BS EN IEC 60730-1:2024+A11:2024



BSI Standards Publication

Automatic electrical controls

Part 1: General requirements

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National foreword

This British Standard is the UK implementation of EN IEC 60730-1:2024+A11:2024. It is derived from IEC 60730-1:2022. It supersedes BS EN 60730-1:2016+A2:2022, which will be withdrawn on 25 April 2025.

The start and finish of text introduced or altered by amendment A11 is indicated in the text by tags. Tags indicating changes to text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A11 is indicated by ⟦A11⟩ ⟨A11⟩.

The UK participation in its preparation was entrusted to Technical Committee CPL/72, Electrical control devices for household equipment and appliances.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Amendments/corrigenda issued since publication

Date	Text affected

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60730-1:2024+A11

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English Version

Automatic electrical controls - Part 1: General requirements (IEC 60730-1:2022)

Dispositifs de commande électrique automatiques - Partie 1: Exigences générales (IEC 60730-1:2022)

Automatische elektrische Regel- und Steuergeräte - Teil 1: Allgemeine Anforderungen (IEC 60730-1:2022)

This European Standard was approved by CENELEC on 2024-01-31. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

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European foreword

The text of document 72/1307/FDIS, future edition 6 of IEC 60730-1, prepared by IEC/TC 72 "Automatic electrical controls" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60730-1:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-04-25
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) –

This document supersedes EN 60730-1:2016 and all of its amendments and corrigenda (if any).

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

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 60730-1:2022 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 standard indicated:

IEC 60990:2016	NOTE	Approved as EN 60990:2016 (not modified)
IEC 60243-1	NOTE	Approved as EN 60243-1
IEC 60669-1	NOTE	Approved as EN 60669-1
IEC 60730-2-5	NOTE	Approved as EN 60730-2-5
IEC 60998-2-1	NOTE	Approved as EN 60998-2-1
IEC 61000-6-7:2014	NOTE	Approved as EN 61000-6-7:2015 (not modified)
IEC 61032:1997	NOTE	Approved as EN 61032:1998 (not modified)
IEC 61058-1-1	NOTE	Approved as EN 61058-1-1
IEC 61140:2016	NOTE	Approved as EN 61140:2016 (not modified)
IEC 61508-3:2010	NOTE	Approved as EN 61508-3:2010 (not modified)
IEC 61508-7:2010	NOTE	Approved as EN 61508-7:2010 (not modified)

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IEC 61810-1	NOTE	Approved as EN 61810-1
IEC 63044-3	NOTE	Approved as EN IEC 63044-3
IEC 63044-5-1:2017	NOTE	Approved as EN IEC 63044-5-1:2019 (not modified)
ISO 62:2008	NOTE	Approved as EN ISO 62:2008 (not modified)
ISO 75-1	NOTE	Approved as EN ISO 75-1
ISO 178:2019	NOTE	Approved as EN ISO 178:2019 (not modified)
ISO 527-1:2019	NOTE	Approved as EN ISO 527-1:2019 (not modified)
ISO 16484-2	NOTE	Approved as EN ISO 16484-2

European foreword to amendment A11

This document (EN IEC 60730-1:2024/A11:2024) has been prepared by Technical Committee CLC/TC 72 “Automatic controls for household use”, the secretariat of which is held by BSI.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-04-25
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) —*

* No date of withdrawal (dow) has been given pending the updating of all the Parts 2 to align with EN IEC 60730-1:2024. The applicable date of withdrawal is given in each part 2. It is intended the dow for this Part 1 will be fixed once all the Parts 2 have been updated.

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

This document is read in conjunction with appropriate Part 2 for a particular type of control, or for controls for particular applications. This document can also be applied, so far as reasonable, to controls not mentioned in a Part 2, and to controls designed on new principles, in which case additional requirements can be necessary.

Subclauses which are additional to those in IEC 60730-1:2022 are numbered 601, 602 etc. New annexes are labelled ZA, ZB etc.

Special national conditions causing a deviation from this document are listed in Annex ZB (normative).

National deviations from this document are listed in Annex ZC (informative).

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users’ national committee. A complete listing of these bodies can be found on the CENELEC website.

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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.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60038	-	IEC standard voltages	EN 60038	2011
IEC 60065	2014	Audio, video and similar electronic apparatus – Safety requirements	EN 60065	2014
			+ A11	2017
			+ AC	2016
			+ AC	2017
			+ AC	2018
IEC 60068-2-75	-	Environmental testing – Part 2–75: Tests - Test Eh: Hammer tests	EN 60068-2-75	2014
IEC 60085	-	Electrical insulation - Thermal evaluation and designation	EN 60085	2008
IEC 60099-1	1991[1]	Surge arresters – Part 1: Nonlinear resistor type gapped arresters for a.c. systems	-	-
IEC 60112	2020	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN IEC 60112	2020
IEC 60127	series	Miniature fuses	EN 60127-1	2006
			+ A1	2011
			+ A2	2015
			EN 60127-2	2014
			EN 60127-3	2015
			+ A1	2020
			EN 60127-4	2005
			+ A1	2009
			+ A2	2013
			EN 60127-6	2014
			EN 60127-7	2016
			EN IEC 60127-8	2018

[1] IEC 60099-1 is referred to into Annex C (informative) only, therefore it is listed in the bibliography. Future Amendment 1 to IEC 60730-1:2022 will refer to IEC 60664-1:2020 and therefore there will be a new reference to IEC 61643 (all parts) instead of IEC 60099-1.

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Publication	Year	Title	EN/HD	Year
IEC 60227-1	-	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V Part 1: General requirements	EN 50525-2-11	2011
IEC 60245-1	-	Rubber insulated cables - Rated voltages up to and including 450/750 V Part 1: General requirements	EN 50525-2-21 + AC	2011 2013
IEC 60269	series	Low-voltage fuses	EN 60269-1 + A1 + A2 EN 60269-4 + A1 + A2 EN 60269-6 HD 60269-2 + A1 HD 60269-3 + A1	2007 2009 2014 2009 2012 2016 2011 2013 2017 2010 2013
IEC 60335-1	2020	Household and similar electrical appliances – Safety – Part 1: General requirements	EN IEC 60335-1 + A11	2023 2023
IEC 60384-14	-	Fixed capacitors for use in electronic equipment - Part 14: Sectional specification - Fixed capacitors for electromagnetic interference suppression and connection to the supply mains	EN 60384-14 + A1 + AC	2013 2016 2016
IEC 60384-16	-	Fixed capacitors for use in electronic equipment Part 16: Sectional specification: Fixed metallized polypropylene film dielectric DC capacitors	EN IEC 60384-16 + AC	2019 2020
IEC 60384-17	-	Fixed capacitors for use in electronic equipment - Part 17: Sectional specification - Fixed metallized polypropylene film dielectric AC and pulse capacitors	EN IEC 60384-17 + AC	2019 2021
IEC 60417	Database	Graphical symbols for use on equipment	-	-
IEC 60423	-	Conduit systems for cable management – Outside diameters of conduits for electrical installations and threads for conduits and fittings	EN 60423	2007
IEC 60529 + AMD1 + AMD2	1989 1999 2013	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May + A1 + A2 + AC	1991 1993 2000 2013 2016
IEC 60539	series	Directly heated negative temperature coefficient thermistors	EN 60539-1 + AC EN IEC 60539-2	2016 2017 2019

