

Switches for household and similar fixed electrical installations

Part 1. General requirements

The European Standard EN 60669-1 : 1995 has the status of a
British Standard

ICS 29.120.40

Committees responsible for this British Standard

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- Association of Control Manufacturers — TACMA (BEAMA Ltd.)
- Association of Manufacturers of Domestic Electrical Appliances
- ASTA Certification Services
- British Electrical Systems Association (BEAMA Ltd.)
- British Electrotechnical Approvals Board
- British Radio Electronic Equipment Manufacturers' Association
- BSI Testing Services
- Consumers' Association
- Consumer Policy Committee of BSI
- Copper Development Association
- Department of Trade and Industry (Consumer Safety Unit, CA Division)
- Electrical Installation Equipment Manufacturers Association (BEAMA Ltd.)
- Electricity Association
- ERA Technology Ltd.
- Federation of the Electronics Industry
- Industry Council for Electronic Equipment Recycling
- Institute of Trading Standards Administration
- Institution of Electrical Engineers
- Institution of Incorporated Executive Engineers
- International Consumer Electronics Association (ICEA)
- Lighting Association
- Lighting Industry Federation Ltd.
- National Inspection Council for Electrical Installation Contracting
- National Standards Authority of Ireland
- Royal Society for the Prevention of Accidents

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National foreword

This British Standard has been prepared by Technical Committee PEL/23 and is the English language version of EN 60669-1 *Switches for household and similar fixed electrical installations — Part 1 : 1995 General requirements*, published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC 669-1 : 1993 published by the International Electrotechnical Commission (IEC).

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by a side line in the margin.

The foreword of the European Standard makes reference to the 'date of withdrawal', now, of the relevant national standard. In this case the relevant national standard will be withdrawn on 2005-10-15. Certificates and Marks will not be awarded after this date with respect to the withdrawn British Standard. However, such Certificates and Marks, already awarded, may continue to apply to production until 2010-10-15.

In this standard, the following print types are used:

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

Cross-references

Publication referred to	Corresponding British Standard
HD 214 S2 : 1980 (IEC 112 : 1979)	BS 5901 : 1980 <i>Method of test for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions</i>
HD 437 S1 : 1984 (IEC 212)	BS 2844 : 1995 <i>Memorandum on conditioning of solid electrical insulating materials prior to and during testing</i>
HD 383 S2 : 1986 (IEC 228A : 1982)	BS 6360 : 1991 <i>Specification for conductors in insulated cables and cords</i>
HD 243 S12 : 1995 (IEC 417 : 1973)	BS 6217 : 1981 <i>Guide to graphical symbols for use on electrical equipment</i>
EN 60529 : 1991 (IEC 529 : 1989)	BS EN 60529 : 1992 <i>Specification for degrees of protection provided by enclosures (IP code)</i>
EN 60719 : 1993 (IEC 719 : 1992)	BS EN 60719 : 1993 <i>Calculation for the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltages up to and including 450/750 V</i>
EN 60998-1 : 1993 (IEC 998-1 : 1990)	BS EN 60998 <i>Connecting devices for low-voltage circuits for household and similar purposes</i> Part 1 : 1993 <i>General requirements</i>
EN 60998-2-1 : 1993 (IEC 998-2-1 : 1990)	Part 2-1 : 1993 <i>Particular requirements for connecting devices as separate entities with screw-type clamping units</i>
EN 60998-2-2 : 1993 (IEC 998-2-2 : 1991)	Part 2-2 : 1994 <i>Particular requirements for connecting devices as separate entities with screwless-type clamping units</i>
EN 60999 : 1993 (IEC 999 : 1990)	BS EN 60999 : 1993 <i>Connecting devices. Safety requirements for screw-type and screwless-type clamping units for electrical copper conductors</i>
ISO 2039-2 : 1987	BS 2782 <i>Method for testing plastics</i> Part 3 : <i>Mechanical properties</i> Method 365C : 1992 <i>Determination of Rockwell hardness</i>

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

ICS 29.120.40

Descriptors: Switches for household use $U_{\max} = 440$ V r.m.s., requirements, classification, testing, properties, definitions, electrical safety, requirements, materials testing

English version

Switches for household and similar fixed electrical installations Part 1: General requirements

(IEC 669-1 : 1993, modified)

Interrupteurs pour installations électriques fixes
domestiques et analogues
Partie 1: Prescriptions générales
(CEI 669-1 : 1993, modifiée)

Schalter für Haushalt und ähnliche ortsfeste
elektrische Installationen
Teil 1: Allgemeine Anforderungen
(IEC 669-1 : 1993, modifiziert)

This European Standard was approved by CENELEC on 1995-07-04. 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.

