

Specification for

Automatic electrical controls for household and similar use —

Part 1: General requirements

The European Standard EN 60730-1:1991 has the status of a
British Standard

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Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

This British Standard, having been prepared under the direction of the Light Electrical Engineering Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 September 1992

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National foreword

This British Standard has been prepared under the direction of the Light Electrical Engineering Standards Policy Committee and is the English language version of EN 60730-1, “*Automatic electrical controls for household and similar use — Part 1: General requirements*”, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by that organization from IEC Publication 730-1 (1986) first edition, which has the same title as the European Standard.

The CENELEC common modifications have been implemented at the appropriate places in the text of IEC Publication 730-1 (1986) first edition as amended by Amendment No. 1 (1990) and Amendment No. 2 (1991) and are indicated by a sideline in the margin. The foreword and preface of IEC Publication 730-1 (1986) first edition as amended by Amendment No. 1 (1990) and Amendment No. 2 (1991) and the deleted parts of the original IEC text which do not form part of the text of EN 60730-1 have been quoted in National appendix NA. Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. National appendices are designated “informative”.

References to page numbers in the text are to page numbers in IEC 730-1 (1986) and should be ignored for the purposes of this British Standard.

This British Standard incorporates amendments EN 60730-1/A1 (1991), EN 60730-1/A11 (1991), EN 60730-1/A12 (1993) and EN 60730-1/A14 (1995).

Particular requirements for specific controls will be specified in subsequent Parts of BS EN 60730. Such controls have been specified in BS 3955 “*Specification for electrical controls for household and similar general purposes*”. As the subsequent Parts of BS EN 60730 are published, BS 3955 will be progressively amended to delete specific controls at the dates of withdrawal agreed.

Amend the text of European Standard EN 60730-1 as follows.

In 4.1.5, line 2 delete “and 17.13”.

In 17.8.4, in the last line, delete “17.8.4” and substitute “7.2”.

Cross-references. The relationship between other international publications quoted in this standard and British Standards which are either identical or technically equivalent is given in national National appendix NC.

Product approval. Attention is drawn to the fact that products conforming to this British Standard may be approved by the British Electrotechnical Approvals Board for the purposes of participation in the CENELEC Certification Agreement and in the CB Scheme of the IECEE. (Details of the BEAB Approval Scheme are given on the inside back cover.)

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 166, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Automatic electrical controls for household and similar use Part 1: General requirements

(Includes Amendment A1:1991 + Amendment A11:1991 + A12:1993 + A14:1995)
(IEC 730-1:1986, modified)

Dispositifs de commande électrique
automatiques à usage domestique et analogue
Première partie: Règles générales
(CEI 730-1:1986, modifiée)

(Inclut les amendement A1:1991 + A11:1991
+ A12:1993 + A14:1995)

Automatische elektrische Regel- und
Steuergeräte für den Hausgebrauch und
ähnliche Anwendungen

Teil 1: Allgemeine Anforderungen

(IEC 730-1:1986, modifiziert)

(Einschließlich Änderung A1:1991 + A11:1991
+ A12:1993 + A14:1995)

This European Standard was approved by CENELEC on 11 September 1990. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 730-1:1986 could be accepted without textual changes, has shown that some common modifications were necessary for the acceptance as European Standard.

The reference document, together with the common modifications prepared by the CENELEC Technical Committee TC 72: Automatic controls for household use, was submitted to the CENELEC members for formal vote.

The text of the draft was approved by CENELEC on 11 September 1990.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1992-07-01
- latest date of withdrawal
of conflicting standards (dow) 1995-07-01

For products which have complied with the relevant national standard before 1995-07-01 as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1999-07-01.

This document supplements or modifies the corresponding clauses of IEC 730-1:1986, so as to convert it into the European Standard EN 60730-1.

In using this standard, reference must also be made to all appropriate amendments to this standard which contain additional common modifications.

Subclauses which are in addition to those in the IEC 730-1 are numbered 501, 502 etc. New annexes are numbered Annex ZA, Annex ZB etc.

Special national conditions (snc) causing a deviation from this European Standard are listed in Annex ZA (normative) which forms part of this standard.

Where reference is made to other international or harmonized standards, the edition of that standard quoted in Annex ZB (normative) is applicable.

This standard will be in two parts:

Part 1: General requirements, comprising clauses of a general character for automatic electrical controls for use in, on, or with household and similar electrical appliances.

It applies only when there is a Part 2 for a particular type of control, or for controls for particular application.

Part 2: Particular requirements, dealing with particular types of controls or controls for particular application. The clauses of these particular requirements supplement or modify the corresponding clauses of Part 1.

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

- supplement — the Part 1 text applies with the additional requirement indicated in Part 2;
- amendment — the Part 1 text applies with a minor change as indicated in Part 2;
- replacement — the Part 2 text contains a change which replaces the Part 1 text in its entirety;
- deletion — the Part 1 text does not apply.

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

NOTE In this document, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type;*
- explanatory matter: in smaller roman type.

Foreword to amendment A1

The CENELEC questionnaire procedure, performed for finding out whether or not amendment No. 1:1990 to the International Standard IEC 730-1:1986 could be accepted without textual changes, has shown that some common modifications were necessary for the acceptance as amendment to the European Standard.

The reference document, together with the common modifications prepared by the CENELEC Technical Committee TC 72: Automatic controls for household use, was submitted to the CENELEC members for formal vote.

The text of the draft was approved by CENELEC as amendment A1 on 11 September 1990.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1992-07-01
- latest date of withdrawal
of conflicting standards (dow) 1995-07-01

This document supplements or modifies the corresponding clauses of amendment No. 1:1990 to IEC 730-1:1986, so as to convert it into amendment A1 to EN 60730-1.

Subclauses which are in addition to those in the IEC Standard 730-1 are numbered 501, 502 etc. New annexes are numbered Annex ZA, Annex ZB etc.

Special national conditions (snc) causing a deviation from this amendment are listed in Annex ZA (normative) which forms part of this standard.

Where reference is made to other international or harmonized standards, the edition of that standard quoted in Annex ZB (normative) is applicable.

Foreword to amendment A11

The CENELEC questionnaire procedure, performed for finding out whether or not the IEC Central Office documents IEC 72(CO)38, 72(CO)40, 72(CO)42, and 72(CO)24 as amended by 72(CO)35, could be accepted without textual changes, has shown that some common modifications were necessary for the acceptance as amendment to the European Standard.

The reference documents, together with the common modifications prepared by the CENELEC Technical Committee TC 72: Automatic controls for household use, were submitted to the CENELEC members for formal vote as draft amendments prAA, prAB, prAC and prAD to EN 60730-1. All four documents received sufficient positive votes for submission to the Technical Board for ratification.

Amendment No. 2 to IEC Publication 730-1 will include the above referenced Central Office documents. However, because of delays in printing this amendment, it has been found necessary to issue the present amendment to EN 60730-1 as amendment A11.

When IEC Amendment No. 2 becomes available, CENELEC/TC 72 will discuss this amendment again with the object of re-issuing it as an endorsement of IEC Amendment No. 2. The separate sections of this document will then be eliminated.

The texts of the drafts were approved by CENELEC as amendment A11 on 11 September 1990.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1992-07-01
- latest date of withdrawal of conflicting standards (dow) 1995-07-01

This document supplements or modifies the corresponding clauses of the IEC Central Office documents IEC 72(CO)38, 72(CO)40, 72(CO)24 as amended by 72(CO)35, so as to convert them into amendment A11 to EN 60730-1.

Where reference is made to other international or harmonized standards, the edition of that standard quoted in Annex ZB (normative) is applicable.

Foreword to amendment A12

This amendment A12 to EN 60730-1:1991 has been prepared by the CENELEC Technical Committee TC 72: Automatic controls for household use.

It was agreed for submission to the CENELEC formal vote at the meeting of CLC/TC 72 in Brussels on 26 and 27 November 1991.

At that meeting it was considered necessary to issue a correction to clause 6 of EN 60730-1.

At that same meeting, a proposal from the Danish Committee (CLC/TC 72(DK)5) to delete note 12 to Table 20.1 because this is a North American requirement which should not have appeared in the EN, was accepted.

The text of the draft was approved by CENELEC as amendment A12 to EN 60730-1 on 9 December 1992.

The following dates are fixed:

- latest date of publication of an identical national standard (dop) 1994-01-01
- latest date of withdrawal of conflicting standards (dow) 1995-07-01

Foreword to amendment A14

At the request of the British Electrotechnical Committee, a draft for an amendment to EN 60730-1:1991 was submitted to the CENELEC members for acceptance in January 1995.

The text of the draft was accepted by CENELEC as amendment A14 to EN 60730-1:1991 on 1995-03-20.

The following dates were fixed:

- latest date by which the existence of the amendment has to be announced at national level (doa) 1995-06-20
- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1995-09-20

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1 Scope

1.1 In general, this standard applies to automatic electrical controls for household and similar use, including electrical controls for heating, air conditioning, and similar applications.

1.1.1 This 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, household or similar equipment.

This standard is also applicable to controls for appliances within the scope of EN 60335-1: Safety of Household and Similar Electrical Appliances, Part 1: General requirements.

Throughout this standard the word “equipment” means “appliance and equipment”.

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 or acceleration. It also applies to controls incorporating electronic parts.

1.1.3 This standard applies to starting relays, which are a specific type of automatic electrical control, designed 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.

Requirements for manual switches not forming part of an automatic control are contained in IEC Publication 1058: Switches for Appliances.

1.2 This standard applies to controls with a rated voltage not exceeding 660 V and with a rated current not exceeding 63 A.

1.3 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.

1.4 This standard applies also to controls incorporating electronic devices, requirements for which are contained in Appendix H.

2 Definitions

The following definitions apply for the purpose of this standard. 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, frequency and wattages

2.1.1

rated voltage, current, frequency or wattage

rated voltage, current, frequency or wattage denotes the voltage, current, frequency or wattage assigned to a control by the manufacturer. For three-phase supply, the rated voltage is the line voltage

2.1.2

rated voltage, current, frequency or wattage range

rated voltage, current, frequency or wattage range denotes the 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

working voltage denotes the maximum voltage to which the part under consideration is subjected when the control is operating at its rated voltage under conditions of normal use or likely fault

When determining working voltage, normal use includes such likely faults as those either within the control or associated load, which produce a voltage change on the part under consideration.

A typical likely fault is when a filament lamp, supplied through a series resistor from a higher voltage, burns out, so producing the higher voltage across the lamp holder terminations.

When considering working voltage, the effect of possible transient voltages on the mains is ignored.

2.1.4

extra-low voltage

extra-low voltage denotes a nominal voltage not exceeding 42 V between conductors and between conductors and earth, or for three-phase connection not exceeding 42 V between line conductors and 24 V between line conductors and neutral

2.1.5

safety extra-low voltage

safety extra-low voltage denotes a nominal voltage 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

when safety extra-low voltage is obtained from supply mains of higher voltages, it shall be through a safety isolating transformer or a converter with separate windings providing equivalent insulation

The voltage limits are based on the assumption that the safety isolating transformer is supplied at its rated voltage.

