

INTERNATIONAL STANDARD

**Low-voltage switchgear and controlgear -
Part 5-3: Control circuit devices and switching elements - Requirements for
proximity devices with defined behaviour under fault conditions (PDDB)**

CONTENTS

FOREWORD	7
1 Scope	9
2 Normative references	9
3 Terms, definitions, symbols and abbreviated terms	11
3.1 General terms and definitions	11
3.2 Terms and definitions concerning Annex B	14
3.3 Symbols and abbreviated terms	16
4 Classification	17
4.1 General	17
4.2 Classification according to sensing means	17
4.3 Classification according to the mechanical installation	18
4.4 Classification according to the construction form and size	18
4.5 void	18
4.6 Classification according to type of output	18
4.6.1 General	18
4.6.2 Interface type	18
4.7 Classification according to method of connection	18
4.8 Electrical equipment class	19
4.9 Functional safety device types	19
4.9.1 General	19
4.9.2 Type 1 functional safety device	19
4.9.3 Type 2 functional safety device	19
4.9.4 Type 3 functional safety device	19
4.10 Interlocking device type	19
4.10.1 General	19
4.10.2 Interlocking device type 3	20
4.10.3 Interlocking device type 4	20
4.11 Target coding	20
4.11.1 General	20
4.11.2 Coding level low	20
4.11.3 Coding level medium	20
4.11.4 Coding level high	20
4.12 Operating mode	20
4.12.1 General	20
4.12.2 Operating mode TP (target present)	21
4.12.3 Operating mode TA (target absent)	21
4.12.4 Combined operating modes TP&TA	21
5 Characteristics	21
5.1 General	21
5.2 Safety related switching distances	21
5.2.1 General	21
5.2.2 Switching distance s_{AS}	22
5.2.3 Switching distance s_{PS}	23
5.2.4 Sensing means with operating range	23
5.3 Rated and limiting values for the proximity switch and switching element(s)	23
5.3.1 Voltages	23

5.3.2	Currents	24
5.3.3	Rated supply frequency	24
5.3.4	Void.....	24
5.3.5	Normal load and abnormal load characteristics	24
5.3.6	Short-circuit characteristics	24
5.3.7	OFF-state of the OSSD.....	25
5.3.8	Interface Types A0, B0, C0, C1, C2, C3.....	25
5.4	Utilization categories for the switching element	25
5.5	Safety related characteristics	26
5.5.1	Proximity device with defined behaviour	26
5.5.2	Safety integrity	26
5.5.3	Fault detection on the connection lines of the OSSDs.....	27
5.6	Electrical equipment Class III.....	27
6	Product information	28
6.1	Nature of information – Identification.....	28
6.2	Marking.....	28
6.2.1	General	28
6.2.2	Terminal identification and marking	28
6.2.3	Marking of electrical equipment Class II.....	28
6.2.4	Marking of electrical equipment Class III.....	28
6.3	Instructions for installation, operation, and maintenance	29
6.3.1	General	29
6.3.2	Information for PDDb of electrical equipment Class III.....	29
6.3.3	Diagnostic test information	29
6.3.4	Information about the interface types	30
6.4	Environmental information	30
6.4.1	Environmentally conscious design process (ECD process)	30
6.4.2	Procedure to establish material declaration	30
7	Normal service, mounting and transport conditions	30
7.1	Normal service conditions	30
7.2	Conditions during transport and storage.....	30
7.3	Mounting.....	30
8	Constructional and performance requirements	30
8.1	Constructional requirements	30
8.1.1	Materials	30
8.1.2	Current-carrying parts and their connections	31
8.1.3	Clearance and creepage distances	31
8.1.4	Actuation	31
8.1.5	Void.....	31
8.1.6	Void.....	31
8.1.7	Terminals	31
8.1.8	Void.....	31
8.1.9	Provision for protective earthing	31
8.1.10	Enclosure degree of protection	31
8.1.11	Requirements for proximity switches with integrally connected cables	32
8.1.12	Electrical equipment Class II	32
8.1.13	Chemical stress	32
8.1.14	Equipment design	32
8.1.15	Protection against artificial optical radiation.....	32