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CENELEC

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

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Foreword

The text of the international standard IEC 669-1 : 1993, prepared by SC 23B, Plugs, socket-outlets and switches, of IEC TC 23, Electrical accessories, together with common modifications prepared by the Technical Committee CENELEC TC 23B, Switches for household and similar fixed electrical installations, was submitted to the formal vote and was approved by CENELEC as EN 60669-1 on 1995-07-04.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-01-15
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-10-15

For products which have complied with the relevant national standard before 2005-10-15, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2010-10-15.

Annexes designated 'normative' are part of the body of the standard. Annexes designated 'informative' are given for information only. In this standard, annexes A, B, ZA and ZB are normative and annex ZA is informative. Annexes ZA, ZB and ZC have been added by CENELEC.

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SWITCHES FOR HOUSEHOLD AND SIMILAR FIXED-ELECTRICAL INSTALLATIONS

Part 1 : General requirements

1 Scope

This part of IEC 669 applies to manually operated general purpose switches for a.c. only with a rated voltage not exceeding 440 V and a rated current not exceeding 63 A, intended for household and similar fixed-electrical installations, either indoors or outdoors.

The rated current is limited to 16 A for switches provided with screwless terminals.

NOTES

1 *(deleted)*

2 An extension of the scope to switches for rated voltages higher than 440 V is under consideration.

Unless otherwise specified in subsequent parts, this standard applies to switches intended to be used at 50 Hz.

The standard also applies to boxes for switches, with the exception of flush mounting boxes for flush-type switches.

NOTE 3 - In this standard specific requirements are given for boxes, while general requirements for boxes for ordinary* flush-type switches are given in IEC 670.

It also applies to switches such as:

- switches incorporating pilot lights;
- electromagnetic remote control switches;
- switches incorporating a time-delay device;
- combinations of switches and other functions (with the exception of switches combined with fuses);
- electronic switches (particular requirements are given in part 2);
- switches having facilities for the retention of and outlet for flexible cables (see annex B).

NOTE 4 - The minimum length of the flexible cable used with these switches may be governed by National Wiring Rules.

Switches complying with this standard are suitable for use at ambient temperatures not normally exceeding 25 °C, but occasionally reaching 35 °C.

NOTES

5 Additional requirements for flush-type non-ordinary switches are under consideration.

6 Switches complying with this standard are suitable only for incorporation in equipment in such a way and in such a place that it is unlikely that the surrounding ambient temperature exceeds 35 °C.

* See 7.1.4, note 1.

In locations where special conditions prevail, as in ships, vehicles and the like and in hazardous locations, for example where explosions are liable to occur, special constructions may be required.

This standard does not include requirements and tests for switches with protection against ingress of solid foreign bodies. These are under consideration.

2 Normative references

NOTE – Normative references to international publications are listed in Annex ZA (normative)

3 Definitions

For the purpose of this part of IEC 669 the following definitions apply.

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

3.1 switch: Device designed to make or break the current in one or more electric circuits.

3.1.1 push-button switch: Control switch having one actuator intended to be operated by force exerted by a part of the human body, usually the finger or the palm of the hand, having stored energy return, for instance a spring.

3.1.2 momentary contact switch: Switching device which returns automatically to the initial state after operation.

NOTE – Momentary contact switches are intended to operate bells, electromagnetic remote control switches or time-delay switches.

3.1.3 Void.

3.1.4 cord-operated switch: Switch the operating means of which is a cord which has to be pulled in order to change its contact state.

3.1.5 switch of mini-gap construction: Switch construction having a clearance between the contacts which is less than 3 mm but is at least 1,2 mm.

NOTE – Switches of mini-gap construction are for functional purposes and they are not intended to be used for safety isolation purposes (see IEC 364-4-46).

3.2 one operation: Transfer of the moving contacts from one operating position to another.

3.3 terminal: The conductive part of one pole, composed of one or more clamping unit(s) and insulation if necessary.

3.4 clamping unit: Part or parts of a terminal necessary for the mechanical and the electrical connection of the conductor(s).

3.5 terminal with screw clamping: Terminal intended for the connection, by clamping only, of external rigid or flexible conductors.

3.6 pillar terminal: Terminal with screw clamping in which the conductor is inserted into the hole or cavity, where it is clamped under the end of the screw or screws. The clamping pressure may be applied directly by the end of the screw or through an intermediate clamping member to which pressure is applied by the end of the screw.

NOTE – Examples of pillar terminals are shown in figure 4.

3.7 screw terminal: Terminal with screw clamping in which the conductor is clamped under the head of the screw. The clamping pressure may be applied directly to the head of the screw or through an intermediate part, such as a washer, clamping plate or anti-spread device.

NOTE – Examples of screw terminals are shown in figure 5.

