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# IEC 60730-1

Edition 5.1 2015-12

# FINAL VERSION

# VERSION FINALE

colour inside

For EESC TC1WG11 SSSO, Standard development only

## Automatic electrical controls –
## Part 1: General requirements

## Dispositifs de commande électrique automatiques –
## Partie 1: Exigences générales

IEC 60730-1:2013-11+AMD1:2015-12 CSV(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

# AUTOMATIC ELECTRICAL CONTROLS –

## Part 1: General requirements

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**This Consolidated version of IEC 60730-1 bears the edition number 5.1. It consists of the fifth edition (2013-11) [documents 72/899/FDIS and 72/928/RVD] and its corrigendum 1 (september 2014), and its amendment 1 (2015-12) [documents 72/1017/FDIS and 72/1026/RVD]. The technical content is identical to the base edition and its amendment.**

**This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.**

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

This edition constitutes a technical revision. The major changes with respect to the previous edition are as follows.

– modification of the title and scope;
– revisions to Clause H.26 based on changes in technology, applications, and to improve consistency and layout;
– modification to Table H.12 to align with CISPR 22;
– revisions to Annex J to correlate the fault modes of thermistors and to exempt thermistors used in conjunction with type 1 controls in SELV low power circuits from the tests specified in Annex J;
– new requirements covering battery-powered controls, and the use of batteries in controls;
– revision addressing the exclusion of relay faults;
– new/updated requirements in Clause 24, for switch mode power supplies;
– revisions covering the allowance of screwless-type clamping units complying with IEC 60999-1;
– new requirements addressing remotely actuated control functions;
– addition of a new/updated leakage current diagram to align the Annex E diagram with the diagram in IEC 60990;
– updated requirements for temperature sensing controls.

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 controls for household and similar use, 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” notes regarding differing national practices are contained in the following subclauses:

| | | |
|---|---|---|
| 2.1.5 | 11.11.1.2 | 17.10.4 |
| 2.7.2 | 11.11.1.3 | 17.12.5 |
| 2.7.3 | 11.11.1.4 | 18.1.6 |
| 2.14.2 | 12.1.6 | 18.1.6.1 |
| 4.2.1 | 12.3 | 18.1.6.2 |
| 6.6.1 | Table 12 (13.2.1), footnote a | 18.1.6.3 |
| Table 1 (7.2), footnote d | 13.3.4 | 18.4 |
| 7.4.3 | 14.4 | 19.2.4.1 |
| 7.4.3.2 | Table 13 (14.7.4), footnote f | 19.2.5.1 |
| 8.1.1.1 | 15.1 | 21.1 |
| 8.4 | 16.2.1 | 21.4 |
| 9.3.2 | 17.1.3.1 | 27.2.3.1 |
| 9.3.4 | 17.2.2 | Annex C |
| 9.5.2 | 17.2.3 | Annex D |
| Table 3 (10.1.4), footnote b | 17.2.3.1 | H.26.10 |
| 10.1.4.1 | Table 14 (17.2.5) | Table H.18 (H.26.10.4) |
| 10.1.14 | Table 15 (17.2.5) | H.27.1.1.3 |
| 10.1.16 | Table 16 (17.2.5) | Table K.1, footnote b |
| 10.1.16.1 | 17.5.1 | Table K.2, footnote b |

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| | | |
|---|---|---|
| Table 6 (10.2.1), footnote b | 17.7.7 | T.3.2 |
| 11.5 | 17.8.4.1 | |
| Table 10 (11.8.2), footnote b | 17.10 | |

It is envisaged that in the next edition of this standard 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.

NOTE In this standard 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**.

Some table titles contain reference in brackets to table numbers in IEC 60730-1, edition 3 for ease of correlation between parts 2 and the Part 1.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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.

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# AUTOMATIC ELECTRICAL CONTROLS –

## Part 1: General requirements

## 1 Scope and normative references

### 1.1 Scope

In general, this part of IEC 60730 applies to automatic **electrical controls** for use in, on, or in association with equipment for household and similar use. The equipment may use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof.

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

EXAMPLE 1 **Controls** for appliances within the scope of IEC 60335.

This International Standard is applicable to **controls** for building automation within the scope of ISO 16484.

This standard also applies to automatic **electrical controls** for equipment that may be 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.

This standard is also applicable to individual **controls** utilized as part of a **control** system or **controls** which are mechanically integral with multifunctional **controls** having non-electrical outputs.

EXAMPLE 3 Independently mounted water valves, **controls** in smart grid systems and **controls** for building automation systems within the scope of ISO 16484-2.

This standard is also applicable to relays when used as **controls** for IEC 60335 appliances. Additional requirements for the safety and **operating values** of relays when used as **controls** for IEC 60335 appliances are contained in Annex U.

NOTE 2 These requirements are referred to in the scope of IEC 61810-1.

NOTE 3 This standard is intended to be used for the testing of any stand-alone relay which is intended to be used as a **control** of an appliance according to IEC 60335-1. It is not intended to be used for any other stand-alone relay, or to replace the IEC 61810 series of standards.

This standard does not apply to automatic **electrical controls** intended exclusively for industrial process applications unless explicitly mentioned in the relevant part 2 or the equipment standard.

This standard applies to **controls** powered by primary or secondary batteries, requirements for which are contained within the standard, including Annex V.

**1.1.1** This International Standard applies to the inherent safety, to the **operating values**, **operating times**, and **operating sequences** where such are associated with equipment safety, and to the testing of automatic **electrical control** devices used in, or in association with, equipment.

This standard applies to **controls** using **thermistors**, see also Annex J.

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This standard is also applicable to the **functional safety** of **low complexity safety related systems** and **controls**.

**1.1.2** This standard applies to automatic **electrical controls**, 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.

**1.1.3** This standard applies to starting relays, which are a specific type of automatic **electrical control**, intended to switch the starting winding of a motor. Such **controls** may be built into, or be separate from, the motor.

**1.1.4** This standard applies to **manual controls** when such are electrically and/or mechanically integral with **automatic controls**.

NOTE Requirements for manual switches not forming part of an **automatic control** are contained in IEC 61058-1.

**1.1.5** This standard applies to a.c. or d.c. powered **controls** with a rated voltage not exceeding 690 V a.c. or 600 V d.c.

**1.1.6** This standard does not 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 household equipment standard or as determined by the manufacturer shall apply.

**1.1.7** This standard applies also to **controls** incorporating **electronic devices**, requirements for which are contained in Annex H.

**1.1.8** This standard applies also to **controls** using NTC or PTC **thermistors**, requirements for which are contained in Annex J.

**1.1.9** This standard applies to the electrical and **functional safety** of **controls** capable of receiving and responding to communications signals, including signals for power billing rate and demand response.

The signals may be transmitted to or received from external units being part of the **control** (wired), or to and from external units which are not part of the **control** (wireless) under test.

**1.1.10** This standard does not 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**.

## 1.2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038, *IEC standard voltages*

IEC 60065:2001, *Audio, video and similar electronic apparatus – Safety requirements*[1]
Amendment 1:2005
Amendment 2:2010

[1] There exists a consolidated edition 7.2:2011 including IEC 60065:2001 and its Amendments 1:2005 and 2:2010.

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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, *Surge arresters – Part 1: Non-linear resistor type gapped arresters for a.c. systems*[2]

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*[3]
Amendment 1:2009

IEC 60127-1, *Miniature fuses – Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links*

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

IEC 60335-1:2010, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60364 (all parts), *Low-voltage electrical installations*

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*

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

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

IEC 60417 (all parts), *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)*[4]
Amendment 1:1999

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

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

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[2] Withdrawn.

[3] There exists a consolidated edition 4.1:2009 including IEC 60112:2003 and its Amendment 1:2009.

[4] There exists a consolidated edition 2.1:2001 including IEC 60529:1989 and its Amendment 1:1999.