8.1.16	Biological and chemical effects	32
8.1.17	Unattended operation	32
8.1.18	Software related security	32
8.1.19	Requirements for embedded software.....	32
8.1.20	Requirements for safety related hardware	33
8.1.21	Limited energy source	33
8.2	Performance requirements	35
8.2.1	Operating conditions.....	35
8.2.2	Temperature rise	42
8.2.3	Dielectric properties.....	42
8.2.4	Ability to make and break under normal load and abnormal load conditions	42
8.2.5	Conditional short-circuit current	42
8.2.6	Electromagnetic compatibility (EMC)	43
8.3	Physical dimensions	46
8.4	Shock and vibration	46
8.4.1	General	46
8.4.2	Shock	46
8.4.3	Vibration.....	47
8.4.4	Results to be obtained	47
8.4.5	Special environmental condition – damp heat, salt mist, shock and vibration	47
8.5	Fault detection requirements.....	47
8.5.1	Faults	47
8.5.2	Diagnostic	48
8.5.3	Lock-out condition	48
8.6	Measures to influence quantities	48
9	Tests	49
9.1	Kind of tests.....	49
9.1.1	General	49
9.1.2	Type tests.....	49
9.1.3	Routine tests	49
9.1.4	Sampling tests.....	49
9.2	Compliance with constructional requirements.....	49
9.2.1	General	49
9.2.2	Test of materials to abnormal heat and fire.....	50
9.2.3	void	50
9.2.4	Enclosures for equipment	50
9.2.5	Mechanical and electrical properties of terminals.....	50
9.2.6	void	50
9.2.7	Limited energy source test.....	50
9.2.8	Stored charge energy test.....	50
9.2.9	Conduit pull-out test, torque test and bending test with metallic conduits	50
9.2.10	Test of earth continuity for protective earth.....	50
9.2.11	Breakdown of components.....	50
9.2.12	Short-circuit and overload protection of ports.....	50
9.2.13	void	50
9.2.14	Wire flexing test.....	50
9.2.15	Artificial optical radiation test.....	50

9.3	Performances	51
9.3.1	Test sequences	51
9.3.2	General test conditions	52
9.3.3	Performance under no load, normal load and abnormal load conditions	53
9.3.4	Performances under short-circuit current conditions	58
9.3.5	Fault insertion tests	58
9.4	Verification of the safety related switching distances.....	59
9.4.1	General	59
9.4.2	Switching distance test	59
9.5	Verification of timing	60
9.5.1	General	60
9.5.2	Verification of turn-on time (t_{on})	60
9.5.3	Verification of turn-off time (t_{off})	60
9.6	Verification of electromagnetic compatibility.....	61
9.6.1	General	61
9.6.2	Immunity.....	61
9.6.3	Emission.....	61
9.7	Test results and test report	61
9.8	Ambient temperature variation and humidity	62
9.8.1	General	62
9.8.2	Temperature variation.....	62
9.8.3	Temperature variation and humidity test	62
9.8.4	Condensing test.....	63
Annex A (informative)	Example of a safety related control system	64
A.1	Description	64
A.1.1	General	64
A.1.2	Safety integrity level requirements, performance level requirements	64
A.1.3	Conditions of use.....	64
A.2	Realization.....	65
A.3	Collection of data.....	65
A.4	Quantitative calculation.....	66
A.5	Results	68
Annex B (informative)	Classification of binary interfaces – Functional safety aspects covered by dynamic testing.....	69
B.1	General.....	69
B.2	Minimum information on compatibility to be provided in the product documentation	69
B.2.1	General	69
B.2.2	Basic electrical parameters.....	69
B.2.3	Structure of the identifying key for a Pddb	69
B.3	Characteristics of Interface Type A0	70
B.3.1	General	70
B.3.2	Static characteristics of Interface Type A0	71
B.3.3	Dynamic characteristics of Interface Type A0	71
B.3.4	Product information to be supplied in the product documentation.....	71
B.4	Characteristics of Interface Type B0	72
B.4.1	General	72
B.4.2	Static characteristics of Interface Type B0	72
B.4.3	Dynamic characteristics of Interface Type B0	72