3.8 stud terminal: Terminal with screw clamping 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, clamping plate or anti-spread device.

NOTE – Examples of stud terminals are shown in figure 5.

3.9 saddle terminal: Terminal with screw clamping in which the conductor is clamped under a saddle by means of two or more screws or nuts.

NOTE – Examples of saddle terminals are shown in figure 6.

3.10 lug terminal: Screw terminal or stud terminal, designed for clamping a cable lug or bar by means of a screw or nut.

NOTE – Examples of lug terminals are shown in figure 7.

3.11 mantle terminal: Terminal with screw clamping 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 by equally effective means for transmitting the pressure from the nut to the conductor within the slot.

NOTE – Examples of mantle terminals are shown in figure 8.

3.12 screwless terminal: Connecting device for the connection and subsequent disconnection of a rigid (solid or stranded) or flexible conductor or the interconnection of two conductors capable of being dismantled, the connection being made, directly or indirectly, by means of springs, parts of angled, eccentric or conical form, etc, without special preparation of the conductor concerned, other than removal of insulation.

3.13 thread-forming screw: Tapping screw having an uninterrupted thread which, by screwing in, forms a thread by displacing material.

NOTE – An example of a thread-forming screw is shown in figure 11.

3.14 thread-cutting screw: Tapping screw having an interrupted thread which, by screwing in, forms a thread by removing material.

NOTE – An example of a thread-cutting screw is shown in figure 12.

3.15 mechanical time-delay device: Device which, through a mechanical auxiliary, operates some time after the instant at which the conditions which cause it to operate are established.

3.16 base: Part of the switch retaining current-carrying parts and, in general, the mechanism in position.

3.17 rated voltage: Voltage assigned to the switch by the manufacturer.

3.18 rated current: Current assigned to the switch by the manufacturer.

3.19 operating member: Part of a cord-operated switch which connects the internal mechanism with a pull cord. It is usually attached to the actuating member of the switch.

3.20 pole (of a switch): Part of a switch associated with one conductive path (way) of its circuit(s) provided with contacts intended to connect and disconnect the circuit itself and excluding those portions which provide a means for connecting and operating the poles together.

A conducting path may be constituted by portions common to other conducting paths of the switch.

3.21 type test: (IEV 151-04-15) A test of one or more switches made to a certain design to show that the design meets certain specifications.

3.22 routine test: (IEV 151-04-16) A test to which each individual switch is subjected during and/or after manufacture to ascertain whether it complies with certain criteria.

3.23 actuating member: (IEV 442-04-16) A part which is pulled, pushed or turned or otherwise moved to cause an operation.

3.24 surface-type switch: A switch, which when mounted, projects wholly above the surface on which it is mounted.

3.25 flush-type switch: A switch mainly intended to be mounted in a flush-type box.

3.26 semi flush-type switch: A switch mainly intended to be mounted in a semi flush-type box.

3.27 panel-type switch: A switch mainly intended for mounting to a panel having an aperture through which the intended accessible surface of the switch protrudes.

3.28 architrave-type switch: A switch having a cover plate of such proportions that it may be accommodated within an architrave.

3.29 live part: (IEV 826-03-01) A conductor or conductive part intended to be energised in normal use, including a neutral conductor but, by convention not a PEN conductor.

NOTE – A protective conductor (PE) is not a live part.

4 General requirements

Switches and boxes shall be so designed and constructed that, in normal use, their performance is reliable and without danger to the user or the surroundings.

Where tolerances are not specified in this standard the values are to be regarded as nominal.

Compliance is checked by meeting all the relevant requirements and tests specified.

5 General notes on tests

5.1 *Tests according to this standard are type tests.*

5.2 *Unless otherwise specified, the specimens are tested as delivered and under normal conditions of use.*

Flush-type switches which do not comply with any accepted standard sheet are tested together with the corresponding boxes.

5.3 *Unless otherwise specified, the tests are carried out in the order of the clauses, at an ambient temperature between 15 °C and 35 °C.*

In case of doubt, the tests are made at an ambient temperature of 20 °C ± 5 °C.

5.4 *For switches which are marked with one rated voltage and one rated current, nine specimens are necessary.*

Three specimens are subjected to all the relevant tests, except the tests of 19.2, where one further set of three specimens is used (or two further sets for switches of pattern number 2) , and the tests of clause 24, where another three specimens are used.

For the tests of clause 24, three additional specimens may be required.

For each of the tests of 13.15.1 and 13.15.2, three additional specimens of separate membranes, or of switches incorporating membranes, are required.

For the tests of 12.3.11, additional specimens of switches having in total at least five screwless terminals are required.

For the tests of 12.3.12 three additional specimens of switches are necessary; in each specimen, one clamping unit is tested.