2.1.6

safety isolating transformer

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

2.1.7

same polarity

same polarity denotes a relationship between two 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

opposite polarity

opposite polarity denotes a relationship between two live parts such that an interconnection between them allows a flow of current which is limited by the impedance of the electrical supply circuit

2.1.9

isolated limited secondary circuit

isolated limited secondary circuit denotes a circuit derived from an isolated secondary winding of a transformer having a maximum capacity of 100 volt-amperes and an open-circuit secondary voltage rating not exceeding 1 000 volts

2.2 Definitions of types of control according to purpose

2.2.1

electrical control

electrical control (hereinafter referred to as “control”) denotes a 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. At least one of these aspects shall be electrical or electronic

2.2.2

manual control

manual control denotes a 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

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

2.2.4**sensing control**

sensing control denotes an 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**

thermally operated control denotes an automatic control in which the transmission is by a thermal prime mover

2.2.6**thermostat**

thermostat denotes a 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 limiter denotes a 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

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**

thermal cut-out denotes a 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

A thermal cut-out may be of the automatic, the manual reset, or the non-resettable type. Normally a thermal cut-out will provide a Type 2 action.

2.2.9**non-resettable thermal cut-out**

non-resettable thermal cut-out denotes a thermal cut-out which operates only once and then requires partial or complete replacement

2.2.10**energy regulator**

energy regulator denotes a self-cycling control which alters the energy supplied to a load by making and breaking the circuit, and which may be set by the user to change the average energy supplied

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

2.2.11**time-based control**

time-based control denotes an automatic control in which the transmission is effected by a time-based prime mover or a time-based electrical circuit

2.2.12**electrically operated control**

electrically operated control denotes an 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

An example is a relay.

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**

timer denotes a time-based control which requires actuation before the next cycle can take place

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

An example is a 24 h control on a storage heater.

2.2.15

motor protector

motor protector denotes an automatic control that is specifically designed to protect the windings of an electric motor from overheating

2.2.16

thermal motor protector

thermal motor protector denotes an automatic control, built-in or on a motor, that is specifically designed to protect the motor against overheating due to running overload and failure to start. The control carries motor current and is sensitive to motor temperature and current

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

electrically operated valve denotes an 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

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

An example is an electrically operated interlock for a spin dryer lid.

An electric motor is not included in this definition.

2.3 Definitions relating to the function of controls

2.3.1

initiation

initiation denotes the alteration to that aspect of a control which is required to produce transmission and operation

2.3.2

transmission

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

2.3.3

operation

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

2.3.4

automatic action

automatic action denotes 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

slow-make slow-break automatic action denotes a 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

This action may be applicable to either the make, or the break, or both.

2.3.6**manual action**

manual action denotes 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

2.3.7**actuation**

actuation denotes a 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**

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

2.3.9**intermediate position**

intermediate position denotes 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 indeterminate

2.3.10**activating quantity**

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

2.3.11**operating value**

operating value denotes the 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**

operating time denotes the 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**

operating sequence denotes the designed 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

It includes the pattern of opened or closed contacts in any located position, intermediate position or position of setting by manufacturer or user.

2.3.14**response value**

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

2.3.15**trip-free**

trip-free denotes an automatic action, with a reset actuating member, so designed that the automatic action is independent of manipulation or position of the reset mechanism

2.3.16**leakage current**

leakage current denotes 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

2.4 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

all-pole disconnection denotes, 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

The protective earthing conductor is not considered to be a supply conductor.

2.4.2

full-disconnection

full-disconnection denotes contact separation in all supply poles other than earth so as to ensure the equivalent of basic insulation between the supply mains and those parts intended to be disconnected

There are electric strength and dimensional requirements.

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.

2.4.3

micro-disconnection

micro-disconnection denotes adequate contact separation in at least one pole so as to ensure functional security

There is a requirement for the electric strength of the contact gap but no dimensional requirement.

Micro-disconnection ensures 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 Sub-clause 7.2 requirement number 36.

2.4.4

micro-interruption

micro-interruption denotes an interruption of a circuit by contact separation, by a cycling action or by a non-cycling action which does not ensure full-disconnection or micro-disconnection

There are no electric strength or dimensional requirements for the contact gap.

2.4.5

OFF position

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

2.5 Definitions of type of control according to construction

2.5.1

integrated control

integrated control denotes a 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 that equipment

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

Integrated control also denotes a control which is part of a more complex control (electrical or non-electrical).

2.5.2

incorporated control

incorporated control denotes a control intended for incorporation in, or on, an equipment, but which can be tested separately

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 Sub-clause 4.3.1.1.

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

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

in-line cord control denotes a separately cased control designed 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

2.5.4**free-standing control**

free-standing control denotes an in-line cord control intended to stand on a table or on the floor. It may be actuated by hand, by foot or by other similar human activity

2.5.5**independently mounted control**

independently mounted control denotes a control designed for permanent connection to fixed wiring, but intended to be mounted away from the controlled equipment. It may be either:

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

2.5.6**pull-cord actuated control**

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

2.6 Definitions of type of automatic action of a control according to test procedure**2.6.1****type 1 action**

type 1 action denotes an 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

A Type 1 action is sub-classified as specified in Sub-clause 6.4.

2.6.2**type 2 action**

type 2 action denotes an 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

A Type 2 action is sub-classified as specified in Sub-clause 6.4.

2.7 Definitions relating to protection against electric shock**2.7.1****live part**

live part denotes a conductive part, contact with which may cause a significant electric shock

2.7.2**class 0 control**

class 0 control denotes a control in which protection against electric shock relies upon basic insulation. 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

Class 0 controls have either an enclosure of insulating material which may form a part, or the whole, of the basic insulation, or a metal enclosure which is separated from live parts by basic insulation. If a control with an enclosure of insulating material has provision for earthing internal parts, it is deemed to be of Class 0I or Class I construction. Class 0 controls may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage.

In some countries Class 0 controls are not allowed.

Refer snc

2.7.3**class 0I control**

class 0I control denotes an 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

Class 0I controls may have parts with double insulation or reinforced insulation or parts operating at safety extra-low voltage.

Refer snc

2.7.4

class I control

class I control denotes a 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

This provision includes a protective conductor as part of the flexible cord or cable. When controls designed as Class I 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.

Class I controls may have parts with double insulation, or parts operating at safety extra-low voltage.

2.7.5 Class II control

Class II control denotes a 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. Such a control may be one of the following types:

Class II controls may have parts operating at safety extra-low voltage.

2.7.5.1

insulation-encased Class II control

a 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. Such a control is called an insulation-encased Class II control

2.7.5.2

metal-encased Class II control

a 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. Such a control is called a metal-encased Class II control

2.7.5.3

combination insulation-encased/metal-encased Class II control

a control which is a combination of the types described in Sub-clauses 2.7.5.1 and 2.7.5.2

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

class III control denotes a control in which protection against electric shock relies on supply at safety extra-low voltage (SELV) and in which voltages higher than those of SELV are not generated

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

2.7.7

detachable part

detachable part denotes a part which is removable without the use of a tool when the control is mounted as in normal use

2.7.8

accessible part or surface

accessible part or surface denotes a part or surface which can be touched by the test finger of Figure 2, page 79, when the control is mounted as in normal use, and after detachable parts have been removed

Requirements for the screwless fixing of accessible parts are under consideration.

2.7.9**operational insulation**

operational insulation denotes the 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)

This was formerly part of that insulation referred to as “functional insulation”.

In Sub-clauses 2.7.9 to 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**

basic insulation denotes the insulation applied to live parts to provide basic protection against electric shock (L – A or L – I). 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).

This was formerly part of that insulation referred to as “functional insulation”.

2.7.11**supplementary insulation**

supplementary insulation denotes 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). 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**

reinforced insulation denotes, a 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). It includes insulation between live parts 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).

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 or basic insulation.

2.7.13**double insulation**

double insulation denotes insulation comprising both basic insulation and supplementary insulation (Class II situation)

2.8 Definitions relating to component parts of controls**2.8.1****sensing element**

sensing element denotes 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**

switch head denotes the complete control, except for any sensing element

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.

2.8.3

actuating member

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

The term “actuating member” does not include any device such as a set-screw used for setting by the manufacturer if such a device is adequately locked against further movement, or if a tool is required for such setting by the manufacturer.

2.8.4

actuating means

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

2.8.5

pull-cord

pull-cord denotes a flexible actuating member which is pulled to cause actuation

2.8.6

prime mover

prime mover denotes 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

It may be a mechanical storage device (for example a clock-work spring), an electromagnetic device (for example an electric motor, or stepping solenoid), an electrothermal device (for example the heating element of an energy regulator) or any other mechanism producing mechanical energy.

2.8.7

clutch

clutch denotes a 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 or cover plate

cover or cover plate denotes a 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. It shall not require the use of a special purpose tool for its removal

2.8.9

screwless fixed part (or component)

screwless fixed part (or component) denotes an 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. 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

The requirements for screwless fixing of accessible parts are under consideration.

The following are some examples of parts which are not regarded as screwless fixed parts or components:

- parts of components fixed permanently by rivets, gluing 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.

2.9 Definitions of types of terminals and terminations of controls

2.9.1

pillar terminal

pillar terminal denotes a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws. 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, page 85)

2.9.2

screw terminal

screw terminal denotes a terminal in which the conductor is clamped under the head of the screw. 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, page 84)

2.9.3

stud terminal

stud terminal denotes a terminal in which the conductor is clamped under a nut. 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

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

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

flat push-on connector denotes an 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

receptacle denotes the female part of a flat push-on connector intended to be permanently attached to a core or conductor (see Figure 16, page 90)

2.9.7

tab

tab denotes the male part of a flat push-on connector (see Figure 14 and Figure 15, pages 88 and 89)

2.9.8

in-line tab

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

2.9.9

tab forming part of a control

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

2.9.10

termination

termination denotes a 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

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

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

2.9.12

saddle terminal

saddle terminal denotes a terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts (see Figure 13a, page 87)

2.9.13

lug terminal

lug terminal denotes a screw terminal or stud terminal, designed for clamping a cable lug or bar by means of a screw or nut (see Figure 13b, page 87)

2.9.14

mantle terminal

mantle terminal denotes a terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut. 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, page 86)

2.10 Definitions relating to the connections to controls

2.10.1

external conductor

external conductor denotes 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

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

fixed wiring denotes 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

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

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

2.10.4

integrated conductor

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

2.10.5

detachable cord

detachable cord denotes a 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

Non-detachable cord denotes a flexible external conductor connected to, or assembled to, a control according to one of the following methods.

2.10.6.1**type X attachment**

type X attachment denotes a 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**

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

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**

type Y attachment denotes a method of attachment such that the cord can only be replaced with the aid of tools designed specially for the purpose, and normally only available to the manufacturer or his agent. Such a method of attachment may be used with either a standard cord or a special cord

2.10.6.4**type Z attachment**

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

2.11 Definitions relating to the performance of Type 2 actions**2.11.1****manufacturing deviation**

manufacturing deviation denotes the 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

The difference may be related to an absolute value if permitted by the appropriate sub-clause of Clause 15.