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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 similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

IEC 61558-2-16, *Safety of transformers, reactors, power supply units and similar products for voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*

IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

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

IEC 62326 (all parts), *Printed boards*

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

CISPR 14-1:2005, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*[5]
Amendment 1:2008

CISPR 22:2008, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

ISO 16484-2, *Building automation and control systems (BACS) – Part 2: Hardware*

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[5] There exists a consolidated edition 5.1:2009 including CISPR 14-1:2005 and its Amendment 1:2008.

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## 2 Terms and definitions

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

Where the terms "voltage" and "current" are used, they imply the r.m.s. values, unless otherwise specified.

### 2.1 Definitions relating to ratings, voltages, currents, frequencies, and wattages

**2.1.1**
**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 voltage.

**2.1.2**
**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

**2.1.3**
**working voltage**
highest r.m.s. value of the a.c. or d.c. 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.

**2.1.4**
**extra-low voltage**
**ELV**
nominal voltage not exceeding 50 V between conductors and between conductors and earth, or for three-phase connection not exceeding 50 V between line conductors and 29 V between line conductors and neutral

Note 1 to entry: These values were derived from IEC 60335-1:2010, Definition 3.4.1.

Note 2 to entry: In this standard **ELV**-levels for use in a specific application as specified in the relevant application standard may be declared for **controls** used in or with such applications for environmental conditions as specified by the application standard.

**2.1.5**
**safety extra-low voltage**
**SELV**
nominal voltage for use in a **SELV system** or **PELV system** between conductors and between conductors and earth, not exceeding 42 V between conductors, or in the case of three-phase circuits, not exceeding 24 V between conductors and neutral, the no-load voltage of the circuit not exceeding 50 V and 29 V, respectively, and which is provided by a battery or when obtained from higher voltage is provided by a **safety isolating transformer** or a converter with separate windings

Note 1 to entry: The voltage limits are based on the assumption that the **safety isolating transformer** is supplied at its rated voltage.

Note 2 to entry: Converters with separate windings providing equivalent insulation are dealt with in IEC 61558-2-6 and IEC 61558-2-16.

Note 3 to entry: In Canada and the USA, the limit for **safety extra-low voltage** is 30 V.

Note 4 to entry: Also see 2.1.20 **SELV system** and 2.1.21 **PELV system**.

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**2.1.6**
**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

**2.1.7**
**same polarity**
relationship between **live parts** such that an interconnection between them allows a flow of current through a load, and which current is thus limited by the load

**2.1.8 Void**

**2.1.9**
**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

**2.1.10**
**pilot duty**
class of **operation** in which the ultimate electrical load is controlled by an auxiliary means such as a relay or contactor

**2.1.11**
**transient overvoltage**
short duration overvoltage of few milliseconds or less, oscillatory or non-oscillatory, usually highly damped

[SOURCE: IEC 60050-604:1987, 604-03-13]

**2.1.12**
**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

**2.1.13**
**overvoltage category**
numeral characterizing a **transient overvoltage** condition

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

**2.1.14**
**exposed-conductive-part**
conductive part of equipment, which can be touched and which is not normally live, but which 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 60050-195:1998, 195-06-10, modified – Note 1 to entry has been added.]

**2.1.15**
**(conductive) screen**
**(conductive) shield (US)**
conductive part that encloses or separates electric circuits and/or conductors

[SOURCE: IEC 60050-195:1998, Amendment 1:2001, 195-02-38]

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**2.1.16**
**(electrically) protective screen**
**(electrically) protective shield** (US)
**conductive screen** used to separate an electric circuit and/or conductors from hazardous-live-parts

[SOURCE: IEC 60050-195:1998, Amendment 1:2001, 195-06-17]

**2.1.17**
**(electrically) protective screening**
**(electrically) protective shielding** (US)
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 60050-195:1998, Amendment 1:2001, 195-06-18]

**2.1.18**
**simple separation**
separation between circuits or between a circuit and earth by means of **basic insulation**

[SOURCE: IEC 61140:2001, 3.23]

**2.1.19**
**(electrically) protective separation**
separation of one electric circuit from another by means of:

– **double insulation**, or
– **basic insulation** and **electrically protective screening** (**shielding**), or
– **reinforced insulation**

[SOURCE: IEC 60050-195:1998, Amendment 1:2001, 195-06-19]

**2.1.20**
**SELV system**
electrical system in which the voltage cannot exceed **ELV**:

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

[SOURCE: IEC 61140:2001, 3.26.1]

**2.1.21**
**PELV system**
electrical system in which the voltage cannot exceed **ELV**:

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

[SOURCE: IEC 61140:2001, 3.26.2]

## 2.2 Definitions of types of control according to purpose

**2.2.1**
**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**

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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.

**2.2.2**
**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

**2.2.3**
**automatic control**
**control** in which at least one aspect is non-manual

**2.2.4**
**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

**2.2.5**
**thermally operated control**
**automatic control** in which the **transmission** is by a thermal **prime mover**

**2.2.6**
**thermostat**
cycling temperature **sensing control**, which is intended to keep a temperature between two particular values under normal operating conditions and which may have provision for **setting by the user**

**2.2.7**
**temperature limiter**
temperature **sensing control** which is intended to keep a temperature below or above one particular value during normal operating conditions and which may 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.

**2.2.8**
**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: Normally a **thermal cut-out** will provide a **type 2 action**.

**2.2.9 Void**

**2.2.10**
**energy regulator**
self-cycling **control** which alters the energy to a load and which may 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.

**2.2.11**
**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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**2.2.12**
**electrically operated control**
**automatic control** in which the **transmission** is effected 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 testing authority and manufacturer.

**2.2.13**
**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.

**2.2.14**
**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.

**2.2.15**
**motor protector**
**automatic control** that is specifically intended to protect the windings of an electric motor from overheating

**2.2.16**
**thermal motor protector**
**automatic control**, built-in or on a motor, that is specifically intended to protect the motor against overheating due to running overload and failure to start

Note 1 to entry: The **control** carries motor current and is sensitive to motor temperature and current.

Note 2 to entry: The **control** is capable of being reset (either manually or automatically) when its temperature falls to the reset value.

**2.2.17**
**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

**2.2.18**
**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.

**2.2.19**
**operating control**
**control** which starts or regulates the equipment during normal **operation**

**2.2.20**
**protective control**
**control**, the **operation** of which is intended to prevent a hazardous situation during abnormal **operation** of the equipment

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**2.2.21**
**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**.

**2.2.22**
**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.

**2.2.23**
**system**
**control** and **control** sensors and actuators as applied to an application or processes

## 2.3 Definitions relating to the function of controls

**2.3.1**
**initiation**
alteration to that aspect of a **control** which is required to produce **transmission** and **operation**

**2.3.2**
**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 **transmission**; or

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

**2.3.3**
**operation**
change in that aspect of a **control** which modifies the input to the equipment or part of the equipment

**2.3.4**
**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**

**2.3.5**
**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.

**2.3.6**
**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**

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**2.3.7**
**actuation**
movement of the **actuating member** of the **control** by the **user**, by hand, by foot or by any other human activity

**2.3.8**
**located position**
position of the **actuating member** to which it will return if it is released after being moved slightly

**2.3.9**
**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

**2.3.10**
**activating quantity**
physical characteristic of a medium, the variation or stability of which is being sensed

**2.3.11**
**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**

**2.3.12**
**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**

**2.3.13**
**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**.

**2.3.14**
**response value**
**operating value**, the **operating time** or the **operating sequence** which relates a **control** to a particular equipment

**2.3.15**
**trip-free**
**automatic action**, with a reset **actuating member**, in which the **automatic action** is independent of manipulation or position of the reset mechanism

**2.3.16**
**leakage current**
all currents, including capacitively coupled currents, which may be conveyed between exposed conductive surfaces of a device and earth or other exposed conductive surfaces of a device