For cord-operated switches-three further specimens are used for the test of 20.9.

For switches marked with two rated voltages and corresponding rated currents, 15 specimens are necessary.

For each of the two combinations of rated voltages and rated currents marked on the switch, three specimens are subjected to all the relevant tests except the test of 19.2, where two (or four for switches of pattern number 2) further sets of three specimens are used.

Switches marked with a dual voltage are tested at the higher voltage.

Momentary contact switches or time delay switches are not to be submitted to the tests of 18.2 and 19.2.

NOTE – A table showing the number of specimens needed for the test is given in Annex A.

5.5 Unless otherwise stated, three specimens are submitted to all the tests and the requirements are satisfied if all the tests are met. If only one of the specimens does not satisfy a test due to an assembly or manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated and also the tests which follow shall be made in the required sequence on another full set of specimens, all of which shall comply with the requirements.

NOTES

1 In general, it will be necessary only to repeat the test which caused the failure, unless the specimen fails in the test of clause 19.1, in which case the tests are repeated from that of clause 18 onwards.

2 The applicant may submit, together with the number of specimens specified in 5.4, the additional set of specimens which may be required, should one specimen fail. The testing station will then, without further request, test additional specimens and will reject only if a further failure occurs. If the additional set of specimens is not submitted at the same time, the failure of one specimen will entail rejection.

6 Ratings

6.1 Switches shall preferably have rated voltages of 250 V and 400 V.

The values 230 V, 380 V and 440 V may be used.

For momentary contact switches or time delay-switches, the standard voltages are 130 V and 250 V.

If any other voltage rating is used, it shall be not less than 120 V.

6.2 Switches shall preferably have rated currents of 6 A, 10 A, 16 A, 20 A, 25 A, 32 A, 40 A, 45 A and 63 A.

The rated current shall not be less than 6A, except that rated currents of 1A, 2A and 4A are allowed for momentary contact switches, electromagnetic remote control switches and time delay switches.

Switches with a rated current not exceeding 16 A, except switches of pattern numbers 3 and 03 and momentary contact switches, shall have fluorescent lamp current rating equal to the rated current.

For switches with a rated current above 16 A and up to 25 A inclusive the test with fluorescent lamp can be carried out optionally.

Compliance with the requirements of 6.1 and 6.2 is checked by inspection of the marking.

7 Classification

7.1 Switches are classified:

7.1.1 According to the possible connections (see figure 1):

	Pattern number
– single-pole switches	1
– double-pole switches	2
– three-pole switches	3
– three-pole plus switched neutral switches	03
– two-way switches	6
– two-circuit switches with a common incoming line	5
– two-way switches with one off-position	4
– two-way double-pole switches	6/2
– two-way reversing switches (or intermediate switches)	7

NOTES

- 1 Two or more switches having the same or different pattern numbers may be mounted on a common base.
- 2 For the pattern numbers for which an off-position is considered, the above classification refers also to push-button switches and momentary contact switches.

7.1.2 According to the contact opening:

- switches of normal gap construction;
- switches of mini-gap construction.

7.1.3 According to the degree of protection against electric shock:

- unenclosed switches;
- enclosed switches.

NOTE – For unenclosed switches, the protection against electric shock is given by the enclosure in which the switch is intended to be mounted. For enclosed switches, the protection against electric shock is provided by compliance with the requirements of clause 10.

7.1.4 According to the degree of protection against harmful ingress of water:

- ordinary switches, i.e. with degree of protection IPX0;
- switches with degree of protection 1PX4;
- switches with degree of protection IPX5.

NOTES

- 1 For the purpose of this standard the term "ordinary" applies only to the degree of protection against harmful ingress of water.
- 2 For an explanation of IP codes see IEC 529.

7.1.5 According to the method of actuating the switch:

- rotary;
- tumbler;
- rocker;
- push-button;
- cord-operated.

7.1.6 According to the method of mounting the switch:

- surface-type;
- flush-type;
- semi flush-type;
- panel-type;
- architrave-type.

7.1.7 According to the method of installation, as a consequence of the design of the switch:

- switches where the cover or cover plate can be removed without displacement of the conductors (design A);
- switches where the the cover or cover plate cannot be removed without displacement of the conductors (design B).

NOTE – If a switch has a base (main part) which cannot be separated from the cover or cover plate, and requires a supplementary plate to meet the standard, which can be removed for redecorating the wall without displacement of the conductors, it is considered to be of design A, provided the supplementary plate meets the requirements specified for covers and cover plates.

| See Annex ZB for special national conditions.

7.1.8 According to the type of terminal:

- switches with screw-type terminals;
- switches with screwless terminals for rigid conductors only;
- switches with screwless terminals for rigid and flexible conductors.

