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Part 1: General rules

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Introduction

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Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



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IEC SC 121A : LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR		
SECRETARIAT: France	SECRETARY: Mr Michaël LAHEURTE	
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 18, SC 23E, SC 121B	HORIZONTAL FUNCTION(S):	
ASPECTS CONCERNED: Electromagnetic Compatibility, Environment, Safety		

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TITLE: Low-voltage switchgear and controlgear - Part 1: General rules

NOTE FROM TC/SC OFFICERS: SC121A Officers are supporting the circulation of IEC 60947-1 ED7 CD3. Experts are kindly asked to indicate the line number(s) when commenting the document.
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 1: General rules

FOREWORD

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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 edition cancels and replaces the sixth edition published in 2020, This edition constitutes a technical revision.

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

- introduction of different EMC environments;
- improvement of Annex R (new Figure R.5b);
- Reference to IEC 62683 DB;
- Reference to MPSD;
- Safety aspects related to:

- General aspects;
 - Limited energy sources;
 - Breakdown of components analysis and test
 - Use of voltage limiting components, including particular routine test;
 - Minimum creepage distances and flammability of printed wiring board
- Mention of dedicated wiring accessories;
 - Rub test for mandatory marking
 - Reference environmental conditions for transport, storage and services
 - Material selection methods harmonised with IEC 61800-5-1
 - Introduction the PCB terminal block according to IEC 60947-7-4;
 - Requirements for the connection of aluminium conductors in Annex B;
 - Replacement of the annexes O and W by the reference to IEC TS 63058;
 - Determination of critical DC load current;
 - DC utilization categories added to Annex A;
 - Determination of power losses in the main circuit;
 - IP ratings and testing of components intended to be mounted to enclosure walls;
 - Update of Table 4 with reduced head diameter screw;
 - Built-in single-drop digital communication interface in Annex Y.

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 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.

The National Committees are requested to note that for this publication the stability date is 202X.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

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, including electromagnetic compatibility (EMC), safety measures against electric shock, fire hazard and mechanical hazard;
- use of aluminium conductors (Annex B);
- verification of characteristics and performance;

This document does not apply to:

- low-voltage switchgear and controlgear assemblies

NOTE Low-voltage switchgear and controlgear assemblies are dealt with in IEC 61439 series, as applicable.

- use within explosive atmospheres (see IEC 60079 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*

- 58 IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic*
59 *(12 h + 12 h cycle)*
- 60 IEC 60068-2-52:2017, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic*
61 *(sodium chloride solution)*
- 62 IEC 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady*
63 *state*
- 64 IEC 60073:2002, *Basic and safety principles for man-machine interface, marking and*
65 *identification – Coding principles for indicators and actuators*
- 66 IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*
- 67 IEC 60092-504:2016, *Electrical installations in ships – Part 504: Automation, control and*
68 *instrumentation*
- 69 IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2:*
70 *Determination of thermal endurance properties of electrical insulating materials – Choice of test*
71 *criteria*
- 72 IEC 60228:2004, *Conductors of insulated cables*
- 73 IEC 60269-1:2006, *Low-voltage fuses – Part 1: General requirements*
74 IEC 60269-1:2006/AMD1:2009
75 IEC 60269-1:2006/AMD2:2014
- 76 IEC 60300-3-5:2001, *Dependability management – Part 3-5: Application guide – Reliability test*
77 *conditions and statistical test principles*
- 78 IEC TR 60344:2007, *Calculation of d.c. resistance of plain and coated copper conductors of*
79 *low-frequency cables and wires – Application guide*
- 80 IEC 60417, *Graphical symbols for use on equipment* (available at [http://www.graphical-](http://www.graphical-symbols.info/equipment)
81 [symbols.info/equipment](http://www.graphical-symbols.info/equipment))
- 82 IEC 60445:2017, *Basic and safety principles for man-machine interface, marking and*
83 *identification – Identification of equipment terminals, conductor terminations and conductors*
- 84 IEC 60447:2004, *Basic and safety principles for man-machine interface, marking and*
85 *identification – Actuating principles*
- 86 IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*
87 IEC 60529:1989/AMD1:1999
88 IEC 60529:1989/AMD2:2013
- 89 IEC 60617, *Graphical symbols for diagrams* (available at <http://std.iec.ch/iec60617>)
- 90 IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage systems – Part 1:*
91 *Principles, requirements and tests*
- 92 IEC 60695-2-10:2013, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods –*
93 *Glow-wire apparatus and common test procedure*

- 94 IEC 60695-2-11:2014, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods –*
95 *Glow-wire flammability test method for end-products (GWEPT)*
- 96 IEC 60695-2-12, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-*
97 *wire flammability index (GWFI) test method for materials*
- 98 IEC 60695-11-10:2013, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and*
99 *vertical flame test methods*
- 100 IEC 60715:2017, *Dimensions of low-voltage switchgear and controlgear – Standardized*
101 *mounting on rails for mechanical support of switchgear, controlgear and accessories*
- 102 IEC 60721-3-1, *Classification of environmental conditions – Part 3-1: Classification of groups*
103 *of environmental parameters and their severities – Storage*
- 104 IEC 60721-3-2, *Classification of environmental conditions – Part 3-2: Classification of groups*
105 *of environmental parameters and their severities – Transportation and Handling*
- 106 IEC 60730-1, *Automatic electrical controls – Part 1: General requirements*
- 107 IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*
108 *IEC 60947-2:2016/AMD1:2019*
- 109 IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and*
110 *switching elements – Electromechanical control circuit devices*
- 111 IEC 60947-5-2, *Low-voltage switchgear and controlgear – Part 5-2: Control circuit devices and*
112 *switching elements - Proximity switches*
- 113 IEC TS 60947-7-5, *Low-voltage switchgear and controlgear – Part 7-5: Ancillary equipment –*
114 *Terminal blocks for aluminium conductors*
- 115 IEC 60947-8, *Low-voltage switchgear and controlgear – Part 8: Control units for built-in thermal*
116 *protection (PTC) for rotating electrical machines*
- 117 IEC 60981:2019, *Extra heavy-duty electrical rigid steel conduits*
- 118 IEC 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements*
119 *for screw-type and screwless-type clamping units – Part 1: General requirements and particular*
120 *requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*
- 121 IEC 60999-2:2003, *Connecting devices – Electrical copper conductors – Safety requirements*
122 *for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping*
123 *units for conductors above 35 mm² up to 300 mm² (included)*
- 124 IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic*
125 *current emissions (equipment input current ≤ 16 A per phase)*
- 126 IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage*
127 *changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment*
128 *with rated current ≤ 16 A per phase and not subject to conditional connection*