B.4.4	Product information to be supplied in the product documentation	74
B.5	Characteristics of Interface Type C	74
B.5.1	General	74
B.5.2	Static characteristics of Interface Type C	75
B.5.3	Dynamic characteristics of Interface Type C	75
B.5.4	Classification of Interface Type C	76
B.5.5	Product information to be supplied in the product documentation	77
Annex C	Void	79
Annex D (informative)	Void	80
Annex E (informative)	Product information	81
Bibliography		84
Figure 1	Absent and present switching distance s_{AS} and s_P for a Pddb with operating mode TP (target present)	22
Figure 2	Absent and present switching distance s_A and s_{PS} for a Pddb with operating mode TA (target absent)	23
Figure 3	Characteristics of the absent switching distance	36
Figure 4	Characteristics of the present switching distance	37
Figure 5	Voltages and current characteristics	54
Figure 6	Test circuit diagram for the detection of stuck-at-high faults	56
Figure A.1	Position monitoring of movable guards for the prevention of hazardous movements	65
Figure A.2	Safety-related block diagram of the safety-related function	66
Figure B.1	Interface Type A0	70
Figure B.2	Interface Type B0	72
Figure B.3	Test pulse delay Δt_i much smaller than test pulse duration t_i	73
Figure B.4	Test pulse delay Δt_i greater than test pulse duration t_i	73
Figure B.5	Interface Type C	74
Figure B.6	Dynamic behaviour Interface Type C	75
Table 1	Symbols and abbreviated terms	16
Table 2	Interface types of PddbS	18
Table 3	Operating modes of PddbS	20
Table 4	Static characteristics of Interface Types A0, B0, C0, C1, C2 and C3	25
Table 5	Dynamic characteristics of Interface Types A0, B0, C0, C1, C2 and C3	25
Table 6	Characteristic safety values of functional safety device types	27
Table 7	Product information on Interface Types A0, B0, C0, C1, C2 and C3	30
Table 8	Limits for limited energy sources without an overcurrent protective device	34
Table 9	Limits for limited energy sources with an overcurrent protective device	34
Table 10	Limits for limited energy source with limited current impedance	35
Table 11	Characteristics of the absent switching distance	36
Table 12	Characteristics of the present switching distance	37
Table 13	Acceptance criteria for s_{Ai}	39
Table 14	Acceptance criteria for s_{Pi}	39

Table 15 – Operating voltages of 24 V solid state OSSD	42
Table 16 – Reaction of Pddb during test	44
Table 17 – Immunity test requirements for Pddb	45
Table A.1 – Collection of safety related reliability data	65
Table B.1 – Basic electrical parameters	69
Table B.2 – Product information Interface Type A0 – Source	71
Table B.3 – Product information Interface Type A0 – Sink	71
Table B.4 – Product information Interface Type B0 – source	74
Table B.5 – Product information Interface Type B0 – sink	74
Table B.6 – Classification for Interface Type C	76
Table B.7 – Product information Interface Type C – Source	77
Table B.8 – Product information Interface Type C – Sink	78
Table E.1 – Product information	81

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Low-voltage switchgear and controlgear -
Part 5-3: Control circuit devices and switching elements -
Requirements for proximity devices with defined
behaviour under fault conditions (PDDB)**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60947-5-3 has been prepared by subcommittee SC121A: Low-voltage switchgear and controlgear, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage. It is an International Standard.

This third edition cancels and replaces the second edition published in 2013. This edition constitutes a technical revision.

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

- a) Update of the scope, refined fault performance aspects and relation to standards of functional safety.
- b) The 'safe state' is generally determined as 'OFF-state' (see 3.1.8).