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Publication	Year	Title	EN/HD	Year
IEC 60664-1	2007[2]	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests	EN 60664-1	2007
IEC/TR 60664-2-2	2002[3]	Insulation coordination for equipment within low-voltage systems - Part 2–2: Interface considerations - Application guide	-	-
IEC 60664-3	2016	Insulation coordination for equipment within low-voltage systems Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	2017
IEC 60664-4	-	Insulation coordination for equipment within low-voltage systems - Part 4: Consideration of high-frequency voltage stress	EN 60664-4 + corr. Oct.	2006 2006
IEC 60695-2-10	-	Fire hazard testing Part 2–10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN IEC 60695-2-10	2021
IEC 60695-2-11	2021	Fire hazard testing - Part 2–10: Glowing/hot-wire based test methods - Glow-wire flammability test method for end products (GWEPT)	EN IEC 60695-2-11	2021
IEC 60695-10-2	-	Fire hazard testing - Part 10–2: Abnormal heat - Ball pressure test	EN 60695-10-2	2014
IEC 60738	series	Thermistors - Directly heated positive function temperature coefficient	EN 60738-1 + A1 EN 60738-1-1 EN 60738-1-2 EN 60738-1-3 EN 60738-1-4	2006 2009 2008 2008 2008 2008
IEC 60747-5-5	-	Semiconductor devices – Part 5–5: Optoelectronic devices – Photocouplers	EN IEC 60747-5-5	2020
IEC 60884-1	-	Plugs and socket-outlets for household and similar purposes – Part 1: General requirements	IEC 60884-1	2022
IEC 60884-2-5	2017	Plugs and socket-outlets for household and similar purposes – Part 2–5: Particular requirements for adaptors	IEC 60884-2-5	2017
IEC 60998-2-2	-	Connecting devices for low-voltage circuits for household and similar purposes Part 2–2: Particular requirements for connecting devices as separate entities with screwless-type clamping units	EN 60998-2-2	2004
IEC 60998-2-3	-	Connecting devices for low-voltage circuits for household and similar purposes Part 2–3: Particular requirements for connecting devices as separate entities with insulation-piercing clamping units	EN 60998-2-3	2004

[2] withdrawn
[3] Dated as no European equivalent exists.

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Publication	Year	Title	EN/HD	Year
IEC 60999-1	-	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 mm2 up to 35 mm2 (included)	EN 60999-1	2000
IEC 61000-3-2	-	El Electromagnetic compatibility (EMC) – Part 3–2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)	EN IEC 61000-3-2 + A1	2019 2021
IEC 61000-3-3	-	Electromagnetic compatibility (EMC) – Part 3–3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection	EN 61000-3-3 + A1 + A2 + AC	2013 2019 2021 2022
IEC 61000-3-11	-	Electromagnetic compatibility (EMC) – Part 3–11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection	EN IEC 61000-3-11	2019
IEC 61000-3-12	-	Electromagnetic compatibility (EMC) – Part 3–12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase	EN 61000-3-12	2011
IEC 61000-4-2	2008	Electromagnetic compatibility (EMC) Part 4–2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) Part 4–3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN IEC 61000-4-3	2020
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 + A1	2014 2017	Electromagnetic compatibility (EMC) Part 4–5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5 + A1	2014 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 + AC	2014 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

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Publication	Year	Title	EN/HD	Year
IEC 61000-4-11	-	Electromagnetic compatibility (EMC) - Part 4–11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase	EN IEC 61000-4-11 + AC	2020 2020
IEC 61000-4-13 + A1 + A2	2002 2009 2015	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	EN 61000-4-13 + A1 + A2	2002 2009 2016
IEC 61000-4-20	-	Electromagnetic compatibility (EMC) – Part 4–20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides	EN IEC 61000-4-20	2022
IEC 61000-4-21	-	Electromagnetic compatibility (EMC) – Part 4–21: Testing and measurement techniques – Reverberation chamber test methods	EN 61000-4-21	2011
IEC 61000-4-22	-	Electromagnetic compatibility (EMC) – Part 4–22: Testing and measurement techniques – Radiated emissions and immunity measurements in fully anechoic rooms (FARs)	EN 61000-4-22	2011
IEC 61000-4-28	-	Electromagnetic compatibility (EMC) - Part 4–28: Testing and measurement techniques - Variation of power frequency, immunity test	EN 61000-4-28 + A1 + A2	2000 2004 2009
IEC 61000-6-1	2016	Electromagnetic compatibility (EMC) – Part 6–1: Generic standards – Immunity standard for residential, commercial and light-industrial environments	EN IEC 61000-6-1	2019
IEC 61000-6-2	2016	Electromagnetic compatibility (EMC) – Part 6–2: Generic standards – Immunity standard for industrial environments	EN IEC 61000-6-2	2019
IEC 61000-6-3	2020	Electromagnetic compatibility (EMC) – Part 6–3: Generic standards – Emission standard for equipment in residential environments	EN IEC 61000-6-3	2021
IEC 61000-6-4	2018	Electromagnetic compatibility (EMC) – Part 6–4: Generic standards – Emission standard for industrial environments	EN IEC 61000-6-4	2019
IEC 61051-1	-	Varistors for use in electronic equipment – Part 1: Generic specification	EN IEC 61051-1	2018
IEC 61051-2	-	Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors	EN IEC 61051-2	2021
IEC 61051-2-2	1991[4]	Varistors for use in electronic equipment – Part 2: Blank detail specification for zinc oxide surge suppression varistors. Assessment level E	-	-

[4] Dated as no European equivalent exists.

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Publication	Year	Title	EN/HD	Year
IEC 61210	-	Connecting devices - Flat quick-connect terminations for electrical copper conductors - Safety requirements	EN 61210	2010
IEC 61249	series	Materials for printed boards and other interconnecting structures	EN 62326-1 EN 62326-4-1	2002 1997
IEC 61558-2-6	-	Safety of transformers, reactors, power supply units and combinations thereof − Part 2–6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications	EN 61558-2-6	2009
IEC 61558-2-16	-	Safety of transformers, reactors, power supply units and combinations thereof − Part 2–16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications	EN 61558-2-16 + A1	2009 2013
IEC 61810-3	-	Electromechanical elementary relays – Part 3: Replays with forcibly guided (mechanically linked) contacts	EN 61810-3	2015
IEC 62151	-	Safety of equipment electrically connected to a telecommunication network	EN 62949 [5]	2017
IEC 62319	series	Polymeric thermistors – Directly heated positive step function temperature coefficient	EN 62319-1 EN 62319-1-1	2005 2005
IEC 62326	series	Printed boards	EN 62326-1 EN 62326-4 EN 62326-4-1 EN 62326-20	2002 1997 1997 2016
IEC 62368-1	-	Audio/video, information and communication technology equipment - Part 1: Safety requirements	EN IEC 62368-1 + A11 + AC	2020 2020 2020
IEC 63044	series	Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS)	EN 63044-5-2 EN 63044-5-3	2019 2019
CISPR 11	-	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011 + A1 + A11 + A2	2016 2017 2020 2021
CISPR 14-1	2020	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission	EN IEC 55014-1	2021
CISPR 32 + AMD1	2015 2019	Electromagnetic compatibility of multimedia equipment – Emission requirements	EN 55032 + AC + A1 + A11	2015 2016 2020 2020

[5] Reference added since no European equivalent exists for IEC 62151.

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Publication	Year	Title	EN/HD	Year
ISO 4046-4	2016	Paper, board, pulps and related terms − Vocabulary − Part 4: Paper and board grades and converted products	ISO 4046-4	2016
ISO 7637-2	2011	Road vehicles – Electrical disturbances from conduction and coupling – Part 2: Electrical transient conduction along supply lines only	ISO 7637-2	2011
ISO 7637-3	2016	Road vehicles – Electrical disturbances from conduction and coupling – Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines	ISO 7637-3	2016
ISO 16484	series	Building automation and control systems (BACS)	EN ISO 16484-1	2010
			EN ISO 16484-2	2004
			EN ISO 16484-3	2005
			EN ISO 16484-5	2017
			+ A1	2020
			EN ISO 16484-6	2020

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Annex ZB
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard.