2.11.2**drift**

drift denotes the 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

The alteration may be related to an absolute value, or combined with the manufacturing deviation, if permitted by the appropriate sub-clause of Clause 15.

2.12 Definitions relating to the requirements for creepage distances and clearances**2.12.1****clearance**

clearance denotes the 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

The method of measurement is detailed in Appendix B and Figure 17, page 91.

2.12.2**creepage distance**

creepage distance denotes the 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

The method of measurement is detailed in Appendix B and Figure 17, page 91.

2.12.3

sealed situation

sealed situation denotes the situation which exists when the distance under consideration is within an evacuated or inert gas-filled enclosure which is permanently sealed

In Sub-clauses 2.12.3 to 2.12.8 inclusive, pollution generated within the control, such as evaporated contact material, is not taken into consideration, as the effect of this will be adequately checked by the tests of Clause 17.

2.12.4

encapsulated situation

encapsulated situation denotes the situation which exists when the distance under consideration is effectively protected against the ingress of moisture or dust by means of a seal, or cemented joint of cross-linked polymer or other similar material, or by means of an encapsulated or moulded enclosure

2.12.5

clean situation

clean situation denotes the situation which exists when the distance under consideration is not exposed to the deposition of dirt

For example, in the case of a close-fitting cover, it is not necessary that this cover be provided with a gasket or seal.

2.12.6

normal pollution situation

normal pollution situation denotes the situation that exists when the distance under consideration is exposed to the atmosphere prevailing within normal household buildings, and when any dust is only a loose deposit of non-conductive substance

2.12.7

dirty situation

dirty situation denotes the situation that exists when the distance under consideration is exposed to a deposition of dust greater than in a normal pollution situation, particularly when the dust is partially conductive

2.13 Miscellaneous definitions

2.13.1

unique type reference

unique type reference denotes a 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

tool denotes a 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

special-purpose tool denotes a tool which is unlikely to be readily available in a normal household, for example, a key for a hexagonal socket-headed screw. Tools such as coins, screwdrivers and spanners designed to operate square, or hexagonal nuts, are not special-purpose tools

2.13.4

normal use

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

Normal use includes any overload, or abnormal operating conditions specified in the equipment standard.

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**

user maintenance denotes 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**

servicing denotes 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. This includes replacing a flexible cord, non-resettable thermal cut-out or the like

2.13.7**manufacturer servicing**

manufacturer servicing denotes servicing which can only be done by the manufacturer, or his accredited servicemen. This may be due to the need for special tools, or special instrumentation, and includes the setting by the manufacturer

3 General requirement

Controls shall be so designed and constructed that in normal use they function so as to cause no danger to persons or surroundings, 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.

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 $(20 \pm 5)^\circ\text{C}$, except that in cases of doubt, it shall be maintained at $(23 \pm 2)^\circ\text{C}$, unless otherwise specified in a particular clause.*

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

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

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 Sub-clauses 17.12 and 17.13.*

4.1.6 *During and for the purpose of the tests of this standard, other than for the tests of Sub-clause 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 Sub-clause 7.2 and used in Clause 17 (that is α_1 , β_1 , α_2 and β_2) shall have test tolerances of $\pm 12\text{ K/h}$.*

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.*

4.2 Samples required

4.2.1 *One sample is used for the tests in Clauses 5 to 11 and 18 to 23 inclusive. 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.

4.2.2 *Non-resettable thermal cut-outs require a set of 24 samples (see Sub-clause 17.15).*

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

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

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 may influence the results of any specific tests.

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 Sub-clause 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 designed.*

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 designed 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.*

At the option of the testing authority a reduced number of tests may 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 Sub-clause 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.*

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.*

4.3.3 According to protection against shock

4.3.3.1 *If in Class 0, Class 0I or Class I controls, 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.*

4.3.3.3 *If in Class 0, Class 0I, Class I or Class II controls, or controls for Class 0, Class 0I, Class I or Class II equipment, it is necessary to have parts operating at safety extra-low voltage, such parts are checked for compliance with the appropriate requirements specified for Class III controls.*

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 Sub-clause 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.

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 designed operating values, operating times and operating sequences are tested.

4.3.5.3 Any control with a purpose not classified in Sub-clause 6.3 may be tested and approved to this specification, 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.

5 Rating

5.1 Maximum rated voltage

The maximum rated voltage is 660 V.

5.2 Maximum rated current

The maximum rated current is 63 A.

5.3 Compliance

Compliance with Sub-clauses 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.

A control for a.c. only may 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.

Additional tests may 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.

6.2 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.

Such circuits may 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 may 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.

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

Circuits intended for inductive loads only may either be classified under this sub-clause 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.

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.

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 multipurpose control.

Any manual action of an automatic control or a separate manual action being integral with an automatic control is not classified according to this sub-clause.

6.3.1 — thermostat;**6.3.2 — temperature limiter;****6.3.3 — thermal cut-out;****6.3.4 — non-resettable thermal cut-out;****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 Sub-clauses 6.3.1 to 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, and****6.3.13 — electrically operated mechanism.****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:

These further classifications are only applicable if the relevant declarations have been made and any appropriate tests completed. An action providing more than one feature may be classified by a combination of the appropriate letters, for example, Type 1CL or Type 2AE.

A manual action is not classified according to this sub-clause.

6.4.3.1 — full-disconnection on operation (Type 1A or 2A);**6.4.3.2 — micro-disconnection on operation (Type 1B or 2B);****6.4.3.3 — micro-interruption on operation (Type 1C or 2C);****6.4.3.4 — a trip-free mechanism which cannot even momentarily be reclosed against the fault (Type 1D or 2D);****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 1E or 2E);**

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 1F or 2F);**6.4.3.7 — an action which is not intended to be reset under electrically loaded conditions (Type 1G or 2G);****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 safe operation conditions have been restored if the reset means is held in the “reset” position (Type 1H or 2H);**

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 1J or 2J).

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 1K or 2K).

6.4.3.11 — an action that does not require any external auxiliary energy source or electrical supply for its intended operation (Type 1L or 2L);

6.4.3.12 — an action which operates after a declared ageing period (Type 1M or 2M).

6.5 According to the degree of protection and control pollution situation

6.5.1 According to degrees of protection provided by enclosures against ingress of solid objects and dust (see HD 365 S3: Classification of Degrees of Protection Provided by Enclosures).

- IP0X
- IP2X
- IP4X
- IP5X
- IP6X

6.5.2 According to degree of protection provided by enclosures against harmful ingress of water (see HD 365 S3).

- IPX0
- IPX1
- IPX3
- IPX4
- IPX5
- IPX7

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

Preferred combinations of degrees of protection according to Sub-clauses 6.5.1 and 6.5.2:

First characteristic numeral Protection against ingress of foreign bodies	Second characteristic numeral Protection against ingress of water							
	0	1	2	3	4	5	6	7
0	IP00							
1								
2	IP20	IP21						
3								
4		IP41		IP43	IP44			
5					IP54	IP55		
6						IP65		IP67

6.5.3 According to the pollution situation for which the control, without additional protection, is suitable:

- control suitable for use in a clean situation;
- control suitable for use in a normal pollution situation;
- control suitable for use in a dirty situation.

A control designed for use in a particular situation may always be used in a less polluted situation.

A control may be used in a more polluted situation than that for which it is designed, if the appropriate protection is provided by the equipment, a cover or an enclosure.

Within a control designed for use in a particular situation, additional enclosures or sealing may be provided to enable the enclosed parts to use creepage distances and clearances appropriate to the protection afforded them. Thus, within a control classified for use in a dirty situation, some parts may be in a normal situation by virtue of a suitable cover, and other parts may be in a clean situation by virtue of sealing or encapsulation.

6.6 According to method of connection

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

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

A control may be classified under both Sub-clause **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.

6.7 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 ($T_{\max}$) of 55 °C.

6.7.2 Control with a switch head intended to be used in an ambient temperature having a maximum value ($T_{\max}$) other than 55 °C but not less than 30 °C, or a minimum value ($T_{\min}$) lower than 0 °C, or both.

Preferred values of $T_{\max}$ are 30 °C, 55 °C, 70 °C, 85 °C, 105 °C, 125 °C and 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 allowed.

6.8 According to protection against electric shock

6.8.1 For an integrated control:

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;

Refer snc

6.8.2.2 — Class 0I equipment;

Refer snc

6.8.2.3 — Class I equipment;

6.8.2.4 — Class II equipment;

6.8.2.5 — Class III equipment.

For definitions of Class 0, Class 0I, Class I, Class II or Class III equipment, see HD 366 S1: Classification of Electrical and Electronic Equipment with Regard to Protection against Electric Shock. 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 free-standing control, or an independently mounted control:

6.8.3.1 — of Class 0;

Refer snc

6.8.3.2 — of Class 0I;

Refer snc

6.8.3.3 — of Class I;

6.8.3.4 — of Class II;

6.8.3.5 — of Class III.

6.9 According to circuit disconnection or interruption:

6.9.1 — full-disconnection;

6.9.2 — micro-disconnection;

6.9.3 — micro-interruption.

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

Different actions of a control may 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 — 1 00 000 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^a;

6.10.6 — 300 cycles^a;

6.10.7 — 30 cycles^a.

^a 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.

For controls with more than one manual action, a different value may be declared for each.

If a control has more than one intended “OFF” position, then a cycle of actuation shall be regarded as a movement from one “OFF” position to the next “OFF” position.

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

Preferred values are:

6.11.1 — 3 00 000 cycles;

6.11.2 — 2 00 000 cycles;

6.11.3 — 1 00 000 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^a;

6.11.9 — 1 000 cycles^a;

6.11.10 — 300 cycles^b;

6.11.11 — 30 cycles^{bc};

6.11.12 — 1 cycle^d.

^a Not applicable to thermostats or to other fast cycling actions.

^b Applicable only to manual reset.

^c Applicable only to actions which require the replacement of a part after each operation.

^d Can only be reset during manufacturer servicing.

For controls having more than one automatic action a different value may 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 Sub-clause 6.7.

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

An example of such a control is one mounted on a compressor unit in a refrigerator, where the mounting surface may 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 the value of proof tracking index (PTI) for the insulation material used

6.13.1 — material with a PTI of 125 and up to but excluding 175;

6.13.2 — material with a PTI of 175 and up to but excluding 250;

6.13.3 — material with a PTI of 250 and up to but excluding 700, and

6.13.4 — material with a PTI of 700 and over.

Different parts of a control may use materials having different PTI values. See HD 214 S2 for methods of determining PTI values.

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.

Long periods of electrical stress are considered to exist if the control is used in an 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;

6.15.3.1 — free-standing control;

6.15.4 — independently mounted control for:

6.15.4.1 — surface mounting;

6.15.4.2 — flush mounting;

6.15.4.3 — panel mounting.

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.

Controls which operate during the heating or endurance tests of the equipment standard are not classified according to this sub-clause.

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 ensure 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 7.2.

It is not intended that Table 7.2 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 may be on an adjacent part of the equipment, provided that it is clear that it refers to the control.

Information provided by Marking (C) may also be included in Documentation (D).

- by Documentation (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 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.

Information which is indicated as being required by Declaration (X) 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) 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) 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) 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) or by Marking (C).