**2.3.17**
**setting**
mechanical positioning of a part of a **control** in order to select an **operating value**

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**2.3.18**
**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**

**2.3.19**
**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**

**2.3.20**
**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**

**2.3.21**
**setting by the user**
any selection of an **operating value** by **actuation** performed by the **user**

**2.3.22**
**set point**
value selected by **setting**

**2.3.23**
**adjustable set point**
multiple values, within a declared range of values, which can be selected by **setting**

**2.3.24**
**duty cycle**
all automatic and **manual actions** involved in one start-to-finish **operation** of the controlled equipment

**2.3.25**
**cycle of contact operation**
one contact make and one subsequent contact break action, or one contact break and one subsequent contact make action

**2.3.26**
**operating differential**
difference between the upper and lower values of the **operating value**

**2.3.27**
**adjustable differential**
ability to change or alter the **operating differential** within rated limits by **operation** of a manually actuated mechanism

**2.3.28**
**fixed differential**
**operating differential** which cannot be changed from the manufacturer's **setting**

**2.3.29**
**maximum working pressure**
**maximum rated pressure**
declared maximum line or **system** working pressure to which the **control** or parts thereof may be subjected

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**2.3.30**
**maximum temperature**
$T_{max}$
declared maximum continuous ambient temperature to which the **switch head** is intended to be exposed during normal **operation**

**2.3.31**
**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.

**2.3.32**
**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

## 2.4 Definitions relating to disconnection and interruption

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

**2.4.1**
**all-pole disconnection**
for single-phase a.c. appliances and for d.c. appliances, disconnection of both supply conductors by a single switching action or, for appliances to be connected to more than two supply conductors, disconnection of all supply conductors, except the earthed (grounded) conductor, by a single switching action

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

**2.4.2**
**full disconnection**
contact separation in all supply poles other than 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: See also Annex H.

**2.4.3**
**micro-disconnection**
adequate contact separation in at least one pole so as to provide functional security

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 requirement 36 of Table 1.

Note 3 to entry: See also Annex H.

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**2.4.4**
**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: See also Annex H.

**2.4.5**
**OFF position**
position providing a visible or implied indication of a **full disconnection** or **micro-disconnection**

**2.4.6** See Annex H.

## 2.5 Definitions of types of control according to construction

**2.5.1**
**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: The equipment may use electricity, gas, oil, solid fuel or a combination thereof.

Note 2 to entry: **Integrated control** also denotes a **control** which is part of a more complex **control** (electrical or non-electrical).

**2.5.2**
**incorporated control**
**control** intended for incorporation 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 may not be tested in an equipment as specified in 4.3.1.1.

Note 2 to entry: The equipment may use electricity, gas, oil, solid fuel or a combination thereof.

Note 3 to entry: **Incorporated control** also denotes a **control** intended for incorporation in or on a more complex **control** (electrical or non-electrical).

**2.5.3**
**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**.

**2.5.4**
**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.

**2.5.5**
**independently mounted control**
**control** intended for permanent connection to **fixed wiring**, but intended to be mounted away from the controlled equipment

Note 1 to entry: It may be either:

– for surface mounting such as on to a wall;

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– 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.

**2.5.6**
**pull-cord actuated control**
**control** intended to be mounted in, or on, an equipment and actuated by means of a **pull-cord**

**2.5.7** to **2.5.10** See Annex H.

**2.5.11**
**two-step actuation**
sequential performance of two distinct movements of the **actuating member**

## 2.6 Definitions of type of automatic action of a control according to test procedure

**2.6.1**
**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 standard

Note 1 to entry: A **type 1 action** is subclassified as specified in 6.4.

**2.6.2**
**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 standard

Note 1 to entry: A **type 2 action** is subclassified as specified in 6.4.

## 2.7 Definitions relating to protection against electric shock

**2.7.1**
**live part**
conductive part intended to be energized in **normal use**, including a neutral conductor, but by convention not a PEN conductor

**2.7.1.1**
**hazardous live part**
**live part** which, under certain conditions of external influences, can give an electric shock

**2.7.2**
**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: In Austria, Belgium, Denmark, France, Germany, Italy, Norway, and the United Kingdom **class 0 controls** are not allowed.

Note 3 to entry: An earthing terminal is only allowed if it is for continuity or functional (as distinct from protective) purposes.

**2.7.3**
**class 0I control**
**in-line cord control** having at least **basic insulation** throughout and provided with an earthing terminal but with a **non-detachable cord** without earthing conductor, and a plug without earthing contact which cannot be introduced into a socket-outlet with earthing contact

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Note 1 to entry: In Austria, Belgium, Denmark, France, Germany, Italy, Norway, and the United Kingdom **class 0I controls** are not allowed.

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

**2.7.4**
**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; provided that it is fitted with a plug which cannot be introduced into a socket-outlet with earthing contact, the protection is then equivalent to that of class 0, but 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**.

**2.7.5**
**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 2.7.5.1 to 2.7.5.3.

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

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.

**2.7.5.1**
**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**

**2.7.5.2**
**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

**2.7.5.3**
**combination insulation-encased/metal-encased class II control**
**control** which is a combination of the types described in 2.7.5.1 and 2.7.5.2

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.

**2.7.6**
**class III control**
**control** relying on limitation of voltage to **ELV** values as provision against electric shock for basic protection and

– with no provision for **fault** protection;

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– 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 may appear or be generated exceeding **ELV** level; and

– not provided with a means of connection for a **protective conductor**

**2.7.7**
**detachable part**
part which can be removed or opened without the aid of a **tool** and which does not comply with the test of 11.11.1.5

**2.7.8**
**accessible part or accessible surface**
part or surface which can be touched by the test finger of Figure 2, when the **control** is mounted as in **normal use**, and after **detachable parts** have been removed

**2.7.9**
**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)

Note 1 to entry: In 2.7.9 through 2.7.12, the following abbreviations are used:

L **live part**;

A **accessible part** (either conductive or an insulating surface);

I intermediate part.

**2.7.10**
**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).

Note 2 to entry: This was formerly part of that insulation referred to as **functional insulation**.

**2.7.11**
**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).

**2.7.12**
**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 standard (L-(I)-A)

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

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– 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).

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**.

**2.7.13**
**double insulation**
insulation comprising both **basic insulation** and **supplementary insulation** (class II situation)

**2.7.14** See Annex H.

**2.7.15**
**equipotential bonding**
provision of electric connections between conductive parts, intended to achieve equipotentiality

Note 1 to entry: The effectiveness of the **equipotential bonding** depends on the frequency of the current in the bonding.

**Equipotential bonding** is used to connect any conductive part of a building not forming part of the electrical installation and liable to introduce an electrical potential, generally the electric potential of the local earth (extraneous-conductive part) and any conductive part of **controls** or equipment or components in the installation which can be touched and which is not normally live but which can become live when **basic insulation** fails (**exposed-conductive-part**) to a main **equipotential bonding terminal** in the form of a bar, in order to bring these parts to the same potential. Parts to be connected to the **equipotential bonding system** include, for example, **protective conductors**, **PE** conductors, PEN conductors, earthing conductors, protective earthing terminals of **controls** or equipment, all conductive parts in a building, for example, metal tubing for water (drinking and waste), metallic bathtubs, the central heating system piping, any internal gas tubing (which is also required to be isolated from external gas tubing), earth connectors for antennas and telecommunication systems, all metal parts of the building used for construction like mats and iron, and conductors for lightning protection and depending on the installation system, the earth electrode. Requirements for **equipotential bonding** can be found in the IEC standards for the installation of buildings. These may be relevant for the installation of **controls** which consist of several component-parts (for example, sensors, actors, central **control** element, interface elements) connected in parallel to or via the fixed installation of the building.