For the countries for which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

Clause	Special national condition
3.7.3	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0 controls are not allowed.
3.7.4	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0I controls are not allowed.
3.7.6.3	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0I controls are not allowed.
4.3.4.3.1	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0 and class 0I controls are not allowed.
4.3.4.3.3	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0 and class 0I controls are not allowed.
5.4.2.2	**United Kingdom**
	Add to the requirement in 5.4.2.2:
	Terminals intended exclusively for a live external conductor shall be indicated by the letter ‘L’.
5.4.2.4	**United Kingdom**
	Add to the requirement in 5.4.2.4:
	The letter ‘L’ shall not be used except as indicated above.
7.1.1	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0I controls are not allowed.
9.9.5	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Class 0 and class 0I controls are not allowed.
15.2	**Austria, Belgium, Denmark, France, Germany, Italy, Norway and United Kingdom**
	Table 16, footnote [c] Class 0I controls are not allowed.
18.2.1	**Estonia, Finland, Norway and Sweden**
	In the first dashed paragraph, replace “(−10 ± 2) °C” by “(−25 ± 2) °C”.

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Annex ZC
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN and/or CENELEC national member.

This European Standard does not fall under any Directive/Regulation of the EU.

In the relevant CEN and/or CENELEC countries, these A-deviations are valid instead of the respective provisions of the European Standard until the national situation causing the A-deviation has changed.

Clause	Deviation
9.1.3	**United Kingdom** (Statutory Instrument 1768:1994) Add to the requirement: These regulations apply to all plugs for domestic use at a voltage of not less than 200 V and in general allow only plugs to BS 1363-1 to be fitted.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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AUTOMATIC ELECTRICAL CONTROLS –

Part 1: General requirements

FOREWORD

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IEC 60730-1 has been prepared by IEC technical committee 72: Automatic electrical controls. It is an International Standard.

This sixth edition cancels and replaces the fifth edition published in 2013, Amendment 1:2015 and Amendment 2:2020. This edition constitutes a technical revision.

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

a)	Structure of the main clauses	The clauses of the standard are grouped into two sections of requirements, where • the first section consists of the Clauses 5 to 13 that, in general, addresses the construction of the product. It is noted that certain construction requirements may have verification requirements integrated within the clause to facilitate usage of the standard, and • the second section consists of Clauses 14 to 26 that addresses the verification requirements;
b)	Scope	Relocated and deleted clauses to better reflect the products covered under the part 1 and for easier reading;
c)	Normative references	Updated references;
d)	Terms and definitions	Revised text in certain clauses and relocated relevant Clause H.3 subclauses into Clause 3;
e)	General requirements	General structure of the standard explained along with a figure to depict the intent;
f)	General notes on tests	Reduced sample size from 3 to 1, yet requiring analysis; order of tests more flexible; relocation of battery requirements from Annex V;
g)	Rating	Deleted – covered under the scope;
h)	Classification	Deleted – covered under information;
i)	Information	Updated Table 1 to reflect entries from the classification clause, and all cross-references;
j)	Protection against electric shock	Revised Clause 8 to include Clause H.8 and Clause V.8 subclauses, revised clauses as appropriate to distinguish between a live part and a hazardous live part;
k)	Provision for protective earthing	
l)	Construction requirements	One Y1 capacitor allowed; relocated relevant requirements of Clause H.11 and Clause V.11 into Subclause 9.2.5 and Subclause 9.13.4.4 respectively;
m)	Moisture and dust	Relocated IP table from classification to Clause 14; updated references;
n)	Manufacturing deviation and drift	All clauses moved to Annex H since the requirements pertain to functional safety of controls;
o)	EMC-Emissions	Moved Clause H.23 into Clause 23;
p)	EMC-Immunity	New EMC requirements (performance) for all controls except incorporated/integrated controls with Class A control functions. Products intended for HBES/BACS are also subjected to these requirements;
q)	Fault assessment on electronic circuits	Fault assessment moved from Annex H to Clause 13; deleted test abnormal voltage for electronic disconnection;

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r)	Annex H	Relocated all relevant requirements for electronics to the respective clauses within the body of the standard and retained requirements related to functional safety in this annex;
s)	Annex T	Revised clauses for clarity in Annex P;
t)	Annex U	Removed, the necessity of the annex was not seen anymore;
u)	Annex V	Included in the main part of the standard.

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

Draft	Report on voting
72/1307/FDIS	72/1320/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 https//www.iec.ch/publications.

A list of all parts of the IEC 60730 series, under the general title: *Automatic electrical controls*, can be found on the IEC website.

In the development of a fully international standard to cover automatic electrical controls, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.

The "in some countries" clauses have been moved to the regional respectively national differences in Annex Q to Annex T.

It is envisaged that in the next edition of this document, it will be found possible to remove those differences that are covered by new IEC standards now being prepared by other technical committees.

This part 1 is to be used in conjunction with the appropriate part 2 for a particular type of control, or for controls for particular applications. This part 1 may also be applied, so far as reasonable, to controls not mentioned in a part 2, and to controls designed on new principles, in which cases additional requirements may be considered to be necessary.

Where, for a particular clause or subclause, the text of part 2 indicates:

Addition: the part 1 text applies with the additional requirement indicated in a part 2;

Modification: the part 1 text applies with a minor change as indicated in a part 2;

Replacement: the part 2 text contains a change which replaces the part 1 text in its entirety.

Where no change is necessary, the part 2 indicates that the relevant clause or subclause applies.

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NOTE In this document the following print types are used:

– Requirements proper: in roman type;

– *Test specifications: in italic type;*

– Explanatory matter: in smaller roman type;

– Defined terms: **bold type**.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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AUTOMATIC ELECTRICAL CONTROLS –

Part 1: General requirements

1 Scope

This document applies to automatic electrical controls

- for use in, on, or in association with equipment for household appliance and similar use;

NOTE 1 Throughout this document, the word "equipment" means "appliance and equipment".

- for building automation within the scope of ISO 16484 series and IEC 63044 series (HBES/BACS);

EXAMPLE 1 Independently mounted water valves, controls in smart grid systems and controls for building automation systems within the scope of ISO 16484-2.

- for equipment that is used by the public, such as equipment intended to be used in shops, offices, hospitals, farms and commercial and industrial applications;

EXAMPLE 2 Controls for commercial catering, heating and air-conditioning equipment.

- that are **smart enabled controls**;

EXAMPLE 3 Smart grid control, remote interfaces/control of energy-consuming equipment including computer or smart phone.

- that are AC or DC powered controls with a rated voltage not exceeding 690 V AC or 600 V DC where the DC source is provided by primary or secondary batteries;
- used in, on, or in association with equipment that use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof;
- utilized as part of a control system or controls which are mechanically integral with multifunctional controls having non-electrical outputs;
- using NTC or **PTC thermistors** and to discrete **thermistors**, requirements for which are contained in Annex J;
- that are mechanically or electrically operated, responsive to or controlling such characteristics as temperature, pressure, passage of time, humidity, light, electrostatic effects, flow, or liquid level, current, voltage, acceleration, or combinations thereof;
- as well as manual controls when such are electrically and/or mechanically integral with automatic controls.

NOTE 2 Requirements for manually actuated mechanical switches not forming part of an automatic control are contained in IEC 61058-1-1.

This document applies to

– the inherent safety of automatic electrical controls, and

– functional safety of automatic electrical controls and safety related systems,

– controls where the performance (for example the effect of EMC phenomena) of the product can impair the overall safety and performance of the controlled system,

– the operating values, operating times, and operating sequences where such are associated with equipment safety.

This document specifies the requirements for construction, operation and testing of automatic electrical controls used in, on, or in association with an equipment.

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This document does not

- apply to automatic **electronic controls** intended exclusively for industrial process applications unless explicitly mentioned in the relevant part 2 or the equipment standard. However, this document can be applied to evaluate automatic electrical controls intended specifically for industrial applications in cases where no relevant safety standard exists.
- take into account the response value of an automatic action of a control, if such a response value is dependent upon the method of mounting the control in the equipment. Where a response value is of significant purpose for the protection of the user, or surroundings, the value defined in the appropriate equipment standard or as determined by the manufacturer will apply.
- address the integrity of the output signal to the network devices, such as interoperability with other devices unless it has been evaluated as part of the control system.