7.2 Preferred combinations of number of poles and ratings are shown in table 1.

Table 1

Rated current A	Number of poles	
	Rated voltage from 120 to 250 V inclusive	Rated voltage over 250 V
1, 2 and 4	1	–
6	1 2	1 2
10	1 2	1 2 3 4
16, 20, 25, 32, 40, 45 and 63	1 2 3 4	1 2 3 4

8 Marking

8.1 Switches shall be marked with:

- rated current in amperes (A) or rated fluorescent lamp current in amperes (AX), or a combination of both if the two ratings are different (see 6.2 and examples of marking in 8.2);
- rated voltages in volts;
- symbol for nature of supply;
- manufacturer's or responsible vendor's name, trade mark or identification mark;
- type reference, which may be a catalogue number;
- symbol for mini-gap construction, if applicable;
- symbol for degree of protection against harmful ingress of water, if applicable.

NOTES

1 Marking of the pattern number given in 7.1.1 is recommended if the connections are not clear from an inspection of the switch; this pattern number may be part of the type reference.

2 If a base carries two or more switches with separate operating devices, marking with the pattern numbers is recommended, for example 1+6 or 1+1+1.

In addition, switches with screwless terminals shall be marked with an indication of the suitability to accept rigid conductors only, for those switches having this restriction.

The information may be put on the switch and/or the packaging unit.

See Annex ZB for special national conditions.

8.2 When symbols are used, they shall be as follows:

Amperes (fluorescent lamp current)	AX
(other currents)	A
Volts	V
Alternating current	~
Neutral	N
Line	L
Earth	
"off" position	O
"on" position	
Mini-gap construction	m
Splash-proof construction	IPX4
Jet-proof construction	IPX5

NOTES

- 1 Details of construction of symbols are given in IEC 417.
- 2 Ordinary switches are not marked with any symbol for protection against harmful ingress of water.
- 3 In the IP Codes the letter "X", concerning protection against ingress of solid objects, is replaced by the relevant number.
- 4 Lines formed by the construction of the tool are not considered as part of the marking.

For marking with fluorescent lamp current, the symbol "AX" may be replaced by the symbol "X". For marking with rated current and rated voltage the figures may be used alone.

The marking for the nature of supply shall be placed next to the marking for rated current and rated voltage.

NOTE 5 - The marking for current, voltage and nature of supply may be, for example, as follows:

10AX 250V ~	or	10X /250 ~	or	$\frac{10X}{250}$ ~
20A-16AX 250V ~	or	20-16X /250 ~	or	$\frac{20-16X}{250}$ ~
10AX 400V ~	or	10X /400 ~	or	$\frac{10X}{400}$ ~
25AX 400V ~	or	25X /400 ~	or	$\frac{25X}{400}$ ~
25AX 250V ~	or	25X /250 ~	or	$\frac{25X}{250}$ ~
25AX 440V ~	or	25X /440 ~	or	$\frac{25X}{440}$ ~

8.3 The marking for the rated current, rated voltage, nature of supply, manufacturer's name or responsible vendor's name, trade mark or identification mark, type reference and symbol for mini-gap construction (if applicable), shall be on the main part of the switch.

Parts such as cover plates, which are necessary for safety purposes and are intended to be sold separately, shall be marked with the manufacturer's name or responsible vendor's name, trade mark or identification mark and type reference.

The symbol for the degree of protection against harmful ingress of water, if applicable, shall be marked on the outside of its associated enclosure so as to be easily discernible when the switch is mounted and wired as in normal use.

The marking shall be clearly visible with normal or corrected vision, without additional magnification, marked either on the front of the switch or on the inner part of its associated enclosure, or on the main part of the switch so that it is easily legible during installation. These markings shall not be placed on parts which can be removed without the use of a tool.

See Annex ZB for special national conditions.

NOTES

- 1 Additional type references may be marked on the main part, or on the outside or the inside of the associated enclosure.
- 2 The term "main part" means the part carrying the contacts and any part integral with them; it does not include the knob, handle and the like, or parts intended to be sold separately.

8.4 Terminals intended for the connection of phase conductors (supply conductors) shall be identified unless the method of connection is of no importance, is self-evident or is indicated on a wiring diagram. Such identification may take the form of a letter *L* or in the case of more than one of such terminals, the letters *L*₁, *L*₂, *L*₃, etc. which may be accompanied by an arrow or arrows pointing to the relevant terminal or terminals.

Alternatively, the surface of such terminals shall be bare brass or copper, other terminals being covered with a metallic layer of another colour.

For switches of pattern numbers 2, 3, 03 and 6/2, terminals associated with any one pole shall have similar identification, if applicable, differing from that of the terminals associated with the other poles, unless the relationship is self-evident.