[SOURCE: IEC 60050-195:1998, 195-01-10]

**2.7.15.1**
**protective-equipotential-bonding**
**equipotential bonding** for purposes of safety (protection against electric shock)

Note 1 to entry: Functional **equipotential bonding** is defined in [IEV 195-01-16].

[SOURCE: IEC 60050-195:1998, 195-01-15, modified – (protection against electric shock) has been added.]

## 2.8 Definitions relating to component parts of controls

**2.8.1**
**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

**2.8.2**
**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**.

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**2.8.3**
**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**.

**2.8.4**
**actuating means**
any part which connects the **actuating member** to the mechanism of the **control**

**2.8.5**
**pull-cord**
flexible **actuating member** which is pulled to cause **actuation**

**2.8.6**
**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.

**2.8.7**
**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

**2.8.8**
**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.

**2.8.9**
**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.

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## 2.9 Definitions of types of terminals and terminations of controls

**2.9.1**
**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 11).

**2.9.2**
**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 10).

**2.9.3**
**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 10).

**2.9.4**
**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.

**2.9.5**
**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

**2.9.6**
**receptacle**
female part of a **flat push-on connector** intended to be permanently attached to a core or conductor (see Figure 16)

**2.9.7**
**tab**
male part of a **flat push-on connector** (see Figures 14 and 15)

**2.9.8**
**in-line tab**
**tab** intended to be permanently attached to a core or conductor

**2.9.9**
**tab forming part of a control**
**tab** permanently attached to, or an integral part of, a **control**

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**2.9.10**
**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.

**2.9.11**
**solder termination**
**termination** in which the conductor is secured by a mechanical means, and the circuit continuity is assured by solder

**2.9.12**
**saddle terminal**
terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts (see Figure 13a)

**2.9.13**
**lug terminal**
**screw terminal** or **stud terminal**, intended to clamp a cable lug or bar by means of a screw or nut (see Figure 13b)

**2.9.14**
**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 12).

**2.9.15**
**equipotential bonding terminal**
terminal provided on equipment or on a device and intended for the electric connection with the **equipotential bonding system**

[SOURCE: IEC 60050-195:1998, 195-02-32]

**2.9.16**
**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.

**2.9.17**
**protective conductor**
**PE**
conductor provided for purposes of safety, for example, protection against electric shock

[SOURCE: IEC 60050-195:1998, 195-02-09 ]

## 2.10 Definitions relating to the connections to controls

**2.10.1**
**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

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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**.

**2.10.2**
**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.

**2.10.3**
**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.

**2.10.4**
**integrated conductor**
conductor which is inside a **control**, or is used to permanently interconnect terminals or **terminations** of a **control**

**2.10.5**
**detachable cord**
flexible external cord connected to a **control** or equipment by means of an equipment inlet, or plug and socket arrangement

**2.10.6**
**non-detachable cord**
flexible **external conductor** connected to, or assembled to, a **control** according to one of the methods in 2.10.6.1 to 2.10.6.4

**2.10.6.1**
**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

**2.10.6.2**
**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.

**2.10.6.3**
**type Y attachment**
method of attachment of the supply cord such that any replacement is intended to be made by the manufacturer, its service agent or a similar qualified person

**2.10.6.4**
**type Z attachment**
method of attachment such that the flexible cable or cord cannot be replaced without breaking or destroying a part of the **control**

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**2.10.7**
**flying lead**
**pigtail**
wire or wires intended for the connection of the **control**, with one end permanently connected to the **control** by the **control manufacturer**

**2.10.8**
**primary battery**
**cell**
any kind of electrochemical **cell** in which the electrochemical reaction of interest is not reversible

Note 1 to entry: An example is an alkaline battery.

**2.10.9**
**secondary battery**
**rechargeable cell**
any kind of electrochemical **cell** in which the electrochemical reaction of interest is reversible

Note 1 to entry: A rechargeable battery is a group of two or more secondary **cells**.

Note 2 to entry: Examples of rechargeable batteries are nickel metal hydride (NiMH), lithium ion (Li-ion) etc.

## 2.11 Definitions relating to the performance of type 2 actions

**2.11.1**
**manufacturing deviation**
maximum difference of **operating value**, **operating time** or **operating sequence** which is claimed between any two **controls**, supplied by the manufacturer to a **unique type reference**, when tested as submitted and in the same manner

Note 1 to entry: The difference may be related to an absolute value if permitted by the appropriate subclause of Clause 15.

**2.11.2**
**drift**
maximum alteration of **operating value**, **operating time** or **operating sequence** of any one sample which can occur when it is tested under the conditions specified in this standard

Note 1 to entry: The alteration may be related to an absolute value, or combined with the **manufacturing deviation**, if permitted by the appropriate subclause of Clause 15.

## 2.12 Definitions relating to the requirements for creepage distances and clearances

**2.12.1**
**clearance**
shortest distance through air between two conductive parts, or between a conductive part and a metal foil in contact with a surface of insulating material

Note 1 to entry: The method of measurement is detailed in Annex B and Figure 17.

**2.12.2**
**creepage distance**
shortest distance along the surface of the insulating material between two conductive parts, or between a conductive part and a metal foil in contact with any **accessible surface** of insulating material

Note 1 to entry: The method of measurement is detailed in Annex B and Figure 17.

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**2.12.3 Void**

**2.12.4 Void**

**2.12.5 Void**

**2.12.6 Void**

**2.12.7 Void**

**2.12.8**
**pollution**
any addition of foreign matter, solid, liquid, or gaseous that can result in a reduction of electric strength or surface resistivity of the insulation

**2.12.9 Environment**

**2.12.9.1**
**macro-environment**
**environment** of the room or other location in which the equipment is installed or used

**2.12.9.2**
**micro-environment**
immediate **environment** of the insulation which particularly influences the dimensioning of the **creepage distances**

**2.12.9.3**
**pollution degree**
numeral characterizing the expected **pollution** of the **micro-environment**

Note 1 to entry: **Pollution degrees** 1, 2, 3, and 4 are used. See Annex N.

## 2.13 Miscellaneous definitions

**2.13.1**
**unique type reference**
marking such that by quoting it in full to the manufacturer of the **control**, a replacement can be supplied which will be fully interchangeable with the original, electrically, mechanically, dimensionally and functionally

**2.13.2**
**tool**
screwdriver, a coin or any other object which may be used to operate a nut, a screw or similar part

**2.13.3**
**special-purpose tool**
**tool** which is unlikely to be readily available in a normal household, for example, a key for a hexagonal socket-headed screw

Note 1 to entry: **Tools** such as coins, screwdrivers and spanners intended to operate square, or hexagonal nuts, are not **special-purpose tools**.

**2.13.4**
**normal use**
use of the **control**, or its associated equipment, for the purpose for which it was made, and in the manner intended by the manufacturer

Note 1 to entry: **Normal use** includes any overload, or abnormal operating conditions specified in the equipment standard.

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Note 2 to entry: **Normal use** does not include any process which is necessary to maintain the **control** or equipment in good order, even though this may be carried out by the **user** according to the manufacturer's instructions.

**2.13.5**
**user maintenance**
any periodic process necessary to maintain the **control**, or equipment, in good order, for which details are given in the manufacturer's instructions to the **user**

**2.13.6**
**servicing**
any process necessary to maintain a **control**, or equipment, in good order, that would be done by a competent person, such as in a workshop, by an electrician or by a service organization

Note 1 to entry: This includes replacing a flexible cord, thermal link or the like.

**2.13.7**
**manufacturer servicing**
**servicing** which can only be done by the manufacturer, or his accredited serviceman

Note 1 to entry: This may be due to the need for **special purpose tools**, or special instrumentation, and includes the **setting by the control manufacturer**.

**2.13.8**
**failure**
termination of the ability of an item to perform a required function

[SOURCE: IEC 60050-191:1990, 191-04-01]

**2.13.9**
**fault**
state of an item characterised by its inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

Note 1 to entry: ”**Failure**“ is an event, as distinguished from ”**fault**“, which is a state.