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, *IEC standard voltages*

IEC 60065:2014, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

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

IEC 60099-1:1991, *Surge arresters – Part 1: Non-linear resistor type gapped surge arresters for a.c. systems*[1]

IEC 60112:2020, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60127 (all parts), *Miniature fuses*

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60269 (all parts), *Low-voltage fuses*

IEC 60335-1:2020, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

[1] Withdrawn.

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IEC 60384-16, *Fixed capacitors for use in electronic equipment – Part 16: Sectional specification – Fixed metallized polypropylene film dielectric DC capacitors*

IEC 60384-17, *Fixed capacitors for use in electronic equipment – Part 17: Sectional specification – Fixed metallized polypropylene film dielectric AC and pulse capacitors*

IEC 60417, *Graphical symbols for use on equipment*

IEC 60423, *Conduit systems for cable management – Outside diameters of conduits for electrical installations and threads for conduits and fittings*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 60539 (all parts), *Directly heated negative temperature coefficient thermistors*

IEC 60664-1:2007[2], *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC TR 60664-2 (all parts), *Insulation coordination for equipment within low-voltage systems*

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60664-4, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2021, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

IEC 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*

IEC 60738 (all parts), *Thermistors – Directly heated positive temperature coefficient*

IEC 60747-5-5, *Semiconductor devices – Part 5-5: Optoelectronic devices – Photocouplers*

IEC 60884-1, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

IEC 60884-2-5:2017, *Plugs and socket-outlets for household and similar purposes – Part 2-5: Particular requirements for adaptors*

IEC 60998-2-2, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-2: Particular requirements for connecting devices as separate entities with screwless-type clamping units*

[2] Withdrawn.

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IEC 60998-2-3, *Connecting devices for low-voltage circuits for household and similar purposes – Part 2-3: Particular requirements for connecting devices as separate entities with insulation-piercing clamping units*

IEC 60999-1, *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)*

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

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

IEC 61000-3-11, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase*

IEC 61000-4-2:2008, *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 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

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 for equipment with current up to 16 A per phase*

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

IEC 61000-4-20, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-4-21, *Electromagnetic compatibility (EMC) – Part 4-21: Testing and measurement techniques – Reverberation chamber test methods*

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IEC 61000-4-22, *Electromagnetic compatibility (EMC) – Part 4-22: Testing and measurement techniques – Radiated emissions and immunity measurements in fully anechoic rooms (FARs)*

IEC 61000-4-28, *Electromagnetic compatibility (EMC) – Part 4-28: Testing and measurement techniques – Variation of power frequency, immunity test for equipment with input current not exceeding 16A per phase*

IEC 61000-6-1:2016, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments*

IEC 61000-6-2:2016, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-3:2020, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments*

IEC 61000-6-4:2018, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61051-1, *Varistors for use in electronic equipment – Part 1: Generic specification*

IEC 61051-2, *Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors*

IEC 61051-2-2, *Varistors for use in electronic equipment – Part 2: Blank detail specification for zinc oxide surge suppression varistors. Assessment level E*

IEC 61210, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

IEC 61249 (all parts), *Materials for printed boards and other interconnecting structures*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and combinations thereof − Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications*

IEC 61558-2-16, *Safety of transformers, reactors, power supply units and combinations thereof − Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units for general applications*

IEC 61810-3, *Electromechanical elementary relays – Part 3: Replays with forcibly guided (mechanically linked) contacts*

IEC 62151, *Safety of equipment electrically connected to a telecommunication network*

IEC 62319 (all parts), *Polymeric thermistors – Directly heated positive step function temperature coefficient*

IEC 62326 (all parts), *Printed boards*

IEC 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 63044 (all parts), *Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS)*

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

CISPR 14-1:2020, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

CISPR 32:2015, *Electromagnetic compatibility of multimedia equipment – Emission* requirements
CISPR 32:2015/AMD1:2019

ISO 4046-4:2016, *Paper, board, pulps and related terms − Vocabulary − Part 4: Paper and board grades and converted products*

ISO 7637-2:2011, *Road vehicles – Electrical disturbances from conduction and coupling – Part 2: Electrical transient conduction along supply lines only*

ISO 7637-3:2016, *Road vehicles – Electrical disturbances from conduction and coupling – Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines*

ISO 16484 (all parts), *Building automation and control systems (BACS)*

3 Terms and definitions

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

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE Where the terms "voltage" and "current" are used, they imply the RMS values, unless otherwise specified.

3.1 Definitions relating to ratings, voltages, currents, frequencies, and wattages

3.1.1
rated voltage, current, frequency or wattage
voltage, current, frequency or wattage assigned to a **control** by the manufacturer

Note 1 to entry: For three phase supply, the **rated voltage** is the line-to-line voltage.

3.1.2
rated voltage, current, frequency or wattage range
voltage, current, frequency or wattage ranges assigned to the **control** by the manufacturer and expressed by lower and upper values

3.1.3
working voltage
highest RMS value of the AC or DC voltage across any particular insulation which can occur when the equipment is supplied at **rated voltage**

Note 1 to entry: **Transient overvoltages** are disregarded.

Note 2 to entry: Open-circuit conditions and normal operating conditions are taken into account.

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3.1.4
extra-low voltage
ELV
voltage not exceeding the maximum values of 50 V AC (RMS), 70,7 V AC (peak) or 120 V DC (ripple-free) between conductors and between conductors and earth which is permitted to be maintained indefinitely under normal and single-**fault** conditions

Note 1 to entry: Ripple-free is conventionally defined as an RMS ripple voltage of not more than 10 % of the DC component.

Note 2 to entry: The use of **ELV** other than in **SELV system** or **PELV system** is not a protective measure against electric shock, this is in line with IEC 61140:2016.

3.1.5
safety extra-low voltage
protective extra-low voltage
SELV/PELV
voltage for use in **SELV system** or **PELV system** between simultaneously **accessible part**(**s**) and between any **accessible part** and earth, not exceeding the limits of 30 V AC (RMS), 42,4 V AC (peak) or 60 V DC (ripple free) under normal and single-**fault** condition, which is provided by an independent source (such as motor generators, and batteries) or when obtained from higher voltage is obtained by a **safety isolating transformer** or a converter with separate windings providing equivalent insulation

Note 1 to entry: The voltage limits are based on the assumption that the **safety isolating transformer** is supplied at its rated voltage. For the purpose of the output test in 12.2.1, the secondary output voltage limit shall be increased as specified in 19.2.2.

Note 2 to entry: Transformers used in converters that have separate windings and provide equivalent insulation are covered under IEC 61558-2-6 and IEC 61558-2-16.

Note 3 to entry: **SELV/PELV** limits are defined regardless of any special condition which may occur in installation. Different requirements may be specified in the relevant electrical installation standards (e.g. IEC 60364 series) or in the applicable local regulations.

Note 4 to entry: Ripple-free is conventionally defined as an RMS ripple voltage of not more than 10 % of the DC component.

Note 5 to entry: **SELV/PELV** limits may be different in other product or system standards. In case a control is declared exclusively for use in applications governed by a different standard, the limits set by the application standard apply (e.g. controls to be used exclusively in household appliances according IEC 60335 set of standards or connected to HBES/BACS systems according to IEC 63044-3 accept different **SELV** voltage limits).

3.1.6
safety isolating transformer
transformer, the input winding of which is electrically separated from the output winding by an insulation at least equivalent to **double insulation** or **reinforced insulation**, and which is intended to supply **safety extra-low voltage** circuits

3.1.7
isolated limited secondary circuit
circuit from an isolated secondary winding of a transformer having a maximum capacity of 100 VA and an open-circuit secondary voltage rating not exceeding 1 000 V

3.1.8
pilot duty
class of **operation** in which the ultimate electrical load is controlled by an auxiliary means such as a relay or contactor

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3.1.9
transient overvoltage
overvoltage with a duration of a few milliseconds or less, oscillatory or non-oscillatory, usually highly damped

Note 1 to entry: **Transient overvoltages** may be immediately followed by temporary overvoltages. In such cases the two overvoltages are considered as separate events.