7.2.6 Except as indicated in Sub-clause 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). For incorporated controls declared under Item 50, see the explanation of Documentation (D) contained in Sub-clause 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).

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

Table 7.2

Information	Clause or sub-clause	Method
1 Manufacturer's name or trade mark ²⁾		C
2 Unique type reference ^{1) 2)}	2.11.1, 2.13.1	C
3 Rated voltage or rated voltage range in volts (V)	4.3.2, 2.1.2	C
4 Nature of supply, unless the control is for both a.c. and d.c., or unless the rating is the same for a.c. and d.c.	4.3.2, 6.1	C
5 Frequency, if other than for range 50 Hz to 60 Hz inclusive	4.3.2	C
6 Purpose of control	4.3.5, 6.3	D
6a Construction of control and whether the control is electronic	6.15 H.2.5.7	D
7 The type of load controlled by each circuit ⁷⁾	14, 17, 6.2	C
15 Degree of protection provided by enclosure ⁸⁾	6.5.1, 6.5.2, 11.5	C
17 Which of the terminals are suitable for the connection of external conductors, and if they are suitable for line or neutral conductors, or both	6.6, 7.4.2, 7.4.3	C
18 Which of the terminals for external conductors are for a wider range of conductor sizes than those indicated in the table of Sub-clause 10.1.4	10.1	D
19 For screwless terminals the method of connection and disconnection	10	D
20 Details of any special conductors which are intended to be connected to terminals for internal conductors	10.2	D
21 Maximum temperature of terminals for internal conductors, if higher than 85 °C	14	X
22 Temperature limits of the switch head, if $T_{\min}$ lower than 0 °C, or $T_{\max}$ other than 60 °C	6.7, 14.5, 14.7, 17.3	C
23 Temperature limits of mounting surface (T_a) if more than 20 K above $T_{\max}$	6.12.2, 14.1, 17.3	C
24 Classification of control according to protection against electric shock	6.8	X
25 For Class II controls, the symbol for Class II construction	7.3	C
26 Number of cycles of actuation (M) for each manual action	6.10	X
27 Number of automatic cycles (A) for each automatic action	6.11	X
28 Ageing period (Y) for controls with Type 1.M or 2.M action	6.16	X
29 Type of disconnection or interruption provided by each circuit	6.9	X
30 PTI of materials used for insulation.	6.13, 6.15.4 Table 20.1, Note 11	X

Table 7.2

Information	Clause or sub-clause	Method
31 Method of mounting control ⁵⁾	11.6	D
31a Method of providing earthing of control	7.4.3, 9	D
32 Method of attachment for non-detachable cords ⁶⁾	10.1, 11.7	D
33 Intended transportation condition of control	16.1	X
34 Details of any limitation of operating time	14, 17	D
35 Period of electric stress across insulating parts	6.14	X
36 Limits of activating quantity for any sensing element over which micro-disconnection is secure	11.3.2	X
37 Minimum and/or maximum rates of change of activating quantity, or minimum and/or maximum cycling rates for a sensing control ⁴⁾	4, 15, 17	X
38 Values of overshoot of activating quantity for sensing controls which are necessary for correct action, or which can be used for test purposes	17	X
39 Type 1 or Type 2 action	6.4	D
40 Additional features of Type 1 or Type 2 actions	6.4.3	D
41 Manufacturing deviation and condition of test appropriate to deviation	11.4.3, 15, 17.14	X
42 Drift	11.4.3, 15	X
43 Reset characteristics for cut-out action ³⁾	6.4	D
44 If a control is either to be hand-held or is intended for a hand-held equipment	21	X
45 Any limitation to the number or distribution of flat push-on receptacles which can be fitted	10.2.4.4	D
46 Operating sequence for controls with more than one circuit, if significant	11.4.3, 15	D
47 Extent of any sensing element	2.8.1	D
48 Operating value (or values) or operating time (if Sub-clause 15.6 applies)	15.6	D
49 Control pollution situation	6.5.3	D
50 Control intended to be delivered exclusively to the equipment manufacturer	7.2.1, 7.2.6	X
51 Heat and fire resistance category	21	X

NOTE 1 The unique type reference shall be such that, when it is quoted in full, the manufacturer of the control can supply a replacement which will be fully interchangeable with the original electrically, mechanically, dimensionally, and functionally. It may comprise a series type reference with other marking, such as voltage rating or an ambient temperature marking which together provide a unique type reference.

NOTE 2 See Sub-clause 7.2.6.

NOTE 3 The manufacturer may declare a time before which, or a specific value of activating quantity above which, manual reset shall not occur.

NOTE 4 α_1 = minimum rising rate

β_1 = minimum falling rate.

The rates of change (α_1 and β_1) of the activating quantity are those applicable to normal use.

α_2 = maximum rising rate (for Type 2 actions only)

β_2 = maximum falling rate (for Type 2 actions only).

For test purposes, α_1 and β_1 shall be as declared but not lower than the limit(s) indicated in the appropriate Parts 2 for Type 1 actions and/or Type 2 actions. The values α_2 and β_2 , are for test purposes only, and may alternatively be declared as a maximum cycling rate. The rates of change for the purpose of this standard shall be expressed in the units as shown in the following table:¹⁾

¹⁾ The extension of this table is under consideration

Activating quantity	Unit for rate of change
Pressure	Pa/s
Temperature	K/h
Position	mm/s
Illumination	lux/s
Velocity	mm/s ²
Liquid level	mm/s
Current	A/s
Humidity	% rh/s
Airflow	m ³ /s ²

NOTE 5 If, for independently mounted controls, it is necessary to take special precautions when installing or using the control, these details shall be given in an instruction sheet accompanying the control.

Special precautions may be necessary, for example, for flush mounting independently mounted controls. In order to ensure that, after building-in, the conditions necessary to meet the requirements of this standard are achieved, the instruction sheet for such controls shall include clear information concerning:

- the dimensions of the space to be provided for the control;
- the dimensions and position of the means for supporting and fixing the control within this space;
- a minimum clearance between the various parts of the control and the surrounding parts of the fitment;
- the minimum dimensions of ventilating openings and their correct arrangements;
- the connection of the control to the supply and the interconnection of separate components, if any.

If the supply conductors of a control can come into contact with parts of a terminal block or a compartment for fixed wiring, and if these parts have, under conditions of normal use, a temperature exceeding that specified in Table 14.1, the instruction sheet shall also state that the control shall be connected by means of conductors having the appropriate T rating. (See Note 1 of Table 14.1).

NOTE 6 In-line cord, free-standing and independently mounted controls, if fitted with non-detachable cords using attachment methods Y or Z, shall have Documentation (D) containing the substance of one of the following statements, whichever is appropriate:

- “The supply cord of this control cannot be replaced; if the cord is damaged, the control be discarded” (Z)

or

- “The supply cord or this control can be replaced only by the manufacturer or his accredited service agent” (Y).

NOTE 7 For controls with more than one circuit, the current applicable to each circuit and to each terminal. If these are different from each other, then it shall be made clear to which circuit or terminal the information applies. For circuits for resistive and inductive loads, the rated current, or the rated load in VA, at power factors as indicated in the appropriate table of Sub-clause 17.2.

NOTE 8 The Marking (C) requirement does not apply to controls or parts thereof classified as IP00, IP10, IP20, IP30 and IP40.

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)	~	
Alternating current (three phase)	3 ~	
Alternating current (3-phase with neutral)	3N ~	
Direct current	==	
Class II construction		
Ambient temperature limits of switch head	T	(the letter T preceded by a minus sign and the numerical value of the lower temperature if less than 0 °C, or followed by the numerical value of the higher temperature if other than 60 °C)
Rated current of the appropriate fuse in amperes		A
Frequency of supply	Hz	
Earthing terminal	 or 	

For identification of the degree of protection provided by enclosures, the symbols shown in Sub-clause 6.5 shall be used.

Information about rated current and rated voltage may be provided by using figures alone, the figure for the rated current preceding or above that for the rated voltage and separated from it by a line. For circuits for resistive or inductive loads, the rated current for inductive load is placed between parentheses immediately following the rated current for resistive load. The symbol for the nature of the supply is placed after the current and voltage.

Current, voltage and nature of supply may be indicated as follows:

$$16 (3) \text{ A } 250 \text{ V } \sim \text{ or } 16 (3)/250 \sim \text{ or } \frac{16 (3)}{250} \sim$$

The following are examples of ways to provide information about the temperature limits of a control:

— 20T 30 (meaning minus 20 °C up to plus 30 °C)

T85 (meaning 0 °C up to plus 85 °C)

Information concerning declared specific loads may be given by reference to drawings or to types, for example:

“Electric motor, drawing No. ... part list No. ... made by ...” or “5 × 80 W fluorescent”.

7.3 Class II symbol

7.3.1 The symbol for Class II construction shall be used only for controls that are classified according to Sub-clause 6.8.3.4.

7.3.2 The dimension of the symbol for Class II construction shall be such that the length of the sides of the outer square is about twice the length of the sides of the inner square.

7.3.2.1 The length of the sides of the outer square of the symbol shall be not less than 5 mm, unless the largest dimension of the control is 15 mm in length or less, in which case the dimension of the symbol may be reduced, but the length of the sides of its outer square shall be not less than 3 mm.

7.4 Additional requirements for marking

7.4.1 Required marking on a control shall preferably be on the main body of the control but may be placed on non-detachable parts.

Required markings shall be legible and durable.

Compliance is checked by inspection and by the tests of Appendix A.

7.4.2 Terminals of controls intended for the connection of supply conductors shall be indicated by an arrow pointing towards the terminal, unless the method of connection to the supply mains is of no importance or is self-evident.

Compliance is checked by inspection.

7.4.3 Terminals intended exclusively for a neutral external conductor shall be indicated by the letter “N”.

Refer snc

7.4.3.1 Earthing terminals for external earthing conductors, and terminals for earthing continuity of Class II and Class III controls shall be indicated by the earth symbol.

7.4.3.2 All other terminals shall be suitably identified, their purpose self-evident or the control circuitry visually apparent. The arrow, the letter “N” or the earth symbol shall not be used except as indicated above.

Compliance is checked by inspection.

Refer snc

7.4.4 Setting of controls

Controls intended to be set by the user or by the equipment manufacturer during installation shall be provided with an indication of the direction for increasing or decreasing the response value.

An indication of “+” or “−” is sufficient.

Controls intended to be set by the equipment manufacturer or the installer shall be accompanied by documentation (D) indicating the proper method for securing the setting.

7.4.5 Marking requirements of non-resettable thermal cut-outs

Non-resettable thermal cut-outs, parts of non-resettable thermal cut-outs or others parts destroyed by their operation and which have to be replaced, shall be marked so as to enable them to be identified from a catalogue or the like, even after they have operated, unless they are intended to be replaced only during manufacturer servicing.

8 Protection against electric shock

8.1 General requirements

8.1.1 Controls shall be so constructed that there is adequate protection against accidental contact with live parts, in any unfavourable position which may occur in normal use, and after any accessible detachable parts have been removed. During the insertion and removal of lamps, protection against accidental contact with live parts of the lamp cap shall also be ensured.