Note 2 to entry: After **failure**, the item has a **fault**.

Note 3 to entry: This concept as defined does not apply to items consisting of software only.

Note 4 to entry: A **fault** is often the result of a **failure** of the item itself, but may exist without prior **failure**.

[SOURCE: IEC 60050-191:1990, 191-05-01]

**2.13.10**
**smart grid**
**intelligent grid**
electric power **system** that utilizes information exchange and **control** technologies, distributed computing and associated sensors and actuators, for purposes such as:

– to integrate the behaviour and actions of the network **users** and other stakeholders,
– to efficiently deliver sustainable, economic and secure electricity supplies

[SOURCE: IEC 60050-617:2011-10, 617-04-13]

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**2.13.11**
**smart enabled control**
**control** that is intended to interact with the **smart grid** and allows certain functions related to power billing rate or power demand response to be remotely controlled or enabled generally by communication with the power utility or by **user** remote interface

Note 1 to entry: For example, remote interface includes computer or smart phone.

### 2.14 Definitions relating to manufacturer and user

**2.14.1**
**control manufacturer**
manufacturer of the **control**

**2.14.2**
**equipment manufacturer**
manufacturer of equipment in which, on which, or together with which the **control** is used

Note 1 to entry: In Canada and the USA, the **equipment manufacturer** is indicated as the OEM (original **equipment manufacturer**). The OEM receives **controls** from **control manufacturers** for integration or incorporation into equipment.

**2.14.3**
**installer**
person qualified to install the **control** and possibly the associated equipment

**2.14.4**
**user**
one who uses the **control** with the aid of documentation (**user maintenance**) during its normal life

Note 1 to entry: The **user** is considered a layman.

**2.14.5**
**low complexity safety-related systems or controls**
safety related **system** or **control** in which

– the **failure** modes of each individual component are well defined;
– the behaviour of the **system** or **control** under **fault** conditions can be completely determined

### 2.15 Definitions pertaining to thermistors

See Annex J.

### 2.16 Definitions relating to the structure of controls using software

See Annex H.

### 2.17 Definitions relating to error avoidance in controls using software

See Annex H.

### 2.18 Definitions relating to fault/error control techniques for controls using software

See Annex H.

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### 2.19 Definitions relating to memory tests for controls using software

See Annex H.

### 2.20 Definitions of software terminology – General

See Annex H.

### 2.21 Void

### 2.22 Definitions relating to classes of control functions

See Annex H.

### 2.23 Definitions relating to functional safety

See Annex H.

### 2.24 Definitions related to access to data exchange

See Annex H.

## 3 General requirements

**Controls** shall be so designed and constructed that in **normal use**, they function so as not to cause injury to persons or damage to surrounding property, even in the event of such carelessness as may occur in **normal use**.

*In general, compliance is checked by carrying out the relevant tests specified in this standard and the appropriate part 2.*

## 4 General notes on tests

*Tests according to this standard are type tests.*

NOTE 1 If the results of any of the prescribed tests can be determined beyond doubt by assessment, then the test or tests need not be performed.

NOTE 2 See also Annex H. The requirements of Annex H are not applicable to non-electronic **controls**, unless specified in an appropriate part 2 of this standard.

### 4.1 Conditions of test

**4.1.1** *Unless otherwise specified in this standard, the samples are tested as delivered, having been mounted as declared by the manufacturer, but, when significant, in the most unfavourable position.*

**4.1.2** *If the test results are influenced by the room temperature, this shall be maintained at (20 ± 5) °C, except that in cases of doubt, it shall be maintained at (23 ± 2) °C, unless otherwise specified in a particular clause.*

**4.1.3** ***Actuating members*** *are placed in the most unfavourably* ***located position****,* ***intermediate position*** *or position of* ***setting by the user****, unless other instructions are given in a particular clause.*

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**4.1.4** *Unless otherwise specified in this standard, the tests are carried out in the order of the clauses of this standard.*

*See also Annex H.*

**4.1.5** *During the tests of this standard,* ***actuation*** *may be performed by test equipment if so desired, except for the high-speed tests of 17.12.*

**4.1.6** *During and for the purpose of the tests of this standard, other than for the tests of 17.12, the* ***actuating means*** *can be used to actuate the* ***control****, if an* ***actuating member*** *is not supplied by the manufacturer.*

**4.1.7** *The rates of temperature change declared in 7.2 and used in Clause 17 (that is $\alpha_1$, $\beta_1$, $\alpha_2$ and $\beta_2$) shall have test tolerances of ±12 K/h.*

*For other activating quantities, the minimum and/or maximum rates of change declared in requirement 37 of Table 1 and used in Clause 17 (that is $\alpha_1$, $\beta_1$, $\alpha_2$ and $\beta_2$) shall have test tolerances as specified in the appropriate part 2.*

**4.1.8** *In all tests, the measuring instruments or the measuring means shall be such as not to affect appreciably the value being measured.*

**4.1.9** to **4.1.11** See Annex H.

## 4.2 Samples required

**4.2.1** *One sample is used for the tests in Clauses 5 to 11 and 18 to 27, including the relevant annexes. A set of three samples is subjected to the remaining tests.*

*If one sample does not comply with the tests of Clauses 12 to 17 inclusive, the test which caused the non-compliance, and those preceding which may have influenced the result of that test, are repeated on another set of identical samples, all of which shall then comply with the repeated tests.*

*The manufacturer may submit, together with the first set of samples, the additional set or sets which may be wanted should one sample not comply. The testing authority will then, without further request, test the additional samples, and will only reject if a further non-compliance occurs. If the additional sets of samples are not submitted at the same time, a non-compliance of one sample may entail a rejection.*

NOTE In Canada and the USA, only one sample is used for the tests of Clauses 12 to 17 inclusive and the sample tested must comply.

**4.2.2** Void

**4.2.3** *Additional samples may be required for some destructive tests of this standard.*

**4.2.4** ***Controls*** *which are intended to meet the requirements of more than one part 2 document shall, in general, be tested to each part 2 separately.*

NOTE By agreement between manufacturer and testing authority, requirements and tests which are common to more than one part 2, need only be checked once, unless the common tests can influence the results of any specific tests.

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### 4.3 Instructions for test

#### 4.3.1 According to submission

**4.3.1.1** ***Controls****, if submitted in or with an equipment, may either be tested in or with the equipment, in which case they are classified as for declared specific load or tested separately, in which case they may be classified as for declared specific load, resistive load or resistive and inductive load. In either of the latter two cases, the current in the appropriate circuit when the equipment is operating under normal load is regarded as the rated current of the circuit.*

**4.3.1.2** *For all* ***controls*** *submitted, in, on or with an equipment, all other relevant information as required by 7.2 may be obtained by inspection and measurement of the submitted equipment.*

**4.3.1.3** ***Integrated controls*** *are classified as for declared specific load and are tested in the equipment, or part thereof, for which they are intended.*

**4.3.1.4** ***Controls*** *not submitted in or with an equipment are tested separately.*

**4.3.1.5** ***Controls*** *for use with* ***non-detachable cords*** *are tested with the appropriate cord connected.*

#### 4.3.2 According to rating

**4.3.2.1** ***Controls*** *for a.c. only are tested with a.c. at rated frequency if declared; those for d.c. only are tested with d.c. and those for a.c./d.c. at the more unfavourable supply.*

**4.3.2.2** ***Controls*** *for a.c. only, which are not declared for a rated frequency, are tested at either 50 Hz or 60 Hz, whichever is the more unfavourable.* ***Controls*** *with a rated frequency within a declared range other than 50 Hz to 60 Hz are tested at the most unfavourable frequency within the marked or declared range.*

**4.3.2.3** *When testing* ***controls*** *intended for d.c. only, the possible influence of polarity on the* ***operation*** *of the* ***control*** *is taken into consideration.*

**4.3.2.4** *For* ***controls*** *with different a.c. and d.c. ratings, the tests for Clauses 12, 13, 14 and 17, are made on two sets of samples, one being tested according to the a.c. rating, and the other according to the d.c. rating.*

NOTE At the option of the testing authority, a reduced number of tests can be made to cover the various ratings.