- c) Update of EMC requirements in 8.2.6 with references to IEC 60947-5-2:2019 for acceptance criteria A, B and C and requirements of Table 17 for acceptance criterion DS.
- d) Interface types for binary interfaces are introduced (see 4.6.2 and Annex B).
- e) Functional safety device types according to ISO 13849-1:2023 Annex O (see 4.9).
- f) Interlocking device type and coding level according to ISO 14119 are adapted (see 4.10 and 4.11).
- g) The operating modes target present (4.12.2) and target absent (4.12.3) are introduced.
- h) The 'switching distance' replaces the terms 'release' and 'operating'. The behaviour of the Pddb is described according to the operating mode (4.12).
- i) The context and verification of the switching distances are considered according to ISO/IEC Guide 98-3:2008 (GUM) and IEC TR 63649¹ (see 8.2.1.3 and 9.4.2).
- j) Requirements for electrical equipment class III are refined.
- k) The risk time is replaced with the safety response time (3.1.11).
- l) Annex A gives a new example of safety related control system.
- m) The test sequences (see 9.3.1) are updated for the specific behaviour of a Pddb.

This document is to be read in conjunction with IEC 60947-1:2020 and IEC 60947-5-2:2019. The provisions of Part 1 and Part 5-2 are only applicable to this document where specifically called for. The numbering of the subclauses of this document is sometimes not continuous because it is based on the numbering of the subclauses of IEC 60947-1:2020 or IEC 60947-5-2:2019.

The text of this International Standard is based on the following documents:

Draft	Report on voting
121A/716/FDIS	121A/728/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

¹ Under preparation. Stage at the time of publication: IEC DTR 63649:2025.

1 Scope

This part of IEC 60947 provides additional requirements to those given in IEC 60947-5-2 and IEC 60947-5-1:2024, Annex D (reed contact magnetic switches). It addresses the fault performance aspects of proximity devices with a defined behaviour under fault conditions (PDDDB). It does not address any other characteristics that can be required for specific applications.

This document does not apply to protective equipment to directly detect the presence of persons, that are covered by the IEC 61496 series or IEC TS 62998 series.

NOTE 1 A PDDDB device can be used to detect indirectly the presence of a person, for example by detecting the position of a platform on which the operator stands (example, garbage trucks).

This document does not specify requirements for the analogue output of PDDDB, if any.

This document does not deal with any specific requirements on acoustic noise as the noise emission of proximity devices is not considered to be a relevant hazard.

A PDDDB product is intended to be used as sensing subsystem of a safety related control system according to IEC 62061 or ISO 13849-1. Depending on construction principles and complexity, this document is based on product development of the IEC 61508 series to meet the product specific requirements of one or more of the following:

- IEC 61508 series;
- IEC 62061;
- ISO 13849 series.

NOTE 2 The Functional safety device type classification regarding functional safety correlates with IEC 62683-2-3.

This document includes requirements for PDDDB when designed for use as part of an interlocking device according to ISO 14119.

This document does not consider aspects of:

- software updates and self-evolving behaviour;
- explosive atmospheres.

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

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

IEC 60204-1:2016, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*
IEC 60204-1:2016/AMD1:2021

IEC 60730-1, *Automatic electrical controls - Part 1: General requirements*

IEC 60812, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 60947-1:-², *Low-voltage switchgear and controlgear - Part 1: General rules*

IEC 60947-5-1:2024, *Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices*

IEC 60947-5-2:2019, *Low-voltage switchgear and controlgear - Part 5-2: Control circuit devices and switching elements - Proximity switches*

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

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

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

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

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

IEC 61000-4-8, *Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test*

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

IEC 61000-4-29, *Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port - immunity tests*

IEC 61131-2:2017, *Programmable controllers - Part 2: Equipment requirements and tests*

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

IEC 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

IEC 61508-3, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements (see Functional Safety and IEC 61508)*

IEC 62061:2021, *Safety of machinery - Functional safety of safety-related control systems*
IEC 62061:2021/AMD1:2024

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

ISO 14119:2024, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection*

² Under preparation. Stage at the time of publication: IEC CDV 60947-1:2026.