Unless otherwise specified, parts connected to a safety extra-low voltage supply not exceeding 24 V are not considered to be live parts.

8.1.2 For Class II controls and controls for Class II equipment, this requirement applies also with regard to accidental contact with metal parts separated from live parts by basic insulation only.

8.1.3 The insulating properties of lacquer, enamel, paper, cotton, oxide film on metal parts, beads and sealing compounds shall not be relied upon to give the required protection against accidental contact with live parts.

Sealing compounds of the self-hardening types may be touched.

8.1.4 For those Class II controls and controls for Class II equipment which are connected in normal use to the gas supply mains or to the water supply mains, any metal parts conductively connected to the gas pipes or in electrical contact with the water system shall be separated from live parts by double insulation or reinforced insulation.

8.1.5 Those Class II controls and controls for Class II equipment which are intended to be permanently connected to fixed wiring shall be so designed that the required degree of protection against electric shock is not impaired by the installation of the control.

The protection against electric shock of Class II independently mounted controls may be affected, for example, by the installation of metal conduits or of cables provided with a metal sheath.

8.1.5.1 *Compliance is checked by inspection and by the following test:*

The standard test finger shown in Figure 2, page 79, is applied without force in every possible position. Apertures preventing the entry of the finger are further tested by means of a straight unjointed test finger of the same dimensions which is applied with a force of 20 N; if this finger enters, the test with the finger shown in Figure 2 is repeated, the finger being pushed through the aperture if necessary. If the unjointed test finger does not enter, the force applied is increased to 30 N. If then the guard is so displaced or the aperture so distorted that the test finger shown in Figure 2 can be inserted without force, the test with the latter finger is repeated. An electrical contact indicator is used to show contact.

It is recommended that a lamp be used for the indication of contact and that the voltage be not less than 40 V.

8.1.5.2 *The standard test finger shall be so designed that each of the jointed sections can be turned through an angle of 90° with respect to the axis of the finger in the same direction only.*

8.1.5.3 *In addition, openings in insulating material and in unearthed metal, shall be tested by applying the test pin shown in Figure 1, page 78, without force in every possible position.*

8.1.5.4 *It shall not be possible, with either the standard test finger or the test pin, to touch bare live parts.*

8.1.5.5 *For controls which have any parts of double insulation construction, it shall not be possible to touch metal parts with the standard test finger which are only separated from live parts by basic insulation.*

8.1.5.6 *If there is an instruction to remove a part during normal use or user maintenance and if there is no warning on the part which indicates: "Disconnect from supply before removing", that part is regarded as a detachable part even if a tool has to be used for its removal. If there is such a warning on the part, it is permissible, after removal, to touch parts separated from live parts by basic insulation.*

8.1.5.7 *For integrated and incorporated controls the test of Sub-clauses 8.1.5.1 to 8.1.5.6 inclusive, is only applied to those parts of the control which are accessible when it is mounted in any position in accordance with the manufacturer's declarations and after removal of detachable parts.*

8.1.5.8 *For in-line cord and free-standing controls the tests of Sub-clauses 8.1.5.1 to 8.1.5.6 inclusive, are made when the control is fitted with flexible cords either of the smallest, or of the largest nominal cross-sectional area used in Sub-clause 10.1.4 whichever is more unfavourable. Detachable parts are removed, and hinged covers which can be opened without the use of a tool are opened.*

8.1.5.9 *For independently mounted controls the test is made when the control is mounted as in normal use, fitted with cable of the smallest or of the largest nominal cross-sectional area used in Sub-clause 10.1.4, whichever is more unfavourable, or with a rigid, pliable or flexible conduit. Detachable parts are removed, and hinged covers which can be opened without the use of a tool, are opened.*

8.1.10 See Appendix H.

8.2 Actuating members and actuating means

8.2.1 An actuating member shall not be live.

8.2.2 An actuating means shall not be live, unless either it is provided with an insulated actuating member which is adequately fixed or the actuating means is not accessible when the actuating member is removed.

Compliance with Sub-clauses 8.2.1 and 8.2.2 is checked by inspection and by the tests of Sub-clause 8.1.

An insulated actuating member shall be considered to be adequately fixed if it can be removed only by breaking, cutting, or after being seriously damaged.

8.2.3 For controls other than Class III or controls for equipment other than those of Class III, actuating members and handles held in normal use shall be either of insulating material, or adequately covered by insulating material; or, if of metal, their accessible parts, shall be separated from their actuating means, or fixings by supplementary insulation, if such would be likely to become live in the event of an insulation fault.

For controls for connection to fixed wiring, or for controls for stationary equipment this requirement does not apply provided that such parts are either:

- reliably connected to an earthing terminal or earthing contact, or
- shielded from live parts by earthed metal.

Compliance is checked by inspection.

Parts separated from live parts by double insulation of reinforced insulation are not regarded as likely to become live in the event of an insulation fault.

8.3 Capacitors

8.3.1 For Class II in-line cord controls and independently mounted controls, capacitors shall not be connected to accessible metal parts. For controls for Class II equipment, capacitors shall not be connected to metal likely to be connected to accessible metal when the control is mounted in accordance with the manufacturer's declarations. Metal casings of capacitors shall be separated by supplementary insulation from accessible metal parts, and from other metal parts likely to be connected to accessible metal, when the control is mounted in accordance with the manufacturer's declarations.

Compliance is checked by inspection and by the requirements for supplementary insulation in Clauses 13 and 20.

8.3.2 Controls intended to be connected to the supply by means of a plug shall be so designed that in normal use there is no risk of electric shock from charged capacitors when touching the pins of the plug.

Compliance is checked by the test of Sub-clauses 8.3.2.1 to 8.3.2.4 inclusive, which is made ten times.

8.3.2.1 *The control is supplied at rated voltage or at the upper limit of the rated voltage range.*

8.3.2.2 *The actuating member, if any, is then moved to the "OFF" position if one exists and the control is disconnected from the supply by removing the plug from the socket-outlet.*

8.3.2.3 *One second after disconnection, the voltage between the pins of the plug is measured.*

8.3.2.4 *The voltage shall not exceed 34 V. The test is only performed if the capacitor exceeds 0.1 μF .*

8.4 Covers and uninsulated live or hazardous parts

Controls provided with a cover or cover plate of non-metallic material shall be so designed that the cover fixing screws are not accessible, unless they are either earthed or separated from live parts by double insulation or reinforced insulation or not accessible after mounting in the equipment.

Compliance is checked by inspection.

9 Provision for protective earthing

9.1 General requirements

9.1.1 Accessible metal parts, other than actuating members of in-line cord, free-standing and independently mounted controls of Class 0I and Class I which may become live in the event of an insulation fault, shall be permanently and reliably connected to an earthing terminal or termination within the control, or to the earthing contact of an equipment inlet.

Parts separated from live parts by double insulation or reinforced insulation, and parts screened from live parts by metal parts connected to an earthing terminal, earthing termination or earthing contact, are not regarded as likely to become live in the event of an insulation fault.

Requirements for actuation members are specified in clause 8.2.3.

9.1.2 Accessible metal parts, other than actuation members of integrated and incorporated controls for Class 0I and Class I equipment which may become live in the event of an insulation fault shall have provision for earthing.

Integrated controls and incorporated controls may be connected to earth through their fixing means, provided that provision is made for clean metallic surfaces. This also applies, for example, to controls with metallic sensing elements which are connected reliably to the metal parts of the equipment if the manufacturer has declared this to be a method of earthing.

Parts separated from live parts by double insulation or reinforced insulation, and parts screened from live parts by metal parts connected to an earthing terminal, earthing termination or earthing contact, are not regarded as likely to become live in the event of an insulation fault.

Requirements for actuating members are specified in subclause 8.2.3.

9.1.3 Earthing terminals, earthing terminations and earthing contacts shall not be electrically connected to any neutral terminal.

Compliance with Sub-clauses 9.1.1 to 9.1.3 inclusive is checked by inspection.

9.2 Class II and Class III controls shall have no provision for protective earthing.

Compliance is checked by inspection.

When it is necessary to interconnect earthed parts of an equipment or system, through a situation which itself is either of Class II or Class III construction, such interconnection, including terminals or terminations, is permitted in the Class II or Class III situation, if all parts of the earthing circuit are separated from live parts or accessible surfaces by double or reinforced insulation.

9.3 Adequacy of earth connections

9.3.1 General requirements

The connection between an earthing terminal, earthing termination or earthing contact, and parts required to be connected thereto, shall be of low resistance.

Compliance is checked by the following test:

- A current of 1.5 times the rated current, but not less than 25 A, and derived from an a. c. source with a no-load voltage not exceeding 12 V, is passed between the earthing terminal, earthing termination or earthing contact, and each of the parts, in turn.
- The voltage drop between the earthing terminal, earthing termination or earthing contact and the part is measured, and the resistance calculated from the current and this voltage drop. In no case shall the resistance exceed 0.1 Ω . The test is continued until steady conditions have been established.

Care is taken that the contact resistance between the tip of the measuring probe and the metal part under test does not influence the test results.

The resistance of any external conductor or internal conductor is not included in the resistance measurement, but the resistance of any integrated conductor is included.

9.3.2 Fixed wiring and methods X and M

Earthing terminals for the connection of fixed wiring or for non-detachable cords using methods X and M shall comply with the requirements of Sub-clause 10.1.

9.3.3 External conductors

Earthing connections for external conductors shall not be made using screwless terminals.

The use of screwless terminals for the connection of external earthing conductors is under consideration.

9.3.4 Size of accessible earthing terminals

Earthing terminals which are accessible in normal use shall allow the connection of conductors having nominal cross-sectional areas of 2.5 mm² to 6 mm² inclusive and it shall not be possible to loosen them without the aid of a tool.

9.3.5 Size of non-accessible earthing terminals

Earthing terminals which are not accessible in normal use for external conductors shall be of a size equal to or larger than that required for the corresponding current-carrying terminal.

9.3.6 Locking of earthing terminals

Clamping means of earthing terminals for external conductors shall be adequately locked against accidental loosening.

Compliance with Sub-clauses 9.3.2 to 9.3.6 inclusive is checked by inspection, by manual test and by the appropriate tests of Sub-clause 10.1.

In general the designs commonly used for current-carrying terminals provide sufficient resilience to comply with the requirement for adequate locking against accidental loosening, provided that there is no excessive vibration or temperature cycling. If the terminal is subjected to excessive vibration or temperature cycling, special provision such as the use of an adequately resilient part, for example, a pressure plate which is not likely to be removed inadvertently, may be necessary when pillar terminals are used.

9.4 Corrosion resistance

All parts of an earthing terminal shall be such that there is no risk of corrosion resulting from contact between those parts and the copper of the earthing conductor or any other metal that is in contact with those parts.

9.4.1 Materials

The body of an earthing terminal shall be of brass or other metal no less resistant to corrosion, unless it is a part of the metal frame or enclosure. Then any screws or nuts shall be of brass, plated steel or other metal complying with Clause 22, or other metal no less resistant to corrosion.

9.4.2 Frames or enclosures of aluminium

If the body of an earthing terminal is a part of a frame or enclosure of aluminum or aluminum alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminum or its alloys.