**4.3.2.5** *Unless otherwise specified,* ***controls*** *declared for one or more voltage ranges shall be tested at the most unfavourable voltage within the declared range, and this voltage being multiplied by the factor indicated in the appropriate clause (see 4.3.2.7).*

**4.3.2.6** *For* ***controls*** *marked or declared for more than one rated voltage or rated current, the tests of Clause 17 are made on sets of samples for each combination of rated voltage and rated current.*

NOTE At the option of the testing authority, a reduced number of tests can be made to cover the various ratings.

**4.3.2.7** *For* ***controls*** *declared for a voltage range, tests are made on one set of samples at each limit of the range, unless the difference between the limits does not exceed 10 % of the mean value of the range, in which case the tests are made on one set of samples at the upper limit of the range.*

**4.3.2.8** ***Controls*** *intended to be operated from a specific supply are tested with that specific supply.*

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**4.3.2.9** *A circuit for connection to the d.c. mains supply is classified as either a **SELV**/PELV circuit, **ELV** circuit or mains voltage circuit depending on the maximum operating voltage of the supply. This maximum operating voltage shall include consideration of the battery charging "float voltage" associated with the intended supply system, regardless of the marked voltage rating of the equipment.*

NOTE Float voltage is the constant voltage that is applied continuously to a voltaic **cell** to maintain the **cell** in a fully charged condition. Float voltage varies significantly with the chemistry and construction of the battery and ambient temperature.

**4.3.2.10** ***Controls** powered by rechargeable batteries are additionally tested in accordance with Annex V.*

**4.3.2.11** See Annex J.

### 4.3.3 According to protection against shock

**4.3.3.1** *If in **class 0 control**, **class 0I control** or **class I control**, or in **controls** for class 0, class 0I or class I equipment, it is necessary to have parts with **double insulation** or **reinforced insulation**, such parts are checked for compliance with the appropriate requirements specified for **class II controls**.*

**4.3.3.2** *In any **class I control**, and in any **control** used in a class I equipment, unearthed accessible metal or accessible insulating surfaces shall be provided with insulation complying with the requirements for a **class II control** (see 9.1.1).*

**4.3.3.3** *If in **class 0 control**, **class 0I control**, **class I control** or **class II controls**, or **controls** for class 0, class 0I, class I or class II equipment, it is necessary to have parts using **SELV**-circuits, such parts are also checked for compliance with the appropriate requirements specified for protection by use of **SELV** in 11.2.6.*

*If in **class I controls** or **controls** for class I equipment it is necessary to have parts using PELV-circuits, such parts are also checked for compliance with the appropriate requirements specified for protection by use of PELV in 11.2.6.*

NOTE By definition (2.7.5) **class II controls** cannot use PELV-circuits.

### 4.3.4 According to manufacturing variants

**4.3.4.1** ***Controls** which are otherwise identical but which may be set by the manufacturer, or which may, by the inclusion at the manufacturing stage of alternative components or parts produce various **operating values**, **operating times** or **operating sequences**, are for the purpose of this standard normally treated as a single submission. Normally, **controls** set to the most arduous condition will be sufficient. However, the testing authority may require extra samples, set to other values, where it can be clearly shown that these are necessary to allow approval of the whole range.*

**4.3.4.2** *In these cases, due attention shall be paid to possible variations in **manufacturing deviation** and **drift** of any **operating value**, **operating time** or **operating sequence**, and, for **sensing controls**, to the minimum and maximum acceptable rates of rise and fall of the appropriate **activating quantity** which may be applicable to different parts of the range.*

### 4.3.5 According to purpose

**4.3.5.1** *Multi-purpose **controls** shall, according to 6.3, in general be tested for each purpose separately. During the tests for any one purpose, the activating quantities and **prime movers** applicable to all other purposes, shall be maintained constant at the most arduous value or position within the declared range or ranges.*

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**4.3.5.2** *Such **controls** without an appropriate section of Clause 17 shall be tested in a manner agreed between the manufacturer and the testing authority so that the essential intended **operating values**, **operating times** and **operating sequences** are tested.*

**4.3.5.3** *Any **control** with a purpose not classified in 6.3, or in the appropriate part 2, may be tested and approved to this standard, except for Clause 17. A test schedule for Clause 17 shall be based, wherever possible, on the intent of that clause and shall be agreed between the manufacturer and the testing authority.*

**4.3.5.4** See Annex J.

## 5 Rating

### 5.1 Maximum rated voltage

The maximum rated voltage is 690 V.

### 5.2 Void

### 5.3 Compliance

*Compliance with 5.1 and 5.2 is checked by the information requirements in Clause 7.*

## 6 Classification

A **control** is classified:

### 6.1 According to nature of supply

**6.1.1 Control** for a.c. only

NOTE 1 A **control** for a.c. only can be used on a d.c. circuit provided that the current does not exceed 10 % of the rated current for a.c., or 0,1 A, whichever is smaller.

NOTE 2 Additional tests can be required to establish the d.c. rating.

**6.1.2 Control** for d.c. only.

**6.1.3 Control** for a.c. and d.c.

**6.1.4 Control** for specific supplies or multiple supplies.

**6.1.5** Battery powered **control**.

### 6.2 According to type of load to be controlled by each circuit of the control

A **control** having more than one circuit need not have the same classification for each circuit.

**6.2.1** Circuit for a substantially resistive load with a power factor not less than 0,95.

NOTE Such circuits can be used for an inductive load, provided that the power factor is not less than 0,8, and the inductive load does not exceed 60 % of the current rating for the resistive load. Such circuits can also be used for other reactive loads provided that the reactive current does not exceed 5 % of the rated resistive current, and that the load is not greater than 10 VA.

**6.2.2** Circuit suitable for either a resistive load or for an inductive load with a power factor not less than 0,6 or a combination of both.

NOTE 1 An example is a circuit in a fan-heater which incorporates both a heating element and a motor.

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NOTE 2 Circuits intended for inductive loads only can either be classified under 6.2.2 by declaring that the resistive load is equal to the inductive load, or may be classified as for a declared specific load.

**6.2.3** Circuit for declared specific load.

NOTE Examples are circuits for tungsten filament or fluorescent lamp loads, highly inductive loads with a power factor of less than 0,6, capacitive loads, and contacts intended to be operated off load.

**6.2.4** Circuit for a current less than 20 mA.

NOTE Examples are circuits for neon indicators and other signal lamps.

**6.2.5** Circuit for a.c. motor load whose characteristics are defined by the **control** manufacturer's declaration.

**6.2.6** Circuit for pilot load.

### 6.3 According to their purpose

A **control** may be classified for more than one purpose, in which case it is referred to as a multi-purpose **control**.

NOTE Any **manual action** of an **automatic control** or a separate **manual action** being integral with an **automatic control** is not classified according to 6.3.

**6.3.1** – **thermostat**;

**6.3.2** – **temperature limiter**;

**6.3.3** – **thermal cut-out**;

**6.3.4** Void

**6.3.5** – **energy regulator**;

**6.3.6** – **timer**;

**6.3.7** – **time switch**;

**6.3.8** – **manual control**;

**6.3.9** – **sensing control** (other than one covered by 6.3.1 through 6.3.4);

**6.3.10** – **electrically operated control**;

**6.3.11** – **motor protector**;

**6.3.11.1** – **thermal motor protector**;

**6.3.12** – **electrically operated valve**;

**6.3.13** – **electrically operated mechanism**;

**6.3.14** – **protective control**;

**6.3.15** – **operating control**.

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NOTE Further classification can be found in the appropriate part 2.