- 129 IEC 61000-3-11, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage*
130 *changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with*
131 *rated current ≤ 75 A and subject to conditional connection*
- 132 IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic*
133 *currents produced by equipment connected to public low-voltage systems with input current $>$*
134 *16 A and ≤ 75 A per phase*
- 135 IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement*
136 *techniques – Electrostatic discharge immunity test*
- 137 IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement*
138 *techniques – Radiated, radio-frequency, electromagnetic field immunity test*
- 139 IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement*
140 *techniques – Electrical fast transient/burst immunity test*
- 141 IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement*
142 *techniques – Surge immunity test*
- 143 IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement*
144 *techniques – Immunity to conducted disturbances, induced by radio-frequency fields*
- 145 IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement*
146 *techniques – Power frequency magnetic field immunity test*
- 147 IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement*
148 *techniques – Voltage dips, short interruptions and voltage variations immunity tests*
- 149 IEC 61000-4-34, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement*
150 *techniques – Voltage dips, short interruptions and voltage variations immunity tests for*
151 *equipment with input current more than 16 A per phase*
- 152 IEC 61000-6-2:2016, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards –*
153 *Immunity standard for industrial environments*
- 154 IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity*
155 *for equipment used in power station and substation environment*
- 156 IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*
- 157 IEC 61051-2:1991, *Varistors for use in electronic equipment – Part 2: Sectional specification*
158 *for surge suppression varistors*
- 159 IEC 61131-2:2017, *Industrial-process measurement and control – Programmable controllers –*
160 *Part 2: Equipment requirements and tests*
- 161 IEC 61131-9:2022, *Programmable controllers - Part 9: Single-drop digital communication*
162 *interface for small sensors and actuators (SDCI)*
- 163 IEC 61140:2016, *Protection against electric shock – Common aspects for installation and*
164 *equipment*
- 165 IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and*
166 *procedure requirements, test equipment*

- 167 IEC 6189-3:2007, Test method for electrical materials, printed boards and other interconnection
168 structures and assemblies – Part 3: Test methods for interconnection structures (printed
169 boards) IEC 61238-1, *Compression and mechanical connectors for power cables for rated*
170 *voltages up to 30 kV ($U_m = 36$ kV) – Part 1: Test methods and requirements*
- 171 IEC 61238-1-1, *Compression and mechanical connectors for power cables – Part 1-1: Test*
172 *methods and requirements for compression and mechanical connectors for power cables for*
173 *rated voltages up to 1 kV ($U_m = 1,2$ kV) tested on non-insulated conductors*
- 174 IEC 61439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*
- 175 IEC 61508-4, *Functional safety of electrical/electronic/programmable electronic safety-related*
176 *systems – Part 4: Definitions and abbreviations*
- 177 IEC 61545, *Connecting devices – Devices for the connection of aluminium conductors in*
178 *clamping units of any material and copper conductors in aluminium bodied clamping units*
- 179 IEC 61557-2, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V*
180 *DC – Equipment for testing, measuring or monitoring of protective measures – Part 2: Insulation*
181 *resistance*
- 182 IEC 61643-331:2020, *Components for low-voltage surge protection – Part 331: Performance*
183 *requirements and test methods for metal oxide varistors (MOV)*
- 184 IEC 61649:2008, *Weibull analysis*
- 185 IEC 62061:2021, *Safety of machinery – Functional safety of safety-related electrical, electronic*
186 *and programmable electronic control systems*
- 187 IEC 62208:2011, *Empty enclosures for low-voltage switchgear and controlgear assemblies –*
188 *General requirements*
- 189 IEC 62471:2006, *Photobiological safety of lamps and lamp systems*
- 190 IEC 62474:2018, *Material declaration for products of and for the electrotechnical industry*
- 191 IEC 62683DB, *Low-voltage switchgear and controlgear – Product data and properties for*
192 *information exchange – IEC CDD database*
- 193 IEC TS 63058, *Environmental aspects for low-voltage switchgear and controlgear and their*
194 *assemblies*
- 195 IEC TR 63201:2019, *Low-voltage switchgear and controlgear – Guidance for the development*
196 *of embedded software*
- 197 IEC 63208, *Low-voltage switchgear and controlgear – Security aspects*
- 198 IEC 63404, *Switchgear and controlgear and their assemblies for low voltage – Integration*
199 *method of radiocommunication device into an equipment*
- 200 CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance*
201 *characteristics – Limits and methods of measurement*

202 ISO 3864-2, *Graphical symbols – Safety colours and safety signs – Part 2: Design principles*
 203 *for product safety labels*

204 ISO 7000DB, *Graphical symbols for use on equipment – Registered symbols* (available at
 205 <http://www.graphical-symbols.info/equipment>)

206 ISO 13849-1:2023, *Safety of machinery – Safety-related parts of control systems – Part 1:*
 207 *General principles for design*

208 **3 Terms, definitions, symbols and reference clauses**

209 **3.1 General**

210 For the purposes of this document, the following terms and definitions apply.

211 ISO and IEC maintain terminological databases for use in standardization at the following
 212 addresses:

- 213 • IEC Electropedia: available at <http://www.electropedia.org/>
- 214 • ISO Online browsing platform: available at <http://www.iso.org/obp>

215 **3.2 Alphabetical index of definitions**

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3.3 General terms and definitions

3.3.1

switchgear and controlgear

general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures

[SOURCE: IEC 60050-441:1984, 441-11-01]

3.3.2

switchgear

general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy

546 [SOURCE: IEC 60050-441:1984, 441-11-02]

547 **3.3.3**

548 **controlgear**

549 general term covering switching devices and their combination with associated control,
550 measuring, protective and regulating equipment, also assemblies of such devices and
551 equipment with associated interconnections, accessories, enclosures and supporting
552 structures, intended in principle for the control of electric energy consuming equipment

553 [SOURCE: IEC 60050-441:1984, 441-11-03]

554 **3.3.4**

555 **overcurrent**

556 current exceeding the rated current

557 [SOURCE: IEC 60050-441:1984, 441-11-06]

558 **3.3.5**

559 **short-circuit**

560 accidental or intentional conductive path between two or more conductive parts forcing the
561 electric potential differences between these conductive parts to be equal to or close to zero

562 [SOURCE: IEC 60050-195:2021, 195-04-11]

563 **3.3.6**

564 **short-circuit current**

565 overcurrent resulting from a short-circuit due to a fault or an incorrect connection in an electric
566 circuit

567 [SOURCE: IEC 60050-441:1984, 441-11-07, modified – “short circuit” has been replaced by
568 “short-circuit”.]