Compliance with Sub-clauses 9.4, 9.4.1 and 9.4.2 is checked by inspection, and in cases of doubt by an analysis of the materials and their coatings.

Corrosion resistance may be achieved by plating or similar process.

9.5 Other requirements

9.5.1 Detachable parts

If a detachable part of a control has an earth connection, this connection shall be made before any current-carrying connections are established when placing the part in position, and any current-carrying connections shall be separated before the earth connection is broken when removing the part.

Compliance is checked by inspection.

10 Terminals and terminations

10.1 Terminals and terminations for external copper conductors

10.1.1 Terminals for fixed wiring and for non-detachable cords using attachment methods X and M, except as specified in Sub-clause 10.1.3, shall be such that connection is made by means of screws, nuts or equally effective devices or methods, but without requiring a special purpose tool for connection or disconnection.

10.1.1.1 Terminals or terminations for non-detachable cords using attachment methods Y and Z shall satisfy the appropriate requirements for terminals and terminations for internal conductors and may require the use of special purpose tools for connection or disconnection.

Compliance with Sub-clauses 10.1.1 and 10.1.1.1 is checked-by inspection and-test.

Screwless terminals are deemed to be equally effective devices. (Requirements are given in IEC Publication 685-2-1.)

Flat push-on terminals are deemed to require a special purpose tool for effecting the crimp.

10.1.2 Screws and nuts which clamp external conductors shall have a metric ISO thread or a thread of equivalent effectiveness. They shall not serve to fix any other component, except that they may also clamp internal conductors if these are so arranged that they are unlikely to be displaced when fitting the external conductors.

Compliance is checked by inspection.

Provisionally, SI, BA and Unified threads are deemed to be of equal effectiveness to metric ISO thread.

A test for equivalent effectiveness is under consideration. Pending agreement to such a test, all torque values for threads other than ISO, SI, BA and Unified shall be increased by 20 %.

10.1.3 Soldered, welded, crimped or similar terminations

Soldered, welded, crimped or similar terminations shall not be used for the connection of non-detachable cords using attachment methods X and M unless such is permitted by the appropriate equipment standard. When such terminations are used for external conductors, they shall also comply with the requirements of Sub-clauses 10.2.2 and 10.2.3.

Compliance is checked by inspection.

In general, the standards for equipment restrict the use of such connections.

10.1.4 Terminals for fixed wiring or non-detachable cords using attachment methods X or M shall allow at least, the connection of conductors having nominal cross-sectional areas as shown in Table 10.1.4.

Compliance is checked by inspection, by measurement and by fitting conductors of the smallest and largest cross-sectional areas specified or declared.

Table 10.1.4

Current carried by terminal (A)	Nominal cross-sectional area (mm ²)	
	Flexible cord conductors	Fixed wiring conductors
Up to and including 6 ^a	0.5 to 1	1 to 1.5
over 6 up to and including 10	0.75 to 1.5	1 to 2.5
over 10 up to and including 16	1 to 2.5	1.5 to 4
over 16 up to and including 25	1.5 to 4	2.5 to 6
over 25 up to and including 32	2.5 to 6	4 to 10
over 32 up to and including 40	4 to 10	6 to 16
over 40 up to and including 63	6 to 16	10 to 25

^a The nominal cross-sectional areas specified do not apply to terminals in safety extra-low voltage circuits carrying a current not exceeding 3 A.

10.1.4.1 If a terminal is designed to accommodate a wider range of fixed wiring or flexible cord conductor sizes than those indicated in columns 2 and 3 of Table 10.1.4, then this shall be declared.

10.1.5 Terminals for fixed wiring or non-detachable cords using attachment methods X or M shall be so fixed that, when the clamping means is tightened or loosened, the terminal does not work loose, internal conductors are not subjected to stress, and creepage distances and clearances are not reduced below the values specified in Clause 20.

10.1.5.1 *Compliance is checked by inspection and by measurement after fastening and loosening a conductor of the largest cross-sectional area used in Sub-clause 10.1.4 ten times, the conductor being moved each time it is loosened. For threaded parts the full torque applied is either that shown in the table of Sub-clause 19.1, or the torque specified in the relevant figure (see Figure 10 to Figure 13, pages 84 to 87), whichever is greater.*

During the test, terminals shall not work loose and there shall be no damage, such as breakage of screws or damage to the head slots, threads, washers, stirrups or other parts, that will impair the further use of the terminal.

This requirement does not imply that the terminal must be so designed that rotation or displacement is prevented, provided that its movement does not bring about, non-compliance with the other requirements of this standard.

Terminals may be prevented from working loose by fixing with two screws, by fixing with one screw in a recess or by other suitable means.

Covering with sealing compound, or with resins, is only considered to be a sufficient means for preventing a terminal from working loose if:

- the seal is not subject to mechanical strain as a result of connection or disconnection of the conductor or use of the equipment and
- the effectiveness of the sealing compound is not impaired by the temperature which is attained by the terminal under the most unfavourable conditions required by this standard.

10.1.6 Terminals for fixed wiring or non-detachable cords using attachment methods X or M shall be so designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without undue damage to the conductor, except that for screwless terminals intended for circuits carrying a current not exceeding 2 A, one of the surfaces may be of non-metallic material.

Compliance is checked by inspection of the terminal and of the conductors after the test of Sub-clause 10.1.5.

Conductors are considered to be unduly damaged if they show sharp or deep indentations.

10.1.7 Terminals for fixed wiring and non-detachable cords using attachment method X shall not require special preparation of the conductor in order to effect correct connection.

10.1.7.1 Terminals for attachment method X may also have alternative means of connection if at least one of the means conforms to this requirement even if the original factory-made connection uses another means. In this case the original factory-made connection shall comply with the requirements for terminals and terminations for internal conductors.

Compliance is checked by inspection.

The term “special preparation of the conductor” covers soldering of the strands, use of cable lugs, formation of eyelets, etc., but not the reshaping of the conductor before its introduction into the terminal or the twisting of a stranded conductor to consolidate its end.

10.1.8 Terminals for fixed wiring and non-detachable cords using attachment methods X or M, shall be so designed or placed that neither the conductor nor a wire of a stranded conductor can slip out while any clamping screws or nuts are being tightened, or while any equally effective device is being operated.

10.1.8.1 *Compliance is checked by the following test.*

10.1.8.2 Terminals are fitted with conductors according to the use of the terminal, in accordance with Table 10.1.8. The wires of fixed wiring conductors are straightened before inserting into the terminal.

10.1.8.3 The wires of flexible cables and cords are twisted so that there is an even twist of one complete turn in 20 mm. The conductor is inserted into the terminal for the minimum distance prescribed or where no distance is prescribed, until it just projects from the far side of the terminal. The conductor is inserted into the terminal in the position most likely to assist a wire to escape and then the screw is tightened with a torque equal to two-thirds of the torque specified in the table of Sub-clause 19.1.

10.1.8.4 For flexible cords the test is repeated using a new conductor which is twisted as before, but in the opposite direction. After the test no wire of the conductor shall have escaped into the gap between the clamping means and the retaining device.

Table 10.1.8

Current carried by terminal (A)		Conductor to be fitted (number of wires and nominal diameter of each wire in millimetres)	
Flexible cord conductors	Fixed wiring conductors	For flexible cord conductors	For fixed wiring conductors
0–6	—	32 × 0.20	—
6–10	0–6	40 × 0.25	7 × 0.52
10–16	6–10	50 × 0.25	7 × 0.67
16–25	10–16	56 × 0.30	7 × 0.85
25–32	16–25	84 × 0.30	7 × 1.04
—	25–32	94 × 0.30	7 × 1.35
32–40	32–40	80 × 0.40	7 × 1.70
40–63	40–63	126 × 0.40	7 × 2.14

10.1.9 Terminals shall be so designed that they clamp the conductor reliably.

10.1.9.1 Compliance is checked by the following test:

The terminals are fitted with conductors of the smallest and largest nominal cross-sectional areas used in Sub-clause 10.1.4 fixed or flexible, whichever is appropriate, or the more unfavorable and the terminal screws are tightened, the torque applied being equal to two-thirds of the torque specified in the table of Sub-clause 19.1. Each conductor is subjected to a pull of the value shown in Table 10.1.9. The pull is applied without jerks for 1 min, in the direction of the axis of the conductor space.

10.1.9.2 This pull test is normally applied directly to the conductor adjacent to where it enters the terminal. If, however, an additional crimping or clamping device holding the conductor or the insulation around the conductor exists not more than 30 mm from the entry point for the conductor into the terminal and measured along the length of the conductor, this test should apply to the crimping or clamping device, and not to the actual terminal.

10.1.9.3 During the test the conductor shall not move appreciably in the terminal.

Table 10.1.9

Current carried by terminal (A)	Pull (N)	
	Terminals for flexible cord conductors	Terminals for fixed wiring conductors
Up to and including 3	20 ^a	20 ^a
over 3 up to and including 6	30	30
over 6 up to and including 10	30	50
over 10 up to and including 16	50	50
over 16 up to and including 25	50	60
over 25 up to and including 32	60	80
over 32 up to and including 40	90	90
over 40 up to and including 63	100	100

^a Applicable only to safety extra-low voltage circuits, and other applications where particular conductors are not specified.

10.1.10 Terminals shall be so designed that they do not attain excessive temperature in normal use, so as to damage the material of the supporting insulation, or the insulating covering of the clamped conductors.

Compliance is checked during the heating tests of Clause 14.

10.1.11 Terminals shall be so located that each core contained within any fixed wiring sheath or flexible cord sheath can be terminated in reasonable proximity to the other cores within the same sheath, unless there is a good technical reason for the contrary.

Compliance is checked by inspection.

10.1.12 Terminals for non-detachable cords using attachment methods X or M shall be so located or shielded that, should a wire escape when the conductors are fitted, there is no risk of accidental contact between live parts and accessible metal parts, and for Class II controls and controls for Class II equipment, between live parts and metal parts separated from accessible metal parts by supplementary insulation only. Furthermore, there shall be no risk of short-circuiting a declared action providing a full-disconnection or a micro-disconnection.

Compliance is checked by inspection and by the following test:

— *An 8 mm length of insulation is removed from the end of a stranded conductor having a nominal cross-sectional area equal to the minimum size used during the test of Sub-clause 10.1.4. One wire of the stranded conductor is left free, and the other wires are fully inserted into and clamped in the terminal. The free wire is bent, without tearing the insulation back, in every possible direction, but without making sharp bends around barriers.*

— *The free wire of a conductor connected to a live terminal shall not touch any metal part which is accessible or is connected to an accessible metal part, or for Class II controls and controls of Class II equipment, any metal part which is separated from accessible metal parts by supplementary insulation only.*

— *The free wire of a conductor connected to an earthing terminal shall not touch any live part.*

— *The free wire of a conductor connected to a live terminal shall not become accessible, nor shall it short-circuit a declared action providing a full-disconnection or a micro-disconnection.*

10.1.13 Terminals shall be so designed that circuit continuity is not maintained by pressure transmitted through insulating material other than ceramic, or other insulating material with characteristics no less suitable, unless there is sufficient resilience in the appropriate metal parts to compensate for any shrinkage or distortion.