Bibliography

- [1] ISO/IEC Guide 98-3:2008, *Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in Measurement (GUM)*
- [2] IEC 60050-192:2015, *International Electrotechnical Vocabulary (IEV) – Part 192: Dependability*
- [3] IEC 60050-441:1984, *International Electrotechnical Vocabulary (IEV) - Chapter 441: Switchgear, controlgear and fuses*
Amendment 1:2000
- [4] IEC 60068-2-6:2007, *Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)*
- [5] IEC 60068-2-14:2009, *Environmental testing - Part 2-14: Tests - Test N: Change of temperature*
- [6] IEC 60068-2-27:2008, *Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock*
- [7] IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*
IEC 60204-1:2016/AMD1:2021
- [8] IEC 60364 (all parts), *Low-voltage electrical installations*
- [9] IEC 60445:2010, *Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors*
- [10] IEC 60947-5-6:1999, *Low-voltage switchgear and controlgear - Part 5-6: Control circuit devices and switching elements - DC interface for proximity sensors and switching amplifiers (NAMUR)*
- [11] IEC 61000-3-2:2005, *Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*
Amendment 1:2008
Amendment 2:2009
- [12] IEC 61000-3-3:2008, *Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*
- [13] IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*
IEC 61000-4-13:2002/AMD1:2009
IEC 61000-4-13:2002/AMD2:2015
- [14] IEC 61000-6-7:2014, *Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations*
- [15] IEC 61165:2006, *Application of Markov techniques*

- [16] IEC 61326-3-1:2008, *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) - General industrial applications*
- [17] IEC 61496-1:2012, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests*
- [18] IEC 61496-2:2013, *Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*
- [19] IEC 61496-3:2008, *Safety of machinery - Electro-sensitive protective equipment - Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)*
- [20] IEC 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements*
- [21] IEC 61508-4:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 4: Definitions and abbreviations*
- [22] IEC 61508-5:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 5: Examples of methods for the determination of safety integrity levels*
- [23] IEC 61508-6:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*
- [24] IEC 61508-7:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 7: Overview of techniques and measures*
- [25] IEC 61511 (all parts), *Functional safety - Safety instrumented systems for the process industry sector*
- [26] IEC 61511-1:2003, *Functional safety - Safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and software requirements*
- [27] IEC 61511-2:2003, *Functional safety - Safety instrumented systems for the process industry sector - Part 2: Guidelines for the application of IEC 61511-1*
- [28] IEC 61511-3:2003, *Functional safety - Safety instrumented systems for the process industry sector - Part 3: Guidance for the determination of the required safety integrity levels*
- [29] IEC 61709:2017, *Electric components – Reliability – Reference conditions for failure rates and stress models for conversion*
- [30] CISPR 11:2009, *Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement*
Amendment 1:2010
- [31] ISO 14119:1998, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection*
Amendment 1:2007

- [32] IEC 60050-426:2020, *International Electrotechnical Vocabulary (IEV) - Part 426: Explosive atmospheres*
- [33] IEC TS 62998 (all parts), *Safety of machinery - Safety-related sensors used for the protection of persons*
- [34] IEC 61496 (all parts), *Safety of machinery - Electro-sensitive protective equipment*
- [35] IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013
- [36] IEC 62683-2-3, *Product data and properties for information exchange - Engineering data – Part 2-3: Functional safety and reliability*
- [37] ISO/IEC Guide 99:2007, *International vocabulary of metrology - basic and general concepts and associated terms (VIM)*
- [38] IEC Guide 115:2021, *Application of uncertainty of measurement to conformity assessment activities in the electrotechnical sector*
- [39] IEC TS 63058:2021, *Switchgear and controlgear and their assemblies for low voltage - Environmental aspects*
- [40] IEC 31010:2019, *Risk management - Risk assessment techniques*
- [41] IEC 62443 (all parts), *Industrial communication networks - Network and system security*
- [42] IEC 63208, *Low-voltage switchgear and controlgear and their assemblies - Security requirements*
- [43] IEC TR 63649:–³, *Low-voltage switchgear and controlgear - Determination, verification and validation of safety related performance characteristics*
- [44] ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation*
- [45] IEC 61709, *Electric components - Reliability - Reference conditions for failure rates and stress models for conversion*
- [46] ISO 26262-11:2018, *Road vehicles - Functional safety - Part 11: Guidelines on application of ISO 26262 to semiconductors*

³ Under preparation. Stage at the time of publication: IEC DTR 63649:2025.