569 **3.3.7**

570 **overload**

571 operating conditions in an electrically undamaged circuit, which cause an overcurrent

572 [SOURCE: IEC 60050-441:1984, 441-11-08]

573 **3.3.8**

574 **overload current**

575 overcurrent occurring in an electrically undamaged circuit

576 **3.3.9**

577 **ambient air temperature**

578 temperature, determined under prescribed conditions, of the air surrounding the complete
579 switching device or fuse

580 Note 1 to entry: For switching devices or fuses installed inside an enclosure, it is the temperature of the air outside
581 the enclosure.

582 [SOURCE: IEC 60050-441:1984, 441-11-13, modified – “the” has been deleted.]

3.3.10**utilization category**

<for a switching device or a fuse> combination of specified requirements related to the condition in which the switching device or the fuse fulfils its purpose, selected to represent a characteristic group of practical applications

Note 1 to entry: The specified requirements can concern e.g. the values of making capacities (if applicable), breaking capacities and other characteristics, the associated circuits and the relevant conditions of use and behaviour.

[SOURCE: IEC 60050-441:1984, 441-17-19, modified – In Note 1 to entry, “may” changed to “can”.]

3.3.11**galvanic separation**

prevention of electric conduction between two electric circuits intended to exchange power and/or signals

Note 1 to entry: Galvanic separation can be provided e.g. by an isolating transformer or a photocoupler.

Note 2 to entry: A galvanic separation is only functional and not safety related like a protective separation or isolation (see 3.3.16).

[SOURCE: IEC 60050-151:2001, 151-12-26, modified – Note 2 to entry has been added.]

3.3.12**manufacturer**

any person, company or organisation with ultimate responsibility as follows:

- to provide compliant product according to the appropriate standard or standards;
- to provide the product information according to Clause 5.9

Note 1 to entry: For instance, in the case of “protected starters” assembled according to the instructions of the component documentation, the manufacturer will be the entity that undertook the assembly.

3.3.13**solid insulation**

solid insulating material interposed between two conductive parts

3.3.14**insulation coordination barrier**

solid insulating material that is not an integral part, provided for the purpose of increasing either creepage distances or clearance distances or both

3.3.15**isolating distance**

<of a pole of a mechanical switching device> clearance between open contacts meeting the safety requirements specified for disconnectors

[SOURCE: IEC 60050-441:1984, 441-17-35, modified – “the” has been deleted.]

3.3.16**protective separation****electrically protective separation**

separation of one electric circuit from another by means of:

- double insulation, or
- basic insulation and electrically protective screen, or

626 – reinforced insulation

627 **3.3.17**
628 **line conductor**

629 conductor intended to be energized and capable of contributing to the transmission or
630 distribution of electric energy but which is not a neutral conductor or mid-point conductor

631 Note 1 to entry: A definition restricted to polyphase systems is given in IEC 141-03-02.

632 [SOURCE: IEC 60050-195:2021, 195-02-08]

633 **3.3.18**
634 **mid-point conductor**

635 conductor electrically connected to the mid-point and capable of contributing to the distribution
636 of electric energy

637 [SOURCE: IEC 60050-195:2021, 195-02-07]

638 **3.3.19**
639 **PEM conductor**

640 conductor combining the functions of both a protective earthing conductor and a mid-point
641 conductor

642 [SOURCE: IEC 60050-195:2021, 195-02-13]

643 **3.3.20**
644 **PEN conductor**

645 conductor combining the functions of both a protective earthing conductor and a neutral
646 conductor

647 [SOURCE: IEC 60050-195:2021, 195-02-12]

648 **3.3.21**
649 **PEL conductor**

650 conductor combining the functions of both a protective earthing conductor and a line conductor

651 [SOURCE: IEC 60050-195:2021, 195-02-14]

652 **3.3.22**
653 **functional earthing**

654 earthing a point or points in a system or in an installation or in equipment, for purposes other
655 than electrical safety

656 [SOURCE: IEC 62368-1:2023, 3.3.6.7]

657 **3.3.23**
658 **maintenance**

659 combination of all technical actions intended to retain an item in, or restore it to, a state in which
660 it can perform as required

661 [SOURCE: IEC 60050-192:2015, 192-06-01, modified – “and management” and Note 1 to entry
662 have been deleted.]

3.3.24**single-drop digital communication interface****SDCI**

digital communication interface for switching 24 V devices implemented as a point-to-point communication link for connecting sensors and actuators to a master unit

EXAMPLE: IO-Link™

3.3.25**product documentation**

information required for proper selection, installation, service, maintenance, decommissioning dismantling and end-of-life treatment of equipment provided in printed, electronic or other formats

Note 1 to entry: Information is often made available in digital format.

Note 2 to entry: Regulations can apply to the provision of product documentation.

3.3.26**printed wiring board****printed circuit board****printed board****PWB****PCB**

base material cut to size containing all required holes and bearing at least one conductive pattern.

Note 1 to entry: Printed boards are typically subdivided according to:

- their structure (e.g., single- and double-sided, multilayers)

- the nature of the base material (e.g., rigid, flexible)

[SOURCE: IEC 60050-541:1990, 541-01-03, modified – synonymous terms added, text from the second paragraph changed into a Note to entry.]

3.3.27**printed wiring board assembly****printed circuit board assembly****PWBA****PCBA**

assembly that uses a printed wiring board for component mounting and interconnecting purposes.

