevant product standard, to low-voltage switchgear and controlgear hereinafter referred to as "equipment" or "device" and intended to be connected to circuits, the rated voltage of which does not exceed 1 000 V AC or 1 500 V DC.

This document states the general rules and common safety requirements for low-voltage switchgear and controlgear, including:

- definitions;
- characteristics;
- information supplied with the equipment;
- normal service, mounting and transport conditions, decommissioning and dismantling;
- constructional and performance requirements;
- verification of characteristics and performance;
- energy efficiency aspects (see Annex V);
- environmental aspects.

This document does not apply to:

- low-voltage switchgear and controlgear assemblies which are dealt with in IEC 61439 series, as applicable;
- terminals for connection of aluminium conductors;

NOTE Terminals for aluminium conductors are under consideration for the next revision.

- use within explosive atmospheres (see IEC 60079 series);
- software and firmware requirements for functional safety application (see IEC 61508-3);
- cyber security aspects (see IEC 62443 series).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60038:2009, *IEC standard voltages*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:2008, *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)*¹

IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

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

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60092-504:2016, *Electrical installations in ships – Part 504: Automation, control and instrumentation*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60228:2004, *Conductors of insulated cables*

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

IEC 60269-1:2006/AMD1:2009

IEC 60269-1:2006/AMD2:2014

IEC 60300-3-5:2001, *Dependability management – Part 3-5: Application guide – Reliability test conditions and statistical test principles*

IEC TR 60344:2007, *Calculation of d.c. resistance of plain and coated copper conductors of low-frequency cables and wires – Application guide*

IEC 60417, *Graphical symbols for use on equipment* (available at <http://www.graphical-symbols.info/equipment>)

IEC 60445:2017, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors*

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

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

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60617, *Graphical symbols for diagrams* (available at <http://std.iec.ch/iec60617>)

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

¹ Second edition (1996). This 2nd edition was replaced in 2017 by a 3rd Edition IEC 60068-2-52:2017, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*.

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