Note 2 to entry: IEC 60071-1 defines three types of **transient overvoltages**, namely slow-front overvoltages, fast-front overvoltages and very fast-front overvoltages according to their time to peak, tail or total duration, and possible superimposed oscillations.

[SOURCE: IEC 60050-614:2016, 614-03-14]

3.1.10
rated impulse voltage
impulse withstand voltage assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against overvoltages

Note 1 to entry: The term rated impulse voltage is the same as impulse withstand voltage given in IEC 60664-1 overvoltage category.

3.1.11
overvoltage category
numeral defining a **transient overvoltage** condition

Note 1 to entry: Overvoltage categories I, II, III, and IV are used. See Annex D.

[SOURCE: IEC 60050-581:2008, 581-21-02, modified − Note 1 to entry has been added]

3.1.12
SELV system
electrical system in which the voltage cannot exceed the values in 3.1.5:

– under normal conditions, and
– under single **fault** conditions, including protective earth **faults** in other electric circuits

[SOURCE: IEC 60050-826:2004, 826-12-31; modified − "the value of extra-low voltage" has been changed to "the values in 3.1.5" and Note 1 to entry has been deleted]

3.1.13
PELV system
electrical system in which the voltage cannot exceed the values in 3.1.5:

– under normal conditions, and
– under single **fault** conditions, except protective earth **faults** in other electric circuits

[SOURCE: IEC 60050-826:2004, 826-12-32; modified − "the value of extra-low voltage" has been changed to "the values in 3.1.5" and Note 1 to entry has been deleted]

3.2 Definitions of types of control according to purpose

3.2.1
electrical control
device used in, on or in association with an equipment for the purpose of varying or modifying the output from such equipment, and which embodies the aspects of **initiation**, **transmission** and **operation**

Note 1 to entry: Hereinafter, electrical control is referred to as "**control**".

Note 2 to entry: At least one of these aspects shall be electrical or electronic.

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3.2.2
manual control
control in which the **initiation** is by **actuation** and in which the **transmission** and the **operation** are both direct and without any intentional time delay

3.2.3
automatic control
control in which at least one aspect is non-manual

3.2.4
sensing control
automatic control in which **initiation** is by an element sensitive to the particular **activating quantity** declared, for example, temperature, current, humidity, light, liquid level, position, pressure or velocity

3.2.5
thermostat
cycling temperature **sensing control**, which is intended to keep a temperature between two particular values under normal operating conditions and which can have provision for **setting by the user**

Note 1 to entry: A **thermostat** will provide a **type 1 action** or a **type 2 action** as declared.

3.2.6
temperature limiter
temperature **sensing control** which is intended to keep a temperature below or above one particular value during normal operating conditions and which can have provision for **setting by the user**

Note 1 to entry: A **temperature limiter** may be of the automatic or of the manual reset type. It does not make the reverse **operation** during the normal **duty cycle** of the appliance.

Note 2 to entry: A **temperature limiter** will provide a **type 1 action** or a **type 2 action** as declared.

3.2.7
thermal cut-out
temperature **sensing control** intended to keep a temperature below or above one particular value during abnormal operating conditions and which has no provision for **setting by the user**

Note 1 to entry: A **thermal cut-out** may be of the automatic or of the manual reset type.

Note 2 to entry: A **thermal cut-out** will provide a **type 2 action**.

3.2.8
energy regulator
self-cycling **control** which alters the energy to a load and which can incorporate means for **setting by the user** to change the average energy supplied

Note 1 to entry: The ratio of the on-time, to the on-plus-off-time, determines the average energy supplied.

3.2.9
time-based control
automated **control** in which the **transmission** is effected by a time-based **prime mover** or a time-based electrical circuit

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3.2.10
electrically operated control
automatic control in which the **transmission** is affected by an electrical **prime mover** and in which the **operation** controls an electric circuit, and is without intentional significant time-delay

Note 1 to entry: An example is a relay.

Note 2 to entry: A slugged-relay may be either an **electrically operated control**, or a **time-based control** by agreement between test house and manufacturer.

3.2.11
timer
time-based control which requires **actuation** before the next cycle can take place

Note 1 to entry: During a cycle, it may require an external electrical or mechanical signal before moving from a rest position to allow the cycle to continue. An example is a programmer.

3.2.12
time switch
time-based control which continues with a subsequent cycle when the preceding one has been completed

Note 1 to entry: An example is a 24 h **control** on a storage heater.

3.2.13
electrically operated valve
automatic control in which the **transmission** is effected by an electrical **prime mover** and in which the **operation** controls the flow of a liquid or a gas

3.2.14
electrically operated mechanism
automatic control in which the **transmission** is effected by an electrical **prime mover** in which the **operation** controls a mechanical device

Note 1 to entry: An example is an electrically operated interlock for a spin dryer lid.

Note 2 to entry: An electric motor is not included in this definition.

3.2.15
operating control
control which starts or regulates the equipment during normal operation

Note 1 to entry: This operating control can provide **class A**, **class B** or **class C control functions**.

3.2.16
protective control
control, the **operation** of which is intended to prevent a hazardous situation during abnormal operation of the equipment

3.2.17
multipurpose control
electrical control that can be classified and used for more than one purpose

Note 1 to entry: An example of a **multipurpose control** is a **thermostat** that can also be used as a **temperature limiter**.

3.2.18
multifunctional control
electrical control which incorporates more than one function

Note 1 to entry: An example of a **multifunctional control** is the combination of a **thermostat** and a humidistat.

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3.2.19
system
control and **control** sensors and actuators as applied to an application or processes

3.3 Definitions relating to the function of controls

3.3.1
initiation
alteration to that aspect of a **control** which is required to produce **transmission** and **operation**

3.3.2
transmission
essential coupling between **initiation** and **operation** which is required to enable the **control** to fulfil its purpose

Note 1 to entry: This includes, but is not limited to, the use of:

a) communication lines/protocols;

b) additional hardware and/or software;

c) IR/RF; or

all combinations of a) to c) via Internet using, for example, modems, portable telephones, etc.

3.3.3
operation
change in that aspect of a **control** which modifies the input to the equipment or part of the equipment

3.3.4
automatic action
that action of an **automatic control** in which the **transmission** and **operation** are produced by **initiation** which is not the result of **actuation**

3.3.5
slow-make slow-break automatic action
mode of **operation** where the rate of contact make and/or break is directly proportional to the rate of change of the **activating quantity**, or to the speed of movement of a **prime mover**

Note 1 to entry: This action may be applicable to either the make, or the break, or both.

3.3.6
manual action
that action of an **automatic control** or of a **manual control** in which the **transmission** and **operation** are produced by **initiation** which is the result of **actuation**

3.3.7
actuation
movement of the **actuating member** of the **control** by the **user**, by hand, by foot or by any other human activity

3.3.8
located position
position of the **actuating member** to which it will return if it is released after being moved slightly

3.3.9
intermediate position
any position of any **actuating member** which is adjacent to a **located position**, and in which the **actuating member** will remain and in which the **operation** of the **control** is intermediate

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3.3.10
activating quantity
physical characteristic of a medium, the variation or stability of which is being sensed

3.3.11
operating value
value of the relevant temperature, pressure, current, etc. at which a **sensing control** operates on a rise or fall of the **activating quantity**

3.3.12
operating time
duration of time, or the difference of time, between any two functions, electrical or mechanical, occurring during the **automatic action** of a **time-based control**

3.3.13
operating sequence
intended sequence, order or pattern in which the **operation** of the electrical or mechanical functions of a **control** are intended to occur as a result of either an **automatic** or a **manual action** of a **control**

Note 1 to entry: It includes the pattern of opened or closed contacts in any **located position**, **intermediate position** or position of **setting by the equipment manufacturer** or **setting by the user**.