These indications shall not be placed on screws or any other easily removable part.

NOTES

- 1 The wiring diagram may be an instruction sheet which accompanies the switch.
- 2 "Easily removable parts" are those parts which can be removed during the normal installation of the switch.

8.5 Terminals intended exclusively for the neutral conductor shall be indicated by the letter N.

Earthing terminals shall be indicated by the symbol . These markings shall not be placed on screws or any other easily removable part.

8.6 If switches of pattern numbers 2, 3, 03 and switches having a rated voltage exceeding 250 V and rated current exceeding 16 A are marked to indicate the switch position, they shall be so marked that the direction of the movement of the actuating member to its different positions or the actual switch position is clearly indicated. For switches having more than one actuating member, this marking shall indicate, for each of the actuating members, the effect achieved by its operation.

The marking shall be clearly visible on the front of the switch when fitted with its cover or cover plate.

If this marking is placed on the cover, cover plate, or removable actuating members, it shall not be possible to fix them in a position such that the marking is incorrect.

The symbols for "on" and "off" shall not be used for the indication of the switch positions unless, at the same time, they clearly indicate the direction of the movement of the actuating members.

NOTE 1 – Other suitable means for the indication of the switch position may be used, for example indicator lamps.

The short straight line indicating the "on" position, shall be radial for rotary switches, perpendicular to the axis of rotation of the dolly for tumbler switches and rocker switches and vertical for push-button switches when mounted vertically.

Compliance with the requirements of 8.1 to 8.6 is checked by inspection.

8.7 A push-button shall be coloured red only if it serves to open the circuit to be controlled. In addition, it may serve to close auxiliary contacts for control circuits, pilot lamps, etc.

8.8 If it is necessary to take special precautions when installing the switch, details of these shall be given in an instruction sheet which accompanies the switch.

Instruction sheets shall be written in the official language(s) of the country in which the switch is to be sold.

Compliance with the requirements of 8.7 to 8.8 is checked by inspection.

NOTES

1 Special precautions may, for example, be necessary for unenclosed switches and for switches for panel mounting.

If special precautions are necessary in order to ensure that, after installation, the conditions necessary to meet the requirements of this standard are achieved, in that case, the instruction sheet shall include clear information with regard to the following:

- dimensions of the space to be provided for each switch;
- dimensions and position of the means for supporting and fixing the switch within this space;
- minimum clearance between the various parts of the switch and the surrounding parts where fitted;
- minimum dimensions of ventilating openings, if needed, and their correct arrangement.

8.9 Marking shall be durable and easily legible.

Compliance is checked by inspection and by the following test.

The marking is rubbed by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

NOTES

1 Marking made by impression, moulding, pressing or engraving is not subjected to this test.

2 It is recommended that the petroleum spirit used consists of a solvent hexane with an aromatic content of maximum 0,1 % in volume percentage, a kauributanol value of approximately 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a density of approximately 0,68 g/cm³.

9 Checking of dimensions

Switches and boxes shall comply with the appropriate standard sheets (if any).

The manufacturer of the switch shall specify in his catalogue the type of boxes (flush or surface, etc) in which his switches are to be mounted.

Compliance is checked by measurement.

10 Protection against electric shock

10.1 Switches shall be so designed that when they are mounted and wired as in normal use, live parts are not accessible even after removal of parts which can be removed without the use of a tool.

Compliance is checked by inspection and, if necessary, by the following test:

The specimen is mounted as in normal use and fitted with conductors of the smallest cross-sectional area specified in clause 12; the test is repeated using conductors of the largest cross-sectional area specified in clause 12.

The standard test finger shown in figure 2, is applied in every possible position, an electrical indicator, with a voltage not less than 40 V and not more than 50 V, being used to show contact with the relevant part.

Switches, having enclosures or covers in thermoplastic or elastomeric material, are subjected to the following additional test, which is carried out at an ambient temperature of $35\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, the switches being at this temperature.

During the additional test, the switches are subjected for 1 min to a force of 75 N, applied through the tip of a straight unjointed test finger of the same dimensions as the standard test finger.

This finger, with an electrical indicator as described above, is applied to all places where yielding of insulating material could impair the safety of the switch, but is not applied to membranes or the like and is applied to thin-walled knock-outs with a force of only 10 N.

During this test, switches with their associated mounting means shall not deform to such an extent that live parts can be touched with the unjointed test finger.

NOTE – Membranes or the like are tested according to 13.15.1 only.

10.2 Knobs, operating levers, push-buttons, rockers and the like shall be of insulating material, unless their accessible metal parts are separated from the metal parts of the mechanism by double insulation or reinforced insulation, or as an alternative, they are reliably connected to earth.

Compliance is checked by inspection and by the tests of clauses 16 and 23.