### 6.4 According to features of automatic action

**6.4.1** – **Type 1 action**;

**6.4.2** – **Type 2 action**.

**6.4.3** **Type 1 actions** and **type 2 actions** are further classified according to one or more of the following constructional or operational features:

NOTE 1 These further classifications are only applicable if the relevant declarations have been made and any appropriate tests completed.

NOTE 2 An action providing more than one feature may be classified by a combination of the appropriate letters, for example, type 1.C.L. or type 2.A.E.

NOTE 3 A **manual action** is not classified according to 6.4.3.

**6.4.3.1** – **full disconnection** on **operation** (type 1.A or 2.A);

**6.4.3.2** – **micro-disconnection** on **operation** (type 1.B or 2.B);

**6.4.3.3** – **micro-interruption** on **operation** (type 1.C or 2.C);

**6.4.3.4** – a **trip-free** mechanism which cannot even momentarily be reclosed against the **fault** (type 1.D or 2.D);

**6.4.3.5** – a **trip-free** mechanism in which the contacts cannot be prevented from opening or maintained closed against a continuation of the **fault** (type 1.E or 2.E);

NOTE An example is a current-**sensing control** which has to be reclosed or can be reclosed momentarily to detect that the excess current **fault** still exists.

**6.4.3.6** – an action which can only be reset by the use of a **tool** (type 1.F or 2.F);

**6.4.3.7** – an action which is not intended to be reset under electrically loaded conditions (type 1.G or 2.G);

**6.4.3.8** – a **trip-free** mechanism in which the contacts cannot be prevented from opening and which may automatically be reset to the "closed" position after normal **operation** conditions have been restored if the reset means is held in the "reset" position (type 1.H or 2.H);

**6.4.3.9** – a **trip-free** mechanism in which the contacts cannot be prevented from opening and the **control** is not permitted to function as an automatic reset device if the reset means is held in the "reset" or "on" position (type 1.J or 2.J);

**6.4.3.10** – for sensing actions, no increase in the **operating value** as the result of a breakage in the **sensing element**, or in parts connecting the **sensing element** to the **switch head** (type 1.K or 2.K);

**6.4.3.11** – an action that does not require any external auxiliary energy source of electrical supply for its intended **operation** (type 1.L or 2.L);

**6.4.3.12** – an action which operates after a declared ageing period (type 1.M or 2.M).

**6.4.3.13** See Annex H.

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### 6.5 According to the degree of protection and control pollution degree

**6.5.1** According to degrees of protection provided by enclosures against ingress of solid objects and dust (see IEC 60529):

IP0X, IP1X, IP2X, IP3X, IP4X, IP5X, IP6X.

**6.5.2** According to degree of protection provided by enclosures against harmful ingress of water (see IEC 60529):

IPX0, IPX1, IPX2, IPX3, IPX4, IPX5, IPX6, IPX7, IPX8.

NOTE 1 A **control** intended for use in a particular **environment** can be used for a different **environment** if the appropriate provisions, if any, are made in the equipment.

NOTE 2 Preferred combinations of degrees of protection are according to 6.5.1 and 6.5.2:

| **First characteristic numeral**<br>**Protection against ingress of foreign bodies** | **Second characteristic numeral**<br>**Protection against ingress of water** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 0 | IP00 | | | | | | | | |
| 1 | | | | | | | | | |
| 2 | IP20 | IP21 | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | IP41 | | IP43 | IP44 | | | | |
| 5 | | | | | IP54 | IP55 | | | |
| 6 | | | | | | IP65 | | IP67 | IP68 |

**6.5.3** According to the **pollution degree** or **pollution degrees** for which the **control** is declared. See Annex N.

NOTE It is possible that when a **control** is mounted in accordance with the manufacturer's declaration, different parts of the **control** can be in **macro-environments** having different **pollution degrees**.

### 6.6 According to method of connection

**6.6.1** **Control** with at least one terminal intended for the connection of **fixed wiring**.

NOTE In Canada and the USA, **flying leads** are allowed.

**6.6.2** **Control** with at least one terminal intended for the connection of a flexible cord.

A **control** may be classified under both 6.6.1 and 6.6.2.

**6.6.3** **Control** without any terminals intended for the connection of an **external conductor**.

This type of **control** is intended for the connection of only integrated or **internal conductors**.

**6.6.4** **Control** intended for the connection of a **primary battery**.

**6.6.5** Control intended for the connection of a **secondary battery** (**rechargeable cell**).

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### 6.7 According to ambient temperature limits of the switch head

**6.7.1** **Control** with a **switch head** for use in an ambient temperature between a minimum value ($T_{min}$) of 0 °C, and a maximum value ($\boldsymbol{T_{max}}$) of 55 °C.

**6.7.2** **Control** with a **switch head** intended to be used in an ambient temperature having a maximum value ($\boldsymbol{T_{max}}$) other than 55 °C but no less than 30 °C, or a minimum value ($T_{min}$) lower than 0 °C, or both.

NOTE Preferred values of $\boldsymbol{T_{max}}$ are 30 °C, 55 °C, 70 °C, 85 °C, 105 °C, 125 °C, 150 °C. Preferred values of $T_{min}$ are 0 °C, –10 °C, –20 °C, –30 °C, and –40 °C.

Values differing from these preferred values are possible.

### 6.8 According to protection against electric shock

**6.8.1** For an **integrated control**:

NOTE An **integrated control** is not classified but takes the classification of the equipment with which it is integrated.

**6.8.2** For an **incorporated control** for use in:

**6.8.2.1** – class 0 equipment;

**6.8.2.2** – class 0I equipment;

**6.8.2.3** – class I equipment;

**6.8.2.4** – class II equipment;

**6.8.2.5** – class III equipment.

NOTE 1 For coordination of electrical equipment class 0, class I, class II and class III, see IEC 61140, and for protective provisions within an electrical installation, see IEC 60364.

NOTE 2 A **control** intended for incorporation in a particular class of equipment may be used for a different class if appropriate provisions are made in the equipment.

**6.8.3** For an **in-line cord control**, a freestanding **control**, or an **independently mounted control**:

**6.8.3.1** – of class 0;

**6.8.3.2** – of class 0I;

**6.8.3.3** – of class I;

**6.8.3.4** – of class II;

**6.8.3.5** – of class III.

NOTE 1 For coordination of electrical equipment class 0, class I, class II and class III, see IEC 61140, and for protective provisions within an electrical installation, see IEC 60364.

NOTE 2 A **control** intended for incorporation in a particular class of equipment may be used for a different class if appropriate provisions are made in the equipment.

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**6.8.4 Controls** using **SELV** or PELV for protection against electric shock

**6.8.4.1 Controls** using **SELV**-circuit(s), and if applicable, the information declared in Table 1, requirement 86

**6.8.4.2 Controls** using PELV-circuit(s), and if applicable, the information declared in Table 1, requirement 86

**6.9 According to circuit disconnection or interruption**:

**6.9.1** – **full disconnection**;

**6.9.2** – **micro-disconnection**;

**6.9.3** – **micro-interruption**;

**6.9.4** – **all-pole disconnection**;

**6.9.5** – See Annex H.

NOTE 1 Some equipment standards require **full disconnection**, others permit either **full disconnection** or **micro-disconnection**; some only require **micro-interruption**.

NOTE 2 Different actions of a **control** can provide different circuit disconnections or interruptions.

**6.10 According to number of cycles of actuation (M) of each manual action**

Preferred values are:

**6.10.1** – 100 000 cycles;

**6.10.2** – 30 000 cycles;

**6.10.3** – 10 000 cycles;

**6.10.4** – 6 000 cycles;

**6.10.5** – 3 000 cycles [1];

**6.10.6** – 300 cycles [1];

**6.10.7** – 30 cycles [1].

[1] Applicable only to actions of **controls** for specific equipment and applications such as voltage-tap **controls**, summer/winter **controls** for water heaters and where permitted by the appropriate equipment standard.