3.3.14
response value
operating value, the **operating time** or the **operating sequence** which relates a **control** to a particular equipment

3.3.15
trip-free
automatic action, with a reset **actuating member**, in which the **automatic action** is independent of manipulation or position of the reset mechanism

3.3.16
setting
mechanical positioning of a part of a **control** in order to select an **operating value**

3.3.17
setting by the control manufacturer
any **setting** carried out by the **control manufacturer** which is not intended to be altered by the **equipment manufacturer**, the **installer** or the **user**

3.3.18
setting by the equipment manufacturer
any **setting** carried out by the **equipment manufacturer** which is not intended to be altered by the **installer** or the **user**

3.3.19
setting by the installer
any **setting** carried out by the **installer**, as instructed by the **equipment manufacturer** or the **control manufacturer**, and which is not intended to be altered by the **user**

3.3.20
setting by the user
any selection of an **operating value** by **actuation** performed by the **user**

3.3.21
set point
value selected by **setting**

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3.3.22
adjustable set point
multiple values, within a declared range of values, which can be selected by **setting**

3.3.23
duty cycle
all automatic and **manual actions** involved in one start-to-finish **operation** of the controlled equipment

3.3.24
cycle of contact operation
one contact make and one subsequent contact break action, or one contact break and one subsequent contact make action

3.3.25
operating differential
difference between the upper and lower values of the **operating value**

3.3.26
adjustable differential
ability to change or alter the **operating differential** within rated limits by **operation** of a manually actuated mechanism

3.3.27
fixed differential
operating differential which cannot be changed from the manufacturer's **setting**

3.3.28
maximum working pressure
declared maximum line or **system** working pressure to which the control or parts thereof can be subjected

3.3.29
maximum temperature
T_{max}
declared maximum continuous ambient temperature to which the **switch head** is intended to be exposed during normal operation

3.3.30
remotely actuated control function
function providing any **operation** by **control** devices through external means

Note 1 to entry: This includes, but is not limited to, the use of:

a) communication lines/protocols;

b) additional hardware and/or software;

c) IR/RF **transmission**; or

all combinations of a) to c) via Internet using, for example, modems, portable telephones, etc.

3.3.31
safety shut-down
change in the state of all electrical outputs so that all safety critical electrical outputs of the **control** will proceed to a safe condition including shut-down

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3.3.32
mounting surface temperature
$T_{s\ max}$
declared maximum temperature to which the mounting surface of the control is intended to be exposed including any likely overshoot once a control has operated

3.3.33
touch current
electric current passing through a human body or through livestock when it touches one or more accessible parts of an installation or of equipment

Note 1 to entry: Touch current is often referred to as "leakage current" in many safety standards such as IEC 60335 series of standards.

[SOURCE: IEC 60050-195:2021, 195-05-21, modified – Note 1 to entry has been added]

3.4 Definitions relating to disconnection and interruption

Some **controls** can incorporate more than one form of circuit disconnection or interruption.

3.4.1
all-pole disconnection
disconnection of all supply conductors, except the protective earthed (grounded) conductor, by a single switching action

Note 1 to entry: The protective earthing conductor is not considered to be a supply conductor.

3.4.2
full disconnection
contact separation in all supply poles other than protective earth so as to provide the equivalent of **basic insulation** between the supply mains and those parts intended to be disconnected

Note 1 to entry: There are electric strength and dimensional requirements.

Note 2 to entry: Where the number of poles on the **control** is equal to the number of supply poles of the appliance to which it is connected, **full disconnection** provides **all-pole disconnection**.

Note 3 to entry: An **electronic device** does not provide this disconnection.

3.4.3
micro-disconnection
adequate contact separation in at least one pole for functional disconnection

Note 1 to entry: There is a requirement for the electric strength of the contact gap but no dimensional requirement.

Note 2 to entry: **Micro-disconnection** denotes that for non-**sensing controls** the function controlled by the disconnection is secure, and that for **sensing controls** is secure between the limits of **activating quantity** declared in Table 1, requirement 30.

Note 3 to entry: An **electronic device** does not provide this disconnection.

3.4.4
micro-interruption
interruption of a circuit by contact separation, by a cycling action or by a non-cycling action which does not provide **full disconnection** or **micro-disconnection**

Note 1 to entry: There are no electric strength or dimensional requirements for the contact gap.

Note 2 to entry: An **electronic device** does not provide this disconnection.

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3.4.5
OFF position
position providing a visible or implied indication of a **full disconnection** or **micro-disconnection**

3.4.6
electronic disconnection
non-cycling interruption by an **electronic device** of a circuit for functional disconnection and which provides a disconnection other than by means of an air gap by satisfying certain electrical requirements in at least one pole

Note 1 to entry: **Electronic disconnection** ensures that, for all non-**sensing controls**, the function controlled by the disconnection is secure and that, for all **sensing controls**, the function controlled is secure between the limits of the **activating quantity** declared in Table 1, requirement 30.

The disconnection may be obtained by an **automatic action** or a **manual action**.

Some **controls** may incorporate circuit disconnections of more than one form.

3.5 Definitions of types of control according to construction

3.5.1
integrated control
control which is dependent on its correct mounting and fixing in an equipment, and which can only be tested in combination with the relevant parts of the equipment

Note 1 to entry: **Integrated control** also denotes a **control** which is part of a more complex **control** (electrical or non-electrical).

3.5.2
incorporated control
control intended to be mounted in, or on, an equipment, but which can be tested separately

Note 1 to entry: The fact that an **incorporated control** can be tested separately does not imply that it is not allowed to be tested in an equipment as specified in 4.3.4.1.1.

Note 2 to entry: **Incorporated control** also denotes a **control** intended for incorporation in or on a more complex **control** (electrical or non-electrical).

3.5.3
in-line cord control
separately cased **control** intended to be connected to the supply and to the equipment by means of flexible cords, equipment inlets or socket-outlets, and is intended to be manually actuated

Note 1 to entry: A fuse in the plug is not regarded as a part of the **control**.

3.5.4
free-standing control
in-line cord control intended to stand on a table or on the floor

Note 1 to entry: It may be actuated by hand, by foot or by other similar human activity.

3.5.5
independently mounted control
control intended for permanent connection to **fixed wiring**, but intended to be mounted separately from the controlled equipment

Note 1 to entry: It may be either:

– for surface mounting such as on to a wall;
– for flush mounting, such as into a wall cavity, when installation shall be possible from the front;
– for panel mounting, such as onto or into a **control** panel, when installation may be from the rear.

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3.5.6
pull-cord actuated control
control intended to be mounted in, or on, an equipment and actuated by means of a **pull-cord**

3.5.7
electronic control
control which incorporates at least one **electronic device**

3.5.8
electronic device
a device in which conduction is principally by electrons moving through a vacuum, gas or semi-conductor

[SOURCE: IEC 60050-531:1974, 531-11-01]

3.5.9
electronic assembly
group of components, at least one of which is an **electronic device**, but in which individual parts can be replaced without damage to the assembly

Note 1 to entry: An example of this is a group of components mounted on a printed circuit board.

3.5.10
integrated circuit
microcircuit in which all or some of the circuit elements are inseparably associated and electrically interconnected so that it is considered to be indivisible for the purpose of construction and commerce

[SOURCE: IEC 60050-521:2002, 521-10-03]

3.5.11
hybrid circuit
circuit produced on ceramic substrate by means of thick-film, thin-film or surface-mounted devices (SMD) technology, without accessible electrical connections except for I/O points, and with all internal connections constructed as part of a lead frame or other integral construction

3.5.12
two-step actuation
sequential performance of two distinct movements of the **actuating member**

3.6 Definitions of type of automatic action of a control

3.6.1
type 1 action
automatic action for which the **manufacturing deviation** and the **drift** of its **operating value**, **operating time** or **operating sequence** have not been declared and tested under this document

3.6.2
type 2 action
automatic action for which the **manufacturing deviation** and the **drift** of its **operating value**, **operating time** or **operating sequence** have been declared and tested under this document

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3.7 Definitions relating to protection against electric shock and type of insulation

3.7.1
live part
conductor or conductive part intended to be energized in **normal use**, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor

Note 1 to entry: Accessible parts complying with 6.1.1 are not considered to be **live parts**.