Compliance is checked by initial inspection and by further examination of the terminals when the samples have completed the test of Clause 17.

The suitability of the material is considered in respect to the stability of the dimensions within the temperature range applicable to the control.

10.1.14 Screws and threaded parts of terminals shall be of metal.

Compliance is checked by inspection.

10.1.15 Terminals of the pillar type and the mantle type shall be so designed as to allow an adequate length of conductor to be introduced into, and pass beyond the edge of the screw, to ensure that the conductor does not fall out.

Compliance is checked for pillar terminals by measurement of dimension “g” in Figure 11, page 85 and for mantle terminals by the minimum distance specified in Figure 12, page 86.

10.2 Terminals and terminations for internal conductors

10.2.1 Terminals and terminations shall allow the connection of conductors having nominal cross-sectional areas as shown in Table 10.2.1.

A terminal or termination is not required if a conductor is permanently connected to the control by the control manufacturer.

10.2.1.1 *Compliance is checked by inspection and by fitting conductors of the cross-sectional areas specified in Table 10.2.1.*

Table 10.2.1

Current carried by terminal or terminations (A)	Minimum nominal cross-sectional area of conductor (mm ²)
Up to and including 3	— ^a
over 3 up to and including 6	0.75
over 6 up to and including 10	1
over 10 up to and including 16	1.5
over 16 up to and including 25	2.5
over 25 up to and including 32	4
over 32 up to and including 40	6
over 40 up to and including 63	10

^a No minimum specified, but the manufacturer shall declare the conductor size for test purposes.

The requirements of Sub-clause 10.2.1 do not apply to terminals of controls which are not intended to accept standard conductors without special preparation; or which, by their design and application, cannot accept standard conductors; or which are deliberately designed to accept conductors of a different size and which are for use only in particular types of equipment. An example is a thermostat intended for use within the fabric of an electric blanket.

10.2.2 Terminals and terminations shall be suitable for their purpose. Terminations for making soldered, crimped and welded connections shall be capable of withstanding the stresses which occur in normal service.

Compliance is checked by inspection.

10.2.3 When soldered terminals are used, the conductor shall be so positioned or fixed that reliance is not placed upon the soldering alone to maintain the conductor in position, unless barriers are provided such that creepage distances and clearances between live parts and other metal parts cannot be reduced to less than 50 % of the values specified in Sub-clause 20.1 should the conductor break away at the soldered joint.

Compliance is checked by inspection.

In general, "hooking-in" before soldering is considered to be a suitable means for maintaining a conductor in position, provided the hole through which the conductor is passed is not unduly large, and provided that the conductor is not part of a flat-twin tinsel cord. Other methods of maintaining a conductor in position, such as waisting the sides of a solder tag, are also considered acceptable.

10.2.4 Flat push-on connectors

10.2.4.1 Tabs forming part of a control shall comply with the dimensional requirements of Figure 14 or Figure 15, pages 88 and 89. Depressions or holes are optional. If they exist they shall comply with the dimensional requirements.

Compliance is checked by measurement.

Tabs with dimensions other than those shown in Figure 14 or Figure 15 are allowed, if the dimensions and shapes are so different as to prevent any possible mismatching with a standard receptacle (see Figure 16).

Tabs allowing the polarized acceptance of receptacles are allowed (Figure 16).

10.2.4.2 Tabs forming part of a control shall not exceed in normal use the temperature shown in Table 10.2.4.2.

Table 10.2.4.2

Copper and copper alloys (bare or tinned)	Copper and copper alloys (silver plated or nickel plated)	Steel (stainless or nickel plated)
140 °C	200 °C	300 °C

Compliance is checked by measuring the temperatures attained during the tests of Clause 14.

Materials or coatings other than those specified may be used provided their electrical and mechanical characteristics are no less reliable, particularly with regard to resistance to corrosion and mechanical strength.

The temperatures specified are those for continuous use. Higher transient temperatures are permitted, for example, during temperature overshoot of a temperature sensing control.

10.2.4.3 Tabs forming part of a control shall have adequate strength to allow the insertion and withdrawal of receptacles without damage to the control such as to impair compliance with this standard.

Compliance is checked by applying, without jerks, axial forces equal to those shown in Table 10.2.4.3. No significant displacement nor damage shall occur.

Table 10.2.4.3

Tab size (see Figure 16)	Push ^a (N)	Pull ^a (N)
2.8	50	40
4.8	60	50
6.3	80	70
9.5	100	100

^a The values in the above table are the maximum allowed for the insertion and the withdrawal of a receptacle from a tab.

10.2.4.4 Tabs forming part of a control shall be adequately spaced to allow the connection of the appropriate receptacles.

Compliance is checked by applying an appropriate receptacle on each tab unless otherwise declared in Sub-clause 7.2. During this application no strain nor distortion shall occur to any of the tabs nor to their adjacent parts, nor shall the creepage or clearance values be reduced below those specified in Clause 20.

For tabs complying with Figure 14 or Figure 15, pages 88 and 89, the appropriate receptacle is shown in Figure 16, page 90.

10.3 Terminals and terminations for integrated conductors

There are no specific requirements or tests for terminals or terminations for integrated conductors under Clause 10, but the relevant requirements of the other clauses may apply.

11 Constructional requirements

11.1 Materials

11.1.1 Insulating materials — Impregnated

Wood, cotton, silk, ordinary paper and similar fibrous or hygroscopic material shall not be used as insulation unless impregnated.

Compliance is checked by inspection.

Insulating material is considered to be impregnated if the interstices between the fibres of the materials are substantially filled with a suitable insulant.

11.1.2 Current-carrying parts

If brass is used for current-carrying parts other than threaded parts of terminals, it shall contain at least 50 % copper if the part is cast or made from bar, or at least 58 % if the part is made from rolled sheet.

Compliance is checked by inspection and by analysis of the material.

11.1.3 Non-detachable cords

11.1.3.1 Non-detachable cords of Class I controls shall have a green/yellow conductor insulation which is connected to the earthing terminal or termination of the control, or to the earthing contact of any equipment inlet or socket-outlet, if provided.

11.1.3.2 Conductor insulation identified by the colour combination green/yellow shall not be connected to terminals or terminations other than earthing terminals or terminations.

Compliance with Sub-clauses 11.1.3.1 and 11.1.3.2 is checked by inspection.

11.2 Protection against electric shock

11.2.1 Double insulation

When double insulation is employed, the design shall be such that the basic insulation and the supplementary insulation can be tested separately unless satisfaction with regard to the properties of both insulations is provided in another way.

11.2.1.1 If the basic and the supplementary insulation cannot be tested separately or if satisfaction with regard to the properties of both insulations cannot be obtained in another way, the insulation is regarded as reinforced insulation.

Compliance is checked by inspection and by test.

Specially prepared samples, or samples of the insulating parts, are regarded as ways of providing satisfaction.

11.2.2 *Infringement of double or reinforced insulation*

Class II controls and controls for use in Class II equipment shall be so designed that creepage distances and clearances over supplementary insulation or reinforced insulation cannot, as a result of wear, be reduced below the values specified in Clause 20. They shall be so constructed that if any wire, screw, nut, washer, spring, flat push-on receptacle or similar part becomes loose and falls out of position, it cannot in normal use become so disposed that creepage distances or clearances over supplementary insulation or reinforced insulation are reduced to less than 50 % of the value specified in Clause 20.

Compliance is checked by inspection, by measurement and by manual test.

For the purpose of this requirement:

- it is not to be expected that two independent fixings will become loose at the same time;*
- parts fixed by screws or nuts provided with locking washer are regarded as not liable to become loose, provided these screws or nuts are not required to be removed during user maintenance or servicing;*
- springs and spring parts that do not become loose or fall out of position during the tests of clauses 17 and 18 are deemed to comply;*
- wires connected by soldering are considered to be not adequately fixed unless they are held in place near to the termination, independently of the solder;*
- wires connected to terminals are considered to be not adequately secured unless an additional fixing is provided near to the terminal. This additional fixing, in the case of standard conductors, must clamp the insulation and not the conductor;*
- short rigid wires are regarded as not liable to come away from a terminal if they remain in position when any one terminal screw or nut is loosened.*

11.2.3 *Integrated conductors*

11.2.3.1 Integrated conductors shall be so rigid, so fixed or so insulated that in normal use creepage distances and clearances cannot be reduced below the values specified in Clause 20.

11.2.3.2 Insulation, if any, shall be such that it cannot be damaged during mounting or in normal use.

Compliance with Sub-clauses 11.2.3.1 and 11.2.3.2 is checked by inspection, by measurement and by manual test.

If the insulation on a conductor is not at least electrically equivalent to that of cables and flexible cords complying with HD 21 or HD 22 or alternatively does not comply with the electric strength test made between the conductor and metal foil wrapped around the insulation under the conditions specified in Clause 13, the conductor is considered to be a bare conductor.

11.2.4 *Flexible cord sheaths*

Inside a control, the sheath (jacket) of a flexible cable or cord shall be used as supplementary insulation only where it is not subject to undue mechanical or thermal stresses and if its insulating properties are not less than those specified in HD 21: Polyvinyl Chloride Insulated Cables or Rated Voltages up to and including 450/750 V, or HD 22: Rubber Insulated Cables of Rated Voltages up to and including 450/750 V.

Compliance is checked by inspection, and, if necessary, by testing the sheaths of the flexible cords according to HD 21 or HD 22.

11.3 **Actuation and operation**

11.3.1 *Full disconnection*

Controls with positions declared as full-disconnection shall be so designed that in the declared positions there is contact separation in all supply poles other than earth, at least equal to the relevant values specified in Clause 20. The contact separation may be obtained by automatic action or by manual action, but any subsequent automatic action shall not cause any contact separation to be reduced below the specified minimum.

If the disconnection is also declared to provide all-pole disconnection, the contact operation in each supply pole shall substantially together.

Compliance is checked by inspection and by the tests of Clauses 13 and 20, where necessary.

11.3.2 *Micro-disconnection*

Controls with positions declared as micro-disconnection shall be so designed that in the declared positions there is contact separation in at least one supply pole to meet the electric strength requirements of Clause 13 but no clearance dimension is specified. The contact separation may be obtained by automatic action or by manual action, but any subsequent change of activating quantity between the limits declared in Sub-clause 7.2, requirement 36, at any switch head temperature between the limits declared in Sub-clause 7.2, requirements 22, shall not cause an operation which would reduce the contact separation such that the requirements of Clause 13 are no longer met.

Compliance is checked by inspection and, where necessary, by the tests of Clause 13 carried out at the temperature limits declared.

11.3.3 *Reset buttons*

Reset buttons of controls shall be so located or protected that they are not likely to be accidentally reset.

Compliance is checked by inspection.

This requirement precludes, for example, reset buttons mounted in such a position that they can be reset by pushing the control against a wall, or by pushing a piece of furniture against the control.

11.3.4 *Setting by the manufacturer*

Parts used for the setting of controls by the manufacturer shall be secured to prevent accidental shifting after setting.

Compliance is checked by inspection.