[SOURCE: IEC 60194-1:2021, 3.16.140, modified – synonymous terms added]

3.4 Switching devices**3.4.1****switching device**

device designed to make or break the current in one or more electric circuits

Note 1 to entry: A switching device can perform one or both of these operations.

[SOURCE: IEC 60050-441:1984, 441-14-01, modified – Note 1 to entry has been added.]

3.4.2**mechanical switching device**

switching device designed to close and open one or more electric circuits by means of separable contacts

707 Note 1 to entry: Any mechanical switching device can be designated according to the medium in which its contacts
708 open and close, e.g.: air, SF₆, oil.

709 [SOURCE: IEC 60050-441:1984, 441-14-02, modified – In Note 1 to entry, “may” changed to
710 “can”.]

711 3.4.3

712 semiconductor switching device

713 switching device designed to make and/or break the current in an electric circuit by means of
714 the controlled conductivity of a semiconductor

715 [SOURCE: IEC 60050-441:1984, 441-14-03, modified – Addition of “and/or break”.]

716 3.4.4

717 fuse

718 device that, by the operating of one or more of its specifically designed and proportioned
719 components, opens the circuit in which it is inserted by breaking the current when this exceeds
720 a given value for a sufficient time

721 Note 1 to entry: The fuse comprises all the parts that form the complete device.

722 [SOURCE: IEC 60050-441:1984, 441-18-01, modified- “a” has been deleted and “fusing has
723 been replaced by “operating”, “The fuse comprises all the parts that form the complete device”
724 has been moved from the definition to Note 1 to entry.]

725 3.4.5

726 fuse-link

727 part of a fuse (including the fuse-element(s)) intended to be replaced after the fuse has operated

728 [SOURCE: IEC 60050-441:1984, 441-18-09]

729 3.4.6

730 fuse-element

731 part of the fuse-link designed to melt under the action of current exceeding some definite value
732 for a definite period of time

733 [SOURCE: IEC 60050-441:1984, 441-18-08]

734 3.4.7

735 fuse-combination unit

736 combination of a mechanical switching device and one or more fuses in a composite unit,
737 assembled by the manufacturer or in accordance with their instructions

738 [SOURCE: IEC 60050-441:1984, 441-14-04, modified – “his instructions” has been replaced by
739 “their instructions” and Note 1 to entry has been deleted.]

740 3.4.8

741 disconnecter

742 mechanical switching device which, in the open position, complies with the requirements
743 specified for isolation

744 3.4.9

745 switch

746 mechanical switch

747 mechanical switching device capable of making, carrying and breaking currents under normal
748 circuit conditions which can include specified operating overload conditions and also carrying

for a specified time currents under specified abnormal circuit conditions such as those of short-circuit

Note 1 to entry: A switch can be capable of making but not breaking short-circuit currents.

[SOURCE: IEC 60050-441:1984, 441-14-10, modified – In Note 1 to entry, “may” changed to “can”.]

3.4.10

switch-disconnector

switch which, in the open position, satisfies the isolating requirements specified for a disconnector

[SOURCE: IEC 60050-441:1984, 441-14-12]

3.4.11

circuit-breaker

switching device, capable of making, carrying and breaking currents under normal circuit conditions and making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short-circuit, and provides isolation in open position

[SOURCE: IEC 60050-441:1984, 441-14-20, modified – “mechanical” and “also” deleted, “duration” has been replaced by “time”, short circuit” has been replaced by “short-circuit” and “, and provides isolation in open position” added.]

3.4.12

contactor

mechanical contactor

mechanical switching device having only one position of rest, operated otherwise than by hand, capable of making, carrying and breaking currents under normal circuit conditions including operating overload conditions

Note 1 to entry: Contactors can be designated according to the method by which the force for closing the main contacts is provided.

[SOURCE: IEC 60050-441:1984, 441-14-33, modified – In term, “contactor” has been added as synonym for “mechanical contactor”, and in Note 1 to entry, “Mechanical” has been deleted and “may” changed to “can”.]

3.4.13

semiconductor contactor

solid-state contactor

device which performs the function of a contactor by utilizing a semiconductor switching device

Note 1 to entry: A semiconductor contactor can also contain mechanical switching devices.

3.4.14

contactor relay

contactor used as a control switch

[SOURCE: IEC 60050-441:1984, 441-14-35]

3.4.15

starter

combination of all the switching means necessary to start and stop a motor, in combination with suitable overload protection

791 Note 1 to entry: Starters can be designated according to the method by which the force for closing the main contacts
792 is provided.

793 [SOURCE: IEC 60050-441:1984, 441-14-38, modified – In Note 1 to entry, “may” changed to
794 “can”.]

795 **3.4.16**
796 **motor protective switching device**
797 **MPSD**

798 manually operated motor starter additionally providing resettable short-circuit protection to the
799 motor and the circuit

800 Note 1 to entry: A MPSD can also be used as a manual starter, a protected starter or a combination starter.

801 Note 2 to entry: A MPSD is a short-circuit protective device (SCPD).

802 Note 3 to entry: In the United states of America, this device can be qualified as a motor controller suitable for tap
803 conductor protection.

804

805 **3.4.17**
806 **control circuit device**

807 electrical device, intended for the controlling, signalling, interlocking, etc. of switchgear and
808 controlgear

809 Note 1 to entry: Control circuit devices can include associated devices dealt with in other standards, such as
810 instruments, potentiometers, relays, in so far as such associated devices are used for the purposes specified.

811 **3.4.18**
812 **control switch**

813 <for control and auxiliary circuits> mechanical switching device which serves the purpose of
814 controlling the operation of switchgear or controlgear, including signalling, electrical
815 interlocking, etc.

816 Note 1 to entry: A control switch consists of one or more contact elements with a common actuating system.

817 [SOURCE: IEC 60050-441:1984, 441-14-46]

818 **3.4.19**
819 **pilot switch**

820 non-manual control switch actuated in response to specified conditions of an actuating quantity

821 Note 1 to entry: The actuating quantity can be pressure, temperature, velocity, liquid level, elapsed time, etc.

822 [SOURCE: IEC 60050-441:1984, 441-14-48, modified – In Note 1 to entry, “may” changed to
823 “can”.]