NOTE – This requirement does not apply to removable keys or intermediate parts, such as chains or rods.

| See Annex ZB for special national conditions.

10.3 Accessible parts of ordinary switches having rated current not exceeding 16 A shall be made of insulating material with the exception of the following:

- a) small screws and the like which are isolated from live parts and which are used for fixing bases and covers, cover plates and other parts of the enclosure;
- b) actuating members complying with 10.2;
- c) the covers, cover plates and other parts of the enclosure of metal which comply with the requirements of 10.3.1 or 10.3.2.

| See Annex ZB for special national conditions.

10.3.1 Covers, cover plates and other parts of the enclosure of metal shall be protected by additional insulation made by insulating linings or insulating barriers. The insulating linings or insulating barriers shall:

- either be fixed to covers or cover plates or the body of the switches in such a way that they cannot be removed without being permanently damaged;
- or are so designed that:
 - they cannot be replaced in an incorrect position;
 - if they are omitted, the accessories are rendered inoperable or manifestly incomplete;
 - there is no risk of accidental contact between live parts and metal covers or cover plates, for example through their fixing screws, even if a conductor should come away from its terminal;

- precautions are taken in order to prevent creepage distances or clearances becoming less than the values specified in clause 23.

Compliance is checked by inspection.

The above linings or barriers shall comply with the tests of clauses 16 and 23.

NOTE – Insulating coating sprayed on the inside or on the outside of the metal cover or cover plate is not deemed to be an insulating lining or barrier for the purpose of this subclause.

10.3.2 The earthing of metal covers, cover plates and other parts of the enclosure is made while fixing the covers, cover plates and other parts of the enclosure and may be made without requiring the use of means other than the fixing means: the resulting connection shall be of low resistance.

See Annex ZB for special national conditions.

NOTE – Fixing screws or other means are allowed.

Compliance is checked by inspection and by the tests of 11.4.

10.4 Metal parts of the mechanism, such as the spindle or the pivot of the dolly or rocker, that are not insulated from live parts, shall not protrude from the enclosure.

However, for switches operated by means of a removable key or similar device, such metal parts of the mechanism shall be insulated from live parts.

Compliance is checked by inspection, if necessary, after the actuating member has been removed or broken.

NOTE – If the actuating member has to be broken, compliance is checked by the test of clause 24.

10.5 Metal parts of the mechanism, such as the spindle or the pivot of the dolly or rocker, shall not be accessible when the switch is fixed as in normal use.

In addition, they shall be insulated from accessible metal parts, including metal frames supporting the base of flush-type switches, liable to be mounted in a metal box, and from screws for fixing the base to its support.

The additional requirement does not apply if the metal parts of the mechanism are separated from live parts in such a way that the creepage distances and clearances have at least twice the values specified in clause 23, or, as an alternative, if they are reliably connected to earth.

See Annex ZB for special national conditions.

Compliance is checked by inspection, if necessary, by measurement and by the tests of clauses 10 and 16.

NOTES

2 When checking the inaccessibility of metal parts of the mechanism of unenclosed switches or architrave-type switches, the protection provided by the normal way of mounting the switch is taken into account.

3 For unenclosed stack-type switches having a metal spindle pivoting in a metal base plate, the additional requirement means that the creepage distances and clearances between live parts and the spindle, and between metal parts of the mechanism and base plate, must have at least twice the values specified in clause 23.

10.6 Switches operated by means of a removable key or by means of an intermediate part, such as a cord, a chain or a rod, shall be so designed that the key or intermediate part can only touch parts which are insulated from live parts.

The key or intermediate part shall be insulated from metal parts of the mechanism, unless the creepage distances and clearances between live parts and metal parts of the mechanism have at least twice the values specified in clause 23.

Compliance is checked by inspection, by the tests of 15.2 and, if necessary, by measurement.

NOTE – Lacquer or enamel is not considered to be insulating material for the purposes of 10.1 to 10.6.

10.7 Where cord-operated switches are provided with a pull cord, which can be fitted or replaced by the user, it shall be so designed that it is impossible to touch live parts when fitting or replacing the pull cord in the normal way.

Compliance is checked by inspection.

11 Provision for earthing

11.1 Accessible metal parts, which can become live in the event of an insulation fault, shall be provided with, or permanently and reliably connected to, an earthing terminal.

This requirement does not apply to the metal cover plates mentioned in 10.3.1.

For the purpose of this requirement, small screws and the like, isolated from live parts, for fixing bases, covers or cover plates, are not considered as accessible parts which can become live in the event of an insulation fault.

11.2 Earthing terminals shall be terminals with screw clamping and shall comply with the appropriate requirements of clause 12.

They shall have a capacity not less than that of the corresponding terminals for the supply conductors.