Note 2 to entry: Definitions for PEN, PEM and PEL can be found in IEC 61140:2016.

3.7.2
hazardous live part
live part that, under certain conditions, can give a harmful electric shock

[SOURCE: IEC 60050-195:2021, 195-06-05, modified – Note 1 to entry not included.]

3.7.3
class 0 control
control in which protection against electric shock relies upon **basic insulation**

Note 1 to entry: This implies that there are no means for the connection of accessible conductive parts, if any, to the **protective conductor** in the **fixed wiring** of the installation; reliance in the event of a **failure** of the **basic insulation** is placed upon the environment.

Note 2 to entry: An earthing terminal is only allowed if it is for continuity or functional (as distinct from protective) purposes.

〚A11〛 Note to entry 1: See Annex ZB. 〚A11〛

3.7.4
class 0l control
in-line cord control having at least **basic insulation** throughout and provided with a protective earthing terminal but with a **non-detachable cord** without protective earthing conductor, and a plug without protective earthing contact which cannot be introduced into a socket-outlet with protective earthing contact

Note 1 to entry: An earthing terminal is only allowed if it is for continuity (as distinct from protective) purposes.

〚A11〛 Note to entry 1: See Annex ZB. 〚A11〛

3.7.5
class I control
control in which protection against shock does not rely on **basic insulation** only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective earthing conductor in the **fixed wiring** of the installation in such a way that accessible conductive parts cannot become live in the event of a **failure** of the **basic insulation**

Note 1 to entry: This provision includes a **protective conductor** as part of the flexible cord or cable. When **class I controls** are fitted with a two-core flexible cord or cable with a plug which cannot be introduced into a socket-outlet with earthing contact, the protection is then equivalent to that of class 0. However,the earthing provisions of the equipment in all other respects should fully comply with the requirements of class I.

Note 2 to entry: **Class I controls** may have parts with **double insulation** or parts that provide protection against electric shock by **SELV** or **PELV**.

3.7.6
class II control
control in which protection against electric shock does not rely on **basic insulation** only, but in which additional protective precautions, such as **double insulation** or **reinforced insulation**, are provided, there being no provision for protective earthing or reliance upon installation conditions

Note 1 to entry: Such a **control** may be one of the types defined in 3.7.6.1 to 3.7.6.3.

Note 2 to entry: **Class II controls** may have parts that provide protection against electric shock by use of **SELV**.

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Note 3 to entry: **Class II controls** cannot have parts that provide protection against electric shock by use of **PELV**, as such circuits require connection to an earthing terminal.

3.7.6.1
insulation-encased class II control
control having a durable and substantially continuous enclosure of insulation material which envelopes all metal parts, with the exception of small parts, such as name plates, screws and rivets, which are isolated from **live parts** by insulation at least equivalent to **reinforced insulation**

3.7.6.2
metal-encased class II control
control having a substantially continuous metal enclosure in which **double insulation** is used throughout, except for those parts where **reinforced insulation** is used, because the application of **double insulation** is manifestly impracticable

3.7.6.3
combination insulation-encased/metal-encased class II control
control which is a combination of the types described in 3.7.6.1 and 3.7.6.2

Note 1 to entry: The enclosure of an all-insulated **class II control** may form a part or the whole of the **supplementary insulation** or of the **reinforced insulation**. If a **control** with **double insulation** and/or **reinforced insulation** throughout has an earthing terminal or earthing contact, it is deemed to be of class 0I or class I construction.

3.7.7
class III control
control relying on limitation of voltage in 3.1.5 values as provision against electric shock for basic protection and

- with no provision for **fault** protection;
- which for supply are only connected to a **SELV system** or a **PELV system**, to form part of that **system**;
- where internal circuits do not operate at a higher level than **ELV**;
- where in case of a single **fault** within the **control** no steady state touch voltage can appear or be generated exceeding **ELV** level; and
- not provided with a means of connection for a **protective conductor**

3.7.8
detachable part
part that

- can be removed or opened without the aid of a tool, or
- can be removed or opened with a tool according to the **normal use** and user maintenance as declared by the control manufacturer, or
- does not fulfil the test of 9.11.1.3

3.7.9
accessible part or accessible surface
part or surface which can be touched by the test finger of Figure 5, when the **control** is mounted as in **normal use**, and after **detachable parts** have been removed

3.7.10 Definitions relating to type of insulation

NOTE In 3.7.10.1 through 3.7.10.5, the following abbreviations are used:

L **live part**;
A **accessible part** (either conductive or an insulating surface);
I intermediate part.

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3.7.10.1
functional insulation
insulation between **live parts** which have a potential difference between them, and which insulation is necessary for the correct **operation** of the **control** or controlled equipment (L-L)

3.7.10.2
basic insulation
insulation applied to **live parts** to provide basic protection against electric shock (L-A or L-I)

Note 1 to entry: **Basic insulation** includes insulation between **live parts** and

– intermediate conductive parts or metal foil over intermediate insulating surfaces (class II situation);
– accessible conductive parts (class 0, 0I, I situations);
– conductive parts connected to accessible conductive parts (class 0, 0I, I situations);
– metal foil over accessible insulating surfaces (class 0 situation).

3.7.10.3
supplementary insulation
independent insulation applied in addition to **basic insulation** in order to provide protection against electric shock in the event of a **failure** of **basic insulation** (I-A)

Note 1 to entry: It includes insulation between intermediate conductive parts, or metal foil over intermediate insulating surfaces and

– accessible conductive parts (class II situation);
– conductive parts connected to accessible conductive parts (class II situation);
– metal foil over accessible insulating surfaces (class II situation).

3.7.10.4
reinforced insulation
single insulation **system** applied to **live parts**, which provides a degree of protection against electric shock equivalent to **double insulation** under the conditions specified in this document (L-A)

Note 1 to entry: It includes insulation between **live parts** and

– accessible conductive parts;
– conductive parts connected to accessible conductive parts;
– metal foil over accessible insulating surfaces.

Note 2 to entry: The term "insulation system" does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as **supplementary insulation** or **basic insulation**.

3.7.10.5
double insulation
insulation comprising both **basic insulation** and **supplementary insulation** (L-I-A)

[SOURCE: IEC 60050-195:2021, 195-06-08]

3.7.11
protective impedance
impedance connected between live parts and accessible conductive parts, of such value that the current, in normal use and under likely **fault** conditions in the equipment, is limited to a safe value

3.7.12
equipotential bonding
set of electric connections intended to achieve equipotentiality between conductive parts

[SOURCE: IEC 60050-195:2021, 195-01-10]

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3.7.12.1
protective equipotential bonding
equipotential bonding for the purposes of electrical safety

Note 1 to entry: Functional **equipotential bonding** is defined in IEC 60050-195:2021,195-01-16].

[SOURCE: IEC 60050-195:2021, 195-01-15, modified –Note 1 to entry has been added.]

3.7.13
exposed conductive part
conductive part of equipment that can be touched and that is not live under normal conditions, but that can become live when **basic insulation** fails

Note 1 to entry: A conductive part of a **control** which can only become live through contact with an **exposed conductive part** which has become live is not considered to be an **exposed conductive part** itself.

[SOURCE: IEC 60050-195:2021, 195-06-10, modified – Note 1 to entry has been added.]