824 **3.4.20**
825 **push-button**

826 control switch having an actuator intended to be operated by force exerted by a part of the
827 human body, usually the finger or palm of the hand, and having stored energy (spring) return

828 [SOURCE: IEC 60050-441:1984, 441-14-53]

829 **3.4.21**
830 **terminal block**

831 insulating part carrying one or more mutually insulated terminal assemblies and intended to be
832 fixed to a support

3.4.22**short-circuit protective device****SCPD**

device intended to protect a circuit or parts of a circuit against short-circuit currents by interrupting them

3.4.23**surge arrester**

device designed to protect the electrical apparatus from high transient overvoltages and to limit the duration and frequently the amplitude of the follow-on current

3.4.24**individual enclosure**

enclosure designed and dimensioned to contain one equipment only

3.4.25**control and protective switching device****CPS**

mechanical switching device with a control function operated other than by hand capable of:

- making, carrying and breaking currents under normal conditions;
- making, carrying currents for a specified time in overload conditions;
- breaking currents under specified abnormal conditions such as those of short-circuits;
- continuity of service, with or without local manual operating means

[SOURCE: IEC 60947-6-2:2020, 3.2.1]

3.5 Parts of switching devices**3.5.1****pole of a switching device**

portion of a switching device associated exclusively with one electrically separated conducting path of its main circuit and excluding those portions which provide a means for mounting and operating all poles together

Note 1 to entry: A switching device is called single-pole if it has only one pole. If it has more than one pole, it can be called multipole (two-pole, three-pole, etc.) provided the poles are or can be coupled in such a manner as to operate together.

[SOURCE: IEC 60050-441:1984, 441-15-01, modified – In Note 1 to entry, “may” changed to “can”.]

3.5.2**main circuit**

<of a switching device> all the conductive parts of a switching device included in the circuit which it is designed to close or open

[SOURCE: IEC 60050-441:1984, 441-15-02]

3.5.3**control circuit**

<of a switching device> all the conductive parts (other than the main circuit) of a switching device which are included in a circuit used for the closing operation or opening operation, or both, of the device

[SOURCE: IEC 60050-441:1984, 441-15-03]

3.5.4**auxiliary circuit**

<of a switching device> all the conductive parts of a switching device which are intended to be included in a circuit other than the main circuit and the control circuits of the device

Note 1 to entry: Some auxiliary circuits fulfil supplementary functions such as signalling, interlocking, etc., and, as such, they can be part of the control circuit of another switching device.

[SOURCE: IEC 60050-441:1984, 441-15-04, modified – In Note 1 to entry, “may” changed to “can”.]

3.5.5**contact**

<of a mechanical switching device> conductive parts designed to establish circuit continuity when they touch and which, due to their relative motion during an operation, open or close a circuit or, in the case of hinged or sliding contacts, maintain circuit continuity

[SOURCE: IEC 60050-441:1984, 441-15-05]

3.5.6**contact****contact piece**

one of the conductive parts forming a contact

[SOURCE: IEC 60050-441:1984, 441-15-06]

3.5.7**main contact**

contact included in the main circuit of a mechanical switching device, intended to carry, in the closed position, the current of the main circuit

[SOURCE: IEC 60050-441:1984, 441-15-07]

3.5.8**arcing contact**

contact on which the arc is intended to be established

Note 1 to entry: An arcing contact can serve as a main contact; it can be a separate contact so designed that it opens after and closes before another contact which it is intended to protect from deterioration.

[SOURCE: IEC 60050-441:1984, 441-15-08, modified – “injury” has been replaced by “deterioration” and In Note 1 to entry, “may” changed to “can”.]

3.5.9**control contact**

contact included in a control circuit of a mechanical switching device and mechanically operated by this device

[SOURCE: IEC 60050-441:1984, 441-15-09]

3.5.10**auxiliary contact**

contact included in an auxiliary circuit and mechanically operated by the switching device

[SOURCE: IEC 60050-441:1984, 441-15-10]

3.5.11**auxiliary switch**

<of a mechanical switching device> switch containing one or more control and/or auxiliary contacts mechanically operated by a switching device

[SOURCE: IEC 60050-441:1984, 441-15-11]

3.5.12**"a" contact****make contact**

control or auxiliary contact which is closed when the main contacts of the mechanical switching device are closed and open when they are open

[SOURCE: IEC 60050-441:1984, 441-15-12]

3.5.13**"b" contact****break contact**

control or auxiliary contact which is open when the main contacts of the mechanical switching device are closed and closed when they are open

[SOURCE: IEC 60050-441:1984, 441-15-13]

3.5.14**relay****electrical relay**

device designed to produce sudden, predetermined changes in one or more electric output circuits when certain conditions are fulfilled in the electric input circuits controlling the device

[SOURCE: IEC 60050-151:2001, 151-13-31, modified – “electric relay” changed to “electrical relay”.]

3.5.15**release**

<of a mechanical switching device> device, mechanically connected to a mechanical switching device, which releases the holding means and permits the opening or the closing of the switching device

Note 1 to entry: A release can have instantaneous, time-delay, etc., operation. The various types of releases are defined in 3.7.24 to 3.7.35.

[SOURCE: IEC 60050-441:1984, 441-15-17, modified – Note 1 to entry has been added.]

3.5.16**actuating system**

<of a mechanical switching device> whole of the operating means of a mechanical switching device which transmit the actuating force to the contact pieces

Note 1 to entry: The operating means of an actuating system can be mechanical, electromagnetic, hydraulic, pneumatic, thermal, etc.

3.5.17**actuator**

part of the actuating system to which an external actuating force is applied

Note 1 to entry: The actuator can take the form of a handle, knob, push-button, roller, plunger, etc.

[SOURCE: IEC 60050-441:1984, 441-15-22]

3.5.18**position indicating device**

part of a mechanical switching device which indicates whether it is in the open, closed, or, where appropriate, earthed position

[SOURCE: IEC 60050-441:1984, 441-15-25]

3.5.19**indicator light**

light signal giving information either by lighting or extinguishing

3.5.20**anti-pumping device**

device which prevents reclosing after a close-open operation as long as the device initiating closing is maintained in the position for closing

[SOURCE: IEC 60050-441:1984, 441-16-48]

3.5.21**interlocking device**

device which makes the operation of a switching device dependent upon the position of operation of one or more other pieces of equipment

[SOURCE: IEC 60050-441:1984, 441-16-49]

3.5.22**connecting device**

device for the electrical connection of one (or more) conductor(s), comprising one (or more) terminal(s), either fixed to a base or forming an integral part of the equipment

[SOURCE: IEC 60999-1:1999, 3.3]

3.5.23**terminal**

conductive part of one pole of a device for electrical connection to external circuit, composed of one or more clamping unit(s) and insulation if necessary

[SOURCE: IEC 60999-1:1999, 3.2, modified – “of a device for electrical connection to external circuit” has been added.]