11.3.5 *Contacts — general*

Contacts with a d.c. rating greater than 0.1 A which can be operated by actuation, shall be so designed that the speeds of approach and separation of the contact surfaces are independent of the speed of actuation.

Compliance is checked by inspection.

This requirement does not apply to contacts excluded by Sub-clause 11.3.7.

11.3.6 *Contacts for full-disconnection and micro-disconnection*

Contacts for full-disconnection and contacts for micro-disconnection, having either a d.c. rating not greater than 0.1 A, or an a.c. rating, and which can be operated by actuation, shall be so designed that they can come to rest only in a closed position or in an open position.

Compliance is checked by inspection, and for a closed position by the temperature requirements of Clause 14, and for an open position by the requirements of Clause 13, as specified for micro-disconnection. However, where an intermediate position of the actuating member occurs adjacent to a located position declared as full-disconnection, then the tests of Clauses 13 and 20, as specified for full-disconnection, are made for this intermediate position.

11.3.7 The requirements of Sub-clauses 11.3.5 and 11.3.6 shall not apply to contacts where inspection shows they cannot be operated on-load, or are not intended to be operated on-load, nor to contacts which do not arc under conditions of normal use.

11.3.7.1 *Compliance is checked by inspection, and if necessary by the test of Sub-clause 11.3.7.2.*

11.3.7.2 *A d.c. voltage equal to the maximum working voltage is applied to the contacts in series with a resistor such that the current occurring in normal use is obtained. It shall not be possible to maintain an arc by slowly opening the contacts.*

11.3.8 *Contacts rest position*

Contacts shall, in any rest position of the actuating member, be either open or closed as intended, or such that no hazard can occur within the control or equipment.

Compliance is checked by inspection.

The term “rest position of the actuating member” includes located, intermediate and position of setting by the user.

11.3.9 *Pull-cord actuated control*

A pull-cord actuated control shall be so designed that when the pull-cord is released after actuating the control, the relevant parts of the mechanism cannot normally fail to return to a position from which they allow the immediate performance of the next movement in the cycle of actuation of the control.

Compliance is checked by inspection and by the following test.

Pull-cord actuated controls shall be actuated from any located position to the next located position by the application and removal of a steady pull not exceeding 45 N vertically downwards, or 70 N at 45 degrees to the vertical, with the control mounted in any declared manner.

The actuating forces for controls actuated by other than pull cords, are not specified. Attention is drawn to the relevant equipment standard where such requirements may be given.

11.4 Actions

11.4.1 Combined actions

A control having more than one action, with one of the actions designed to operate after the failure of the other action(s), shall be so constructed that this action remains operative after failure of any portion unique to the other action(s).

Compliance is checked by inspection and, if necessary, by tests after making all of the other action(s) inoperative.

11.4.2 Setting by the manufacturer

Type 2 action which has provision for setting by the manufacturer of its operating value, operating time or operating sequence, shall be designed such that it is clearly discernible if any subsequent interference with the setting has been made.

Compliance is checked by inspection.

11.4.3 Type 2 action

Any Type 2 action shall be so designed that the manufacturing deviation and drift of its operating value, operating time or operating sequence is within the limit declared in Table 7.2, requirements 41 and 42.

Compliance is checked by the tests of Clauses 15 to 17 inclusive.

11.4.4 Type 1A or 2A action

A Type 1A or 2A action shall operate to provide the clearances and electric strength requirements specified for full-disconnection.

Compliance is checked by the tests of Clause 13 and the relevant requirements of Clause 20.

11.4.5 Type 1B or 2B action

A Type 1B or 2B action shall operate to provide the electric strength requirements specified for micro-disconnection.

Compliance is checked by the test of Clause 13 and the relevant requirements of Clause 20.

11.4.6 Type 1C or 2C action

A Type 1C or 2C action shall operate to provide circuit interruption by micro-interruption.

Compliance is checked by the relevant requirements of Clause 20.

11.4.7 Type 1D or 2D action

A Type 1D or 2D action shall be so designed that disconnection can neither be prevented nor inhibited, by any reset mechanism and so that after disconnection, it is not possible to reclose the circuit even momentarily while the excess or fault condition persists.

Compliance is checked by inspection and by test.

11.4.8 Type 1E or 2E action

A Type 1E or 2E action shall be designed so that disconnection can neither be prevented, nor inhibited by any reset mechanism and so that the contacts can neither be prevented from opening nor be maintained closed against a continuation of the excess or fault condition.

Compliance is checked by inspection and by test.

11.4.9 Type 1F or 2F action

A Type 1F or 2F action shall be designed so that after the control has been mounted in accordance with the manufacturer's instructions, it can only be reset with the aid of a tool.

Compliance is checked by inspection and by test.

Mounting within an equipment such that a tool is required to gain access to the control is deemed to satisfy this requirement.

11.4.10 Type 1G or 2G action

A Type 1G or 2G action shall be designed so that after the control has operated, it is possible to reset the control (although not intended) under electrically loaded conditions.

Compliance is checked by inspection and by resetting once at rated voltage and rated current.

11.4.11 Type 1H or 2H action

A Type 1H or 2H action shall be so designed that the contacts cannot be prevented from opening and which may automatically reset to the closed position if the reset means is held in the reset position. The control shall not reset automatically at any temperature above $-35\text{ }^{\circ}\text{C}$ with the reset mechanism in the normal position.

Compliance is checked by inspection and by test.

11.4.12 Type 1J or 2J action

A Type 1J or 2J action shall be so designed that 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 position. The control shall not reset automatically at any temperature above $-35\text{ }^{\circ}\text{C}$.

Compliance is checked by inspection and by test.

11.4.13 Type 1K or 2K action

A Type 1K or 2K action shall be so designed that in the event of a break in the sensing element, or in any other part between the sensing element and the switch head, the declared disconnection is provided before the declared operating value, operating time or operating sequence is exceeded.

A test is under consideration.

11.4.14 Type 1L or 2L action

A Type 1L or 2L action shall be so designed that in the case of failure of the electrical supply, the intended function is performed independently of any external auxiliary energy source or electrical supply.

Compliance is checked by inspection.

A simple direct acting spring or weight is not regarded as an external auxiliary energy source or electrical supply.

11.4.15 Type 1M or 2M action

A Type 1M or 2M action shall be so designed that it operates in its intended manner after the declared ageing procedure.

Compliance is checked by the test of Sub-clause 17.6.

11.5 Degree of protection provided by enclosures

11.5.1 In-line cord, free-standing and independently mounted controls, other than those classified in Sub-clause 6.5 as IP00, shall be so designed that they meet the appropriate tests specified in HD 365 S3.

11.5.2 Integrated and incorporated controls shall be so designed that when mounted or installed in the declared manner in an equipment, the combination of control and equipment will meet the appropriate tests.

11.5.3 Drain holes, if any, shall have a minimum area of 20 mm^2 and a width and depth of at least 3 mm.

Compliance with Sub-clauses 11.5.1 to 11.5.3 inclusive is checked by inspection, and the tests of HD 365 S3.

Additional requirements for moisture resistance are contained in Clause 12.

Controls classified IPX7 may have a facility for opening a drain hole.

11.6 Mounting of controls

11.6.1 Controls shall be so designed that the methods of mounting in accordance with the manufacturer's declaration do not adversely affect compliance with this standard.

11.6.2 Declared methods of mounting shall be such that the control cannot rotate or be otherwise displaced and cannot be removed from an equipment without the aid of a tool if such movement or removal could adversely affect compliance with this standard. If removal or partial removal is necessary for correct use of the control then the requirements of Clauses 8, 13 and 20 must be satisfied before and after removal.

Compliance with Sub-clauses 11.6.1 and 11.6.2 is checked by inspection and by manual test.

Controls, other than those with rotary actuation, fixed by a nut and single bushing concentric with the actuating means, are deemed to comply with this requirement, provided that the tightening of the nut requires the use of a tool, and that the parts have adequate mechanical strength. An incorporated control mounted by screwless fixing is deemed to comply with this requirement if the use of a tool is required before the control can be removed from the equipment.

11.7 Attachment of cords

11.7.1 Flexing

11.7.1.1 The flexible cords of in-line cord and free-standing controls shall be capable of withstanding the flexing likely to occur in normal use. If a cord-guard is provided to meet this requirement it shall not be integral with the flexible cord if attachment method X is used.

11.7.1.2 Compliance is checked by subjecting the control, fitted with the flexible cord or range of flexible cords for which it is designed, to the following test:

11.7.1.2.1 *The control is mounted in the flexing apparatus shown in Figure 9, page 83. The axis of oscillation is so chosen that the weight attached to the cord and the cord itself, make the minimum lateral movement during the test. Samples with flat cords are mounted so that the major axis of the cross-section is parallel to the axis of oscillation. Each flexible cord passing through the inlet opening is loaded with a weight of 1 kg. A current equal to the current passing through that particular core when the control is operated at rated voltage is passed through each core, the voltage between cores being maximum rated voltage. The oscillating member is moved backwards and forwards through an angle of 90° (45° on either side of the vertical). The number of flexings (that is one movement through 90°) being 5 000, and the rate of the flexing being 60 flexings per minute.*

11.7.1.2.2 *After the test, the sample shall show no damage within the meaning of this standard. During the test, no interruption of the current and no short-circuit between the individual conductors shall occur, neither shall broken strands pierce the insulation to the outer surface of the accessory. A short-circuit between individual conductors is considered to occur if the current reaches twice the value of the test current.*

11.7.1.2.3 *Not more than 10 % of the total number of conductors of the flexible cord shall have been broken.*

11.7.2 Cord anchorages

11.7.2.1 Controls other than integrated and incorporated, intended to be connected by means of a non-detachable cord shall have cord anchorages such that the conductors are relieved from strain, including twisting, where they are connected to the terminals, and that their covering is protected from abrasion. It shall be clear how the relief from strain and the prevention of twisting is intended to be effected.

11.7.2.2 Cord anchorages of Class II controls shall be of insulating material or, if of metal, be insulated from accessible metal parts or metal foil over accessible metal surfaces by insulation complying with the requirements for supplementary insulation.

11.7.2.3 Cord anchorages of controls, other than those of Class II, shall be of insulating material or be provided with an insulating lining, if otherwise an insulation fault on the cord could make accessible metal parts live. This lining, if any, shall be fixed to the cord anchorage, unless it is a bushing which forms part of a cord guard provided to meet the requirements of Sub-clause 11.7.1.

11.7.2.4 Cord anchorages shall be so designed that:

- the cord cannot touch clamping screws of the cord anchorage, if these screws are accessible metal parts;
- the cord is not clamped by a metal screw which bears directly on the cord;
- for attachment method X or M at least one part is securely fixed to the control;
- for attachment method X or M replacement of the flexible cord does not require the use of a special purpose tool;
- for attachment method X they are suitable for the different types of flexible cord which may be connected.
- for attachment method X the design and location make replacement of the flexible cord easily possible.

11.7.2.5 For other than attachment method Z, make-shift methods such as tying the cord into a knot, or tying the ends with string shall not be used.

11.7.2.6 Glands shall not be used as cord anchorages in in-line cord controls using attachment method X unless they make provision for damping all types and sizes of cords used in Sub-clause 10.1.4.