3.7.14
conductive screen
screen of conductive material intended to reduce the penetration of an electric field

[SOURCE: IEC 60050-195:2021, 195-02-38]

3.7.15
protective screen, <electrically>
conductive screen used to separate an electric circuit and/or conductors from hazardous-live-parts

[SOURCE: IEC 60050-195:2021, 195-06-17]

3.7.16
protective screening, <electrically>
separation of electric circuits and/or conductors from **hazardous live parts** by an **electrically protective screen** connected to the **protective equipotential bonding system** and intended to provide protection against electric shock

[SOURCE: IEC 60050-195:2021, 195-06-18]

3.7.17
simple separation
separation between electric circuits or between an electric circuit and protective earth by means of **basic insulation**

[SOURCE: IEC 60050-826:2004, 826-12-28; modified by replacing "local" by "protective"]

3.7.18
protective separation, <electrically>
separation of one electric circuit from another by means of basic protection and fault protection

[SOURCE: IEC 60050-195:2021, 195-06-19]

3.7.19
protective earthing
earthing for purposes of electrical safety

[SOURCE: IEC 60050-195:2021, 195-01-11]

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3.7.20
functional earthing
earthing for purposes other than electrical safety

[SOURCE: IEC 60050-195:2021, 195-01-13]

3.8 Definitions relating to component parts of controls

3.8.1
sensing element
that part of the **control** which is intended to be exposed to the influences of the **activating quantity** to which the **automatic action** of a **sensing control** responds

3.8.2
switch head
complete **control**, except for any **sensing element**

Note 1 to entry: If by construction it is impossible to distinguish between the **switch head** and the **sensing element**, then the whole **control** is considered to be the **sensing element**.

3.8.3
actuating member
that part which is manually moved, pulled, pushed or turned to cause **initiation** of a **control** action, or for **setting by the user**

Note 1 to entry: The term "**actuating member**" does not include any device such as a set-screw used for **setting by the control manufacturer** if such a device is adequately locked against further movement, or if a **tool** is required for such **setting by the control manufacturer**.

3.8.4
actuating means
any part which connects the **actuating member** to the mechanism of the **control**

3.8.5
pull-cord
flexible **actuating member** which is pulled to cause **actuation**

3.8.6
prime mover
any device used to produce the mechanical energy required to provide the **transmission** for an **automatic control**, such as an **electrically operated control**, an **electrically operated valve**, an **electrically operated mechanism** or a **time-based control**

Note 1 to entry: It may be a mechanical storage device (for example, a clockwork spring), an electro-magnetic device (for example, an electric motor, or stepping solenoid), an electro-thermal device (for example, the heating element of an **energy regulator**) or any other mechanism producing mechanical energy.

3.8.7
clutch
mechanical device by which an **actuating member** can override either a **prime mover** or an **activating quantity**, causing or allowing the **initiation** or cancellation of an action

3.8.8
cover
cover plate
part which is accessible when the **control** is mounted as in **normal use** and which can be removed only with the aid of a **tool**

Note 1 to entry: It shall not require the use of a **special purpose tool** for its removal.

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3.8.9
screwless fixed part (or component)
accessible part (or component) which, after attachment, installation, mounting or assembly into or onto an equipment or another component, or to a specially prepared support, is retained in position by positive means which do not depend on screws

Note 1 to entry: Disassembly or removal may require the use of a **tool**, either applied directly to the part (or component), or to obtain access to the retaining means.

Note 2 to entry: The following are some examples of parts which are not regarded as **screwless fixed parts or components**:

– parts of components fixed permanently by rivets, glueing or similar means;
– flat, push-on connectors;
– **screwless terminals**;
– standard plugs and socket-outlets;
– standard appliance couplers, even if such have additional latching devices to prevent a single action uncoupling;
– the replacement of a lamp in a bayonet type lampholder;
– twist-lug construction;
– friction-fit construction.

3.9 Definitions of types of terminals and terminations of controls

3.9.1
pillar terminal
terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws

Note 1 to entry: The clamping pressure may be applied directly by the shank of the screw, or through an intermediate clamping member to which pressure is applied by the shank of the screw (see Figure 12).

3.9.2
screw terminal
terminal in which the conductor is clamped under the head of the screw

Note 1 to entry: The clamping pressure may be applied directly by the head of the screw, or through an intermediate part, such as a washer, a clamping plate or an anti-spread device (see Figure 11).

3.9.3
stud terminal
terminal in which the conductor is clamped under a nut

Note 1 to entry: The clamping pressure may be applied directly by a suitably shaped nut, or through an intermediate part, such as a washer, a clamping plate or an anti-spread device (see Figure 11).

3.9.4
screwless terminal
terminal in which the connection of the conductor is achieved directly or indirectly by means of springs, wedges, eccentrics, cones or the like

Note 1 to entry: The following are not regarded as **screwless terminals**:

– terminals requiring the fixing of special devices to the conductors before clamping them in the terminal, for example, **flat push-on connectors**;
– terminals requiring wrapping of the conductors, for example, those with wrapped joints;
– terminals providing direct contact to the conductors by means of edges or points penetrating the insulation.

3.9.5
flat push-on connector
assembly of a **tab** and a **receptacle** enabling the connection, at will, of a core or conductor to a **control** or to another core or conductor

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3.9.6
receptacle
female part of a **flat push-on connector** intended to be permanently attached to a core or conductor (see Figure 17)

3.9.7
tab
male part of a **flat push-on connector** (see Figure 15 and Figure 16)

3.9.8
in-line tab
tab intended to be permanently attached to a core or conductor

3.9.9
tab forming part of a control
tab permanently attached to, or an integral part of, a **control**

3.9.10
termination
part by which a conductor can be connected to a **control** in such a way that its replacement requires either a **special purpose tool**, a special process or a specially prepared end of the conductor

Note 1 to entry: Soldering requires a **special purpose tool**. Welding requires a special process. A cable lug attached to a conductor is a specially prepared end.

3.9.11
solder termination
termination in which the conductor is secured by a mechanical means, and the circuit continuity is assured by solder

3.9.12
saddle terminal
terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts (see Figure 14a)

3.9.13
lug terminal
screw terminal or **stud terminal**, intended to clamp a cable lug or bar by means of a screw or nut (see Figure 14b)

3.9.14
mantle terminal
terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut

Note 1 to entry: The conductor is clamped against the base of the slot by a suitably shaped washer under the nut, by a central peg if the nut is a cap nut or equally effective means for transmitting the pressure from the nut to the conductor within the slot (see Figure 13).

3.9.15
protective bonding terminal
terminal intended for **protective equipotential bonding** purposes

Note 1 to entry: Examples are a **protective screen**- or **PE**-terminal of a **control** or equipment.

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3.9.16
protective conductor
PE
conductor provided for purposes of electrical safety

[SOURCE: IEC 60050-195:2021, 195-02-09]

3.10 Definitions relating to the connections to controls

3.10.1
external conductor
any cable, flexible cord, core or conductor, a part of which is external to an **in-line cord control**, an **independently mounted control** or to an equipment in or on which a **control** is mounted

Note 1 to entry: Such a conductor may be a supply lead, a function cord or interconnecting cord between different parts of an equipment; or it may form part of the **fixed wiring**.

3.10.2
fixed wiring
any **external conductor** which is permanently secured to the fabric of the building such that, in **normal use** at the point at which the conductor enters the equipment or **control**, there is no likelihood of any strain being applied to the conductor

Note 1 to entry: Such securing to the fabric of the building may be, for example, by the enclosing of conductors in conduit, burying cables in walls, adequately fixing cables or cords to walls or other surfaces, etc.

3.10.3
internal conductor
any cable, flexible cord, core or conductor which is neither an **external conductor**, nor an **integrated conductor**

Note 1 to entry: An example is a conductor inside the equipment to interconnect the **control** and the equipment.

3.10.4
integrated conductor
conductor which is inside a **control**, or is used to permanently interconnect terminals or **terminations** of a **control**

3.10.5
detachable cord
flexible external cord connected to a **control** or equipment by means of an equipment inlet, or plug and socket arrangement

3.10.6
non-detachable cord
flexible **external conductor** connected to, or assembled to, a **control** according to one of the methods in 3.10.6.1 to 3.10.6.4

3.10.6.1
type X attachment
method of attachment such that the cord can be easily replaced without **special-purpose tools**, using standard cords without any special preparation

3.10.6.2
type M attachment
method of attachment such that the cord can be easily replaced without **special purpose tools**, but is intended to use only a special cord, such as one with a moulded-on cord guard, or one with special prepared ends

Note 1 to entry: This attachment method does not apply if it is possible to fit a standard cord during servicing unless such is permitted by a particular equipment standard.

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