3.5.24**screw-type terminal**

terminal intended for the connection and disconnection of conductors or for the inter-connection of two or more conductors, the connection being made, directly or indirectly, by means of screws or nuts of any kind

Note 1 to entry: Examples are given in Annex D.

3.5.25**screwless-type terminal**

terminal intended for the connection and disconnection of conductors or for the interconnection on two or more conductors, the connection being made, directly or indirectly, by means of springs, wedges, eccentrics or cones, etc.

Note 1 to entry: Examples are given in Annex D.

- 1000 **3.5.25.1**
1001 **universal terminal**
1002 terminal for the connection and disconnection of all types of conductors (solid, stranded and
1003 flexible)
- 1004 [SOURCE: IEC 60998-2-2:2002, 3.101.1, modified – “(rigid and flexible)” replaced with “(solid,
1005 stranded and flexible)”.]
- 1006 **3.5.25.2**
1007 **non-universal terminal**
1008 terminal for the connection and disconnection of a certain kind of conductor only (for example,
1009 solid conductors only or solid and stranded conductors only)
- 1010 [SOURCE: IEC 60998-2-2:2002, 3.101.2, modified – “rigid [solid and stranded]” replaced with
1011 “solid and stranded”.]
- 1012 **3.5.25.3**
1013 **push-wire terminal**
1014 non-universal terminal in which the connection is made by pushing in solid or stranded
1015 conductors
- 1016 [SOURCE: IEC 60998-2-2:2002, 3.101.3, modified – “rigid (solid or stranded)” replaced with
1017 “solid or stranded”.]
- 1018 **3.5.25.4**
1019 **PCB terminal block**
1020 part intended to be mounted on a printed circuit board and carrying one or more mutually
1021 insulated contacts units and which provides an electrical and mechanical connection between
1022 copper conductor and printed circuit board
- 1023 **3.6** [SOURCE: IEC 60947-7-4:2019, 3.2.]
- 1024 **3.6.1**
1025 **clamping unit**
1026 part(s) of the terminal necessary for the mechanical clamping and the electrical connection of
1027 the conductor(s), including the parts which are necessary to ensure the correct contact pressure
- 1028 [SOURCE: IEC 60999-1:1999, 3.1]
- 1029 **3.6.1.1**
1030 **universal clamping unit**
1031 clamping unit intended for all types of conductors
- 1032 **3.6.1.2**
1033 **non-universal clamping unit**
1034 clamping unit intended for certain types of conductors only, for example:
- 1035 – push-wire clamping unit for solid conductors only
1036 – push-wire clamping unit for solid and stranded conductors only
- 1037 Note 1 to entry: On push-wire clamping unit the connection is made by simple insertion of solid or stranded
1038 conductors (see 8.1.8.1).
- 1039 Note 2 to entry: Examples of non-universal clamping units are push-wire clamping unit for solid conductors only,
1040 push-wire clamping unit for solid and stranded conductors only, etc.

1041 **3.6.2**
1042 **unprepared conductor**
1043 conductor which has been cut and the insulation of which has been removed for insertion into
1044 a terminal

1045 Note 1 to entry: A conductor the shape of which is arranged for introduction into a terminal or the strands of which
1046 are twisted to consolidate the end is considered to be an unprepared conductor.

1047 [SOURCE: IEC 60050-442:1998, 442-01-26]

1048 **3.6.3**
1049 **solid conductor**
1050 <as used to describe wiring> conductor consisting of a single wire

1051 Note 1 to entry: The solid conductor can be circular or shaped.

1052 Note 2 to entry: Solid conductor is defined as class 1 conductor in IEC 60228, or by IEC TR 60344, or equivalent
1053 AWG/kcmil.

1054 [SOURCE: IEC 60050-461:2008, 461-01-06, modified – In Note 1 to entry, “may” changed to
1055 “can”, and Note 2 to entry has been added.]

1056 **3.6.4**
1057 **stranded conductor**
1058 <as used to describe wiring> conductor consisting of a number of wires, all or some of which
1059 are wound in a helix

1060 Note 1 to entry: Stranded conductor is defined as class 2 conductor in IEC 60228, or by IEC TR 60344, or equivalent
1061 AWG/kcmil.

1062 [SOURCE: IEC 60050-151:2001, 151-12-36, modified – Note 1 to entry has been added.]

1063 **3.6.5**
1064 **rigid conductor**
1065 solid or stranded conductor having wires of such diameters, or so assembled, that the conductor
1066 is not suitable for use in a flexible cable

1067 **3.6.6**
1068 **flexible conductor**
1069 stranded conductor having wires of diameters small enough and so assembled that the
1070 conductor is suitable for use in a flexible cable

1071 Note 1 to entry: Flexible conductor is defined as class 5 or class 6 conductor in IEC 60228, or by IEC TR 60344, or
1072 equivalent AWG/kcmil.

1073 [SOURCE: IEC 60050-461:2008, 461-01-11, modified – Note 1 to entry has been added.]

1074 **3.6.7**
1075 **multiple tip contact system**
1076 contact system comprising more than one contact gap per pole, which can be switched, in series
1077 and/or in parallel

1078 **3.6.8**
1079 **minimum cross-section**
1080 <in reference to conductors for terminations> value of the smallest connectable conductor
1081 cross-section stated in the product documentation as suitable for the terminal

1082 Note 1 to entry: The product documentation can declare several minimum cross-sections depending on the type of
1083 conductor, for example solid, stranded, flexible, with or without ferrule.

1084 **3.6.9**
1085 **maximum cross-section**
1086 <in reference to conductors for terminations> value of the largest connectable conductor cross-
1087 section stated by the in the product documentation as suitable for the terminal

1088 Note 1 to entry: The product documentation can declare several maximum cross-sections depending on the type of
1089 conductor, for example solid, stranded, flexible, with or without ferrule.