NOTE For **controls** with more than one **manual action**, a different value can be declared for each. If a **control** has more than one intended **"OFF" position**, then a cycle of **actuation** is regarded as a movement from one "OFF" position to the next **"OFF" position**.

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### 6.11 According to number of automatic cycles (A) of each automatic action

Preferred values are:

**6.11.1** – 300 000 cycles;

**6.11.2** – 200 000 cycles;

**6.11.3** – 100 000 cycles;

**6.11.4** – 30 000 cycles;

**6.11.5** – 20 000 cycles;

**6.11.6** – 10 000 cycles;

**6.11.7** – 6 000 cycles;

**6.11.8** – 3 000 cycles [1];

**6.11.9** – 1 000 cycles [1];

**6.11.10** – 300 cycles [2];

**6.11.11** – 30 cycles [2][4];

**6.11.12** – 1 cycle [3].

[1] Not applicable to **thermostats** or to other fast cycling actions.

[2] Applicable only to manual reset.

[3] Applicable only to actions which require the replacement of a part after each **operation**.

[4] Can only be reset during **manufacturer servicing**.

NOTE For **controls** having more than one **automatic action**, a different value can be declared for each.

### 6.12 According to temperature limits of the mounting surface of the control

**6.12.1** **Control** suitable for mounting on a surface which is not more than 20 K above the ambient temperature classified in 6.7.

**6.12.2** **Control** suitable for mounting on a surface which is more than 20 K above the ambient temperature classified in 6.7.

NOTE An example of such a **control** is one mounted on a compressor unit in a refrigerator, where the mounting surface can be 150 °C, although the **sensing element** is at a temperature of –10 °C, and the ambient temperature is only 30 °C.

### 6.13 According to value of proof tracking index (PTI) for the insulation material used

**6.13.1** – material of material group IIIb with a PTI of 100 and up to but excluding 175;

**6.13.2** – material of material group IIIa with a PTI of 175 and up to but excluding 400;

**6.13.3** – material of material group II with a PTI of 400 and up to but excluding 600;

**6.13.4** – material of material group I with a PTI of 600 and over.

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**6.14 According to period of electrical stress across insulating parts supporting live parts and between live parts and earthed metal**

**6.14.1** – short period;

**6.14.2** – long period.

NOTE Long periods of electrical stress are considered to exist if the **control** is used in equipment for continuous use; and also for the supply side of a **control** in any other equipment unlikely to be disconnected from the supply by the removal of a plug or by the **operation** of a **control** providing **full disconnection**.

**6.15 According to construction:**

**6.15.1** – **integrated control**;

**6.15.2** – **incorporated control**;

**6.15.3** – **in-line cord control**;

**6.15.4** – **free-standing control**;

**6.15.5** – **independently mounted control** for:

**6.15.5.1** – surface mounting;

**6.15.5.2** – flush mounting;

**6.15.5.3** – panel mounting.

**6.15.6** See Annex J.

**6.16 According to ageing requirements (Y) of the equipment in which, or with which, the control is intended to be used**

**6.16.1** – 60 000 h;

**6.16.2** – 30 000 h;

**6.16.3** – 10 000 h;

**6.16.4** – 3 000 h;

**6.16.5** – 300 h;

**6.16.6** – 15 h.

NOTE **Controls** which operate during the heating or endurance tests of the equipment standard are not classified according to 6.16.6.

**6.17 According to use of the thermistor**

See Annex J.

**6.18 According to classes of control functions**

See Annex H.

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# 7 Information

## 7.1 General requirements

The **control manufacturer** shall provide adequate information to confirm:

– that a suitable **control** can be selected;

– that the **control** can be mounted and used in a manner that will enable it to meet the requirements of this standard; and

– that the relevant tests can be performed to determine compliance with this standard.

## 7.2 Methods of providing information

**7.2.1** Information shall be provided using one or more of the following methods. The information required for **controls** and the appropriate method for providing this information shall be as indicated in Table 1.

NOTE 1 It is not intended that Table 1 itself necessarily be the actual form used to communicate between manufacturer and test house.

– By marking (C) – this information shall be provided by marking on the **control** itself, except that, in the case of an **integrated control**, such marking can be on an adjacent part of the equipment, provided that it is clear that it refers to the **control**.

  NOTE 2 Information provided by marking (C) can also be included in documentation (D,E).

– By documentation on hard copy (D) – this information shall be provided for the **user** or **installer** of the **control**, and shall consist of legible instructions. Each **control** shall be accompanied by such instructions. Instruction sheets and other texts required by this standard shall be written in the official language(s) of the country in which the **control** is to be sold.

  For **controls** intended to be exclusively delivered to the **equipment manufacturer**, the instruction sheet may be replaced by a leaflet, letter or drawing, etc. It is not necessary for each **control** to be accompanied by such a document.

– By documentation on electronic media on internal or external memory (E) – this information is as alternative to (D).

– By declaration (X) – this information shall be provided for the testing authority for purposes of test and in a manner agreed between testing authority and manufacturer. It may, for example, be provided by a marking on the **control**, by a leaflet, letter or drawing or, in the case of a **control** submitted in, on or with an equipment, by measurement or inspection of the submitted equipment. This information should also be provided to the **equipment manufacturer**, as appropriate.

**7.2.2** Information which is indicated as being required by marking (C) or by documentation (D,E) shall also be provided for the testing authority in an agreed manner if so requested by the testing authority.

**7.2.3** For **controls** submitted in, on or with an equipment, the requirement for documentation (D,E) is replaced by declaration (X).

**7.2.4** For an **integrated control** forming part of a more complex **control**, the marking relating to the **integrated control** may be included in the marking of the more complex **control**.

**7.2.5** The requirement for documentation (D,E) is considered to be met if such information has been provided by marking (C).

**7.2.5.1** The requirement for declaration (X) is considered to be met if such information has been provided by either documentation (D,E) or by marking (C).

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**7.2.6** Except as indicated in 7.4, for **integrated controls** all information is provided by means of declaration (X).Unless otherwise indicated in a part 2, for **incorporated controls**, the only marking required is the manufacturer's name or trade mark and the **unique type reference**, if other required marking is provided by documentation (D,E). For **incorporated controls** declared under requirement 50, see the explanation of documentation (D,E) contained in 7.2.1.

**7.2.7** For **controls** that are neither integrated nor incorporated, where lack of space prevents legible marking as specified, the **control** shall be marked with the manufacturer's name (or trade mark) and the **unique type reference** only. The other marking required shall be included in documentation (D,E).

**7.2.8** Additional marking or information is allowed, provided that it does not give rise to misunderstanding.

**7.2.9** When symbols are used, they shall be as follows:

| | |
|---|---|
| Amperes | A |
| Volts | V |
| Watts | W |
| Volts-amperes | VA |
| Alternating current (single-phase) | ~ IEC 60417-5032 (2002-10) |
| Alternating current (three-phase) | 3~ |
| Alternating current (three-phase with neutral) | 3N~ |
| Direct current | ⎓ IEC 60417-5031 (2002-10) |
| Class II construction | ⧈ IEC 60417-5172 (2003-02) |
| **Class III control** | III IEC 60417-5180 (2003-02) |
| Ambient temperature limits of **switch head** T | (The letter T preceded by a minus sign and the numerical value of the lower temperature if $T_{min}$ less than 0 °C, or followed by the numerical value of the higher temperature if $T_{max}$ other than 55 °C.) |
| Rated current of the appropriate fuse in amperes | IEC 60417-5016 (2002-10) |
| Frequency | Hz |
| Earthing terminal | IEC 60417-5019 (2006-08) |
| Functional earthing | IEC 60417-5018 (2011-07) |

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