1090 Note 2 to entry: The term “rated cross-section” used in IEC 60947-7-1 and IEC 60999-2 and the term “rated
1091 connecting capacity” of a clamping unit used in IEC 60999-1 are considered equivalent when referring to certain
1092 thermal, mechanical and electrical requirements, as stated in the product documentation and as specified in their
1093 relevant product standard.

1094 **3.6.10**
1095 **electronically controlled electromagnet**
1096 electromagnet in which the coil is controlled by a circuit with active electronic elements

1097 **3.6.11**
1098 **current-carrying part**
1099 conductive part which carries the electric current under normal conditions

1100 Note 1 to entry: The line conductor (L), the neutral conductor (N), the mid-point conductor (M), the PEN conductor,
1101 the PEM conductor and the PEL conductor are the current-carrying parts. The protective conductor (PE) is not a
1102 current-carrying part.

1103 **3.7 Operation of switching devices**

1104 **3.7.1**
1105 **operation**
1106 <of a mechanical switching device> transfer of the moving contact(s) from one position to an
1107 adjacent position

1108 Note 1 to entry: For example, for a circuit-breaker, this can be a closing operation or an opening operation.

1109 Note 2 to entry: If distinction is necessary, an operation in the electrical sense, e.g., make or break, is referred to
1110 as a switching operation, and an operation in the mechanical sense, e.g., close or open, is referred to as a mechanical
1111 operation.

1112 [SOURCE: IEC 60050-441:1984, 441-16-01, modified – in Note 1 to entry, “for example” has
1113 been added and “may” changed to “can”.]

1114 **3.7.2**
1115 **operating cycle**
1116 <of a mechanical switching device> succession of operations from one position to another and
1117 back to the first position through all other positions, if any

1118 [SOURCE: IEC 60050-441:1984, 441-16-02]

1119 **3.7.3**
1120 **operating sequence**
1121 <of a mechanical switching device> succession of specified operations with specified time
1122 intervals

1123 [SOURCE: IEC 60050-441:1984, 441-16-03]

1124 **3.7.4**
1125 **manual control**
1126 control of an operation by human intervention

1127 [SOURCE: IEC 60050-441:1984, 441-16-04]

1128 **3.7.5**
1129 **automatic control**
1130 control of an operation without human intervention, in response to the occurrence of
1131 predetermined conditions

1132 [SOURCE: IEC 60050-441:1984, 441-16-05]

1133 **3.7.6**
1134 **local control**
1135 control of an operation at a point on or adjacent to the controlled switching device

1136 [SOURCE: IEC 60050-441:1984, 441-16-06]

1137 **3.7.7**
1138 **remote control**
1139 control of an operation at a point distant from the controlled switching device

1140 [SOURCE: IEC 60050-441:1984, 441-16-07]

1141 **3.7.8**
1142 **closing operation**
1143 <of a mechanical switching device> operation by which the device is brought from the open
1144 position to the closed position

1145 [SOURCE: IEC 60050-441:1984, 441-16-08]

1146 **3.7.9**
1147 **opening operation**
1148 <of a mechanical switching device> operation by which the device is brought from the closed
1149 position to the open position

1150 [SOURCE: IEC 60050-441:1984, 441-16-09]

1151 **3.7.10**
1152 **positive opening operation**
1153 <of a mechanical switching device> opening operation which, in accordance with specified
1154 requirements, ensures that all the main contacts are in the open position when the actuator is
1155 in the position corresponding to the open position of the device

1156 [SOURCE: IEC 60050-441:1984, 441-16-11]

1157 **3.7.11**
1158 **positively driven operation**
1159 operation which, in accordance with specified requirements, is designed to ensure that auxiliary
1160 contacts of a mechanical switching device are in the respective positions corresponding to the
1161 open or closed position of the main contacts

1162 [SOURCE: IEC 60050-441:1984, 441-16-12]

1163 **3.7.12**
1164 **dependent manual operation**
1165 <of a mechanical switching device> operation solely by means of directly applied manual energy
1166 such that the speed and force of the operation are dependent upon the action of the operator

1167 [SOURCE: IEC 60050-441:1984, 441-16-13]

3.7.13**dependent power operation**

<of a mechanical switching device> operation by means of energy other than manual, where the completion of the operation is dependent upon the continuity of the power supply (to solenoids, electric or pneumatic motors, etc.)

[SOURCE: IEC 60050-441:1984, 441-16-14]

3.7.14**stored energy operation**

<of a mechanical switching device> operation by means of energy stored in the mechanism itself prior to the completion of the operation and sufficient to complete it under predetermined conditions

Note 1 to entry: This kind of operation can be subdivided according to:

- 1) the manner of storing the energy (spring, weight, etc.);
- 2) the origin of the energy (manual, electric, etc.);
- 3) the manner of releasing the energy (manual, electric, etc.).

[SOURCE: IEC 60050-441:1984, 441-16-15, modified – In Note 1 to entry, “may” changed to “can”.]

3.7.15**independent manual operation**

<of a mechanical switching device> stored energy operation where the energy originates from manual power, stored and released in one continuous operation, such that the speed and force of the operation are independent of the action of the operator

[SOURCE: IEC 60050-441:1984, 441-16-16]

3.7.16**independent power operation**

<of a mechanical switching device> stored energy operation where the stored energy originates from an external power source and is released in one continuous operation, such that the speed and force of the operation are independent of the action of the operator

3.7.17**actuating force**

force applied to an actuator necessary to complete the intended operation

[SOURCE: IEC 60050-441:1984, 441-16-17]

3.7.18**restoring force**

force provided to restore an actuator or a contact element to its initial position

[SOURCE: IEC 60050-441:1984, 441-16-19]

3.7.19**travel**

<of a mechanical switching device or a part thereof> displacement (translation or rotation) of a point on a moving element

Note 1 to entry: Distinction can be made between pre-travel, over-travel, etc.

1209 [SOURCE: IEC 60050-441:1984, 441-16-21, modified – In Note 1 to entry, “may” changed to
1210 “can”.]

1211 **3.7.20**

1212 **closed position**

1213 <of a mechanical switching device> position in which the predetermined continuity of the main
1214 circuit of the device is secured

1215 [SOURCE: IEC 60050-441:1984, 441-16-22]

1216 **3.7.21**

1217 **open position**

1218 <of a mechanical switching device> position in which the predetermined dielectric withstand
1219 voltage requirements are satisfied between open contacts in the main circuit of the device

1220 [SOURCE: IEC 60050-441:1984, 441-16-23, modified – “clearance between open contacts in
1221 the main circuit of the device is secured ”has been replaced by “dielectric withstand voltage
1222 requirements are satisfied between open contacts in the main circuit of the device”.]

1223 **3.7.22**

1224 **tripped position**

1225 position of the switching device following a tripping operation

1226 **3.7.23**

1227 **tripping** (operation)

1228 opening operation of a mechanical switching device initiated by a relay or release

1229 **3.7.24**

1230 **trip-free mechanical switching device**

1231 mechanical switching device, the moving contacts of which return to and remain in the open
1232 position when the opening (i.e. tripping) operation is initiated after the initiation of the closing
1233 operation, even if the closing command is maintained

1234 Note 1 to entry: To ensure proper breaking of the current which can have been established, it may be necessary
1235 that the contacts momentarily reach the closed position.

1236 [SOURCE: IEC 60050-441:1984, 441-16-31, modified – Addition of “(i.e. tripping)” since the
1237 opening operation of a trip-free mechanical switching device is automatically controlled, in Note
1238 1 to entry, “may” changed to “can”.]

1239 **3.7.25**

1240 **instantaneous relay or release**

1241 relay or release which operates without any intentional time-delay

1242 **3.7.26**

1243 **overcurrent relay or release**

1244 relay or release which causes a mechanical switching device to open with or without time-delay
1245 when the current in the relay or release exceeds a predetermined value

1246 Note 1 to entry: This value can in some cases depend upon the rate-of-rise of current.

1247 **3.7.27**

1248 **definite time-delay overcurrent relay or release**

1249 overcurrent relay or release which operates with a definite time-delay which may be adjustable,
1250 but is independent of the value of the overcurrent

1251 [SOURCE: IEC 60050-441:1984, 441-16-34, modified – Addition of “or release”]

3.7.28**inverse time-delay overcurrent relay or release**

overcurrent relay or release which operates after a time-delay inversely dependent upon the value of the overcurrent

Note 1 to entry: Such a relay or release can be designed so that the time-delay approaches a definite minimum value for high values of overcurrent.

[SOURCE: IEC 60050-441:1984, 441-16-35, modified – Addition of "or release"]

3.7.29**direct overcurrent relay or release**

overcurrent relay or release directly energized by the current in the main circuit of a switching device

[SOURCE: IEC 60050-441:1984, 441-16-36, modified – Addition of "relay or" and "mechanical" has been deleted.]

3.7.30**indirect overcurrent relay or release**

overcurrent relay or release energized by the current in the main circuit of a switching device through a current transformer or a shunt

[SOURCE: IEC 60050-441:1984, 441-16-37, modified – Addition of "relay or" and "mechanical" has been deleted.]

3.7.31**overload relay or release**

overcurrent relay or release intended for protection against overloads

[SOURCE: IEC 60050-441:1984, 441-16-38, modified – Addition of "relay or".]

3.7.32**thermal overload relay or release**

inverse time-delay overload relay or release depending for its operation (including its time-delay) on the thermal action of the current flowing in the relay or release

[SOURCE: IEC 60050-441:1984, 441-16-39, modified – Addition of "relay or".]

3.7.33**magnetic overload relay or release**

overload relay or release depending for its operation on the force exerted by the current in the main circuit exciting the coil of an electromagnet

Note 1 to entry: Such a relay or release usually has an inverse time-delay/current characteristic.

[SOURCE: IEC 60050-441:1984, 441-16-40, modified – Addition of "relay or".]

3.7.34**shunt release**

release energized by a source of voltage

Note 1 to entry: The source of voltage can be independent of the voltage of the main circuit.

[SOURCE: IEC 60050-441:1984, 441-16-41, modified – In Note 1 to entry, "may" changed to "can".]

1292 **3.7.35**
1293 **under-voltage relay or release**
1294 relay or release which permits a mechanical switching device to open or close, with or without
1295 time-delay, when the voltage across the terminals of the relay or release falls below a
1296 predetermined value

1297 [SOURCE: IEC 60050-441:1984, 441-16-42, modified – Addition of "relay or" and "a shunt
1298 release" has been replaced by "relay or release".]

1299 **3.7.36**
1300 **reverse current relay or release** (direct current only)
1301 relay or release which permits a mechanical switching device to open, with or without time-
1302 delay, when the current flows in the reverse direction and exceeds a predetermined value

1303 [SOURCE: IEC 60050-441:1984, 441-16-43, modified – "shunt release" replaced by "relay or
1304 release".]

1305 **3.7.37**
1306 **operating current**
1307 <of an overcurrent relay or release> value of current at and above which the relay or release
1308 will operate

1309 [SOURCE: IEC 60050-441:1984, 441-16-45, modified – Addition of "relay or", "the current
1310 value" has been replaced by "value of current" and "can" has been replaced by "will".]

1311 **3.7.38**
1312 **current-setting**
1313 <of an overcurrent or overload relay or release> value of current of the main circuit to which the
1314 operating characteristics of the relay or release are referred and for which the relay or release
1315 is set

1316 Note 1 to entry: A relay or release can have more than one current setting, provided by an adjustment dial,
1317 interchangeable heaters, etc.

1318 **3.7.39**
1319 **current setting range**
1320 <of an overcurrent or overload relay or release> range between the minimum and maximum
1321 values over which the current setting of the relay or release can be adjusted

1322 [SOURCE: IEC 60050-441:1984, 441-16-47, modified – "current setting" has been replaced by
1323 "current-setting", addition of "relay or" and "the range" has been replaced by "range".]

1324 **3.7.40**
1325 **dedicated wiring accessory**
1326 prefabricated connection wiring system specifically intended for identified switchgear or
1327 controlgear

1328 Note 1 to entry: A dedicated wiring accessory can be integrated in the switchgear or controlgear or delivered
1329 separately.

1330

1331 **3.8 Characteristic quantities**

1332 **3.9 3.7.1**
1333 **nominal value**
1334 value of a quantity used to designate and identify a component, device, equipment, or system