See Annex ZC for A-deviations.

11.3 Surface-type switches, other than ordinary with an enclosure of insulating material, having more than one cable inlet, shall be provided with an internal earthing terminal allowing the connection of an incoming and outgoing conductor for the continuity of the earthing circuit.

Compliance with the requirements of 11.1 to 11.3 is checked by inspection and by the tests of clause 12.

11.4 The connection between the earthing terminal and accessible metal parts to be connected thereto shall be of low resistance.

Compliance is checked by the following test.

A current derived from an a.c. source having a no-load voltage not exceeding 12 V and equal to 1,5 times rated current or 25 A, whichever is the greater, is passed between the earthing terminal and each of the accessible metal parts in turn.

The voltage drop between the earthing terminal and the accessible metal part is measured, and the resistance calculated from the current and this voltage drop.

In no case shall the resistance exceed 0,05 Ω .

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

12 Terminals

12.1 General

Switches shall be provided with terminals having screw clamping or with screwless terminals.

The means for clamping the conductors in the terminals shall not serve to fix any other component, although they may hold the terminals in place or prevent them from turning.

All the tests on terminals, with the exception of 12.3.11, shall be carried out after the test of clause 15.1.

Compliance is checked by inspection and by the tests of 12.2 or 12.3, as applicable.

12.2 Terminals with screw clamping for external copper conductors

12.2.1 Switches shall be provided with terminals which shall allow the proper connection of copper conductors having cross-sectional areas as shown in table 2.

Table 2

Ranges of rated currents A	Rigid conductors (solid or stranded)***	
	Nominal cross-sectional areas mm ²	Diameter of largest conductor mm
Up to and including 4*		
Above 4 up to and including 6	From 0,75 up to 1,5 inclusive	1,45
Above 6 up to and including 10**	From 1 up to 2,5 inclusive	2,13
Above 10 up to and including 16**	From 1,5 up to 4 inclusive	2,72
Above 16 up to and including 25	From 2,5 up to 6 inclusive	3,34
Above 25 up to and including 32	From 4 up to 10 inclusive	4,34
Above 32 up to and including 45	From 6 up to 16 inclusive	5,46
Above 45 up to and including 63	From 10 up to 25 inclusive	6,85
* For special purposes such as extra-low voltage applications, where flexible conductors are used (from 0,5 mm² up to 1 mm² inclusive). ** Each supply terminal of switches, other than those of pattern numbers 3, 03 and 7, shall allow the connection of two 2,5 mm² conductors. For switches having a rated voltage not exceeding 250 V, a round hole is sufficient for the connection of two 2,5 mm² conductors. *** The use of flexible conductors is permitted.		

The conductor space shall be at least that specified in figures 4, 5, 6, 7 and 8.

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

12.2.2 Terminals with screw clamping shall allow the conductor to be connected without special preparation.

Compliance is checked by inspection.

NOTE – The term "special preparation" covers soldering of the wires of the conductor, 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 flexible conductor to consolidate the end.

12.2.3 Terminals with screw clamping shall have adequate mechanical strength.

Screws and nuts for clamping the conductors shall have a metric ISO thread or a thread comparable in pitch and mechanical strength.

Screws shall not be of metal which is soft or liable to creep, such as zinc or aluminium.

Compliance is checked by inspection and by the tests of 12.2.6 and 12.2.8.

NOTE – Provisionally SI, BA, and UN threads are considered to be comparable in pitch and mechanical strength to metric ISO thread.

12.2.4 Terminals with screw clamping shall be resistant to corrosion.

Terminals, the body of which is made of materials as detailed in 22.5, are considered as complying with this requirement.

12.2.5 Screw-type terminals shall be so designed that they clamp the conductor(s) without undue damage to the conductor(s).

Compliance is checked by the following test:

The terminal is fitted with rigid (solid or stranded) conductor(s) according to table 2, firstly with conductors having the smallest cross-sectional area, secondly with conductors having the largest cross-sectional area, in the apparatus shown in figure 3; the clamping screws or nuts are tightened with a torque according to table 5.

The length of the test conductor shall be 7 mm longer than the height (H) specified in table 5A.

The end of one conductor shall be passed through an appropriate sized bushing in a platen positioned at a height (H) below the equipment as given in table 5A. The bushing is positioned in a horizontal plane such that the centre line describes a circle of 75 mm diameter, concentric with the centre of the clamping unit in the horizontal plane; the platen is then rotated at a rate of (10 ± 2) rev/min.

The distance between the mouth of the clamping unit and the upper surface of the bushing shall be within ± 15 mm of the height indicated in table 5A. The bushing shall be lubricated to prevent binding, twisting or rotation of the insulated conductor.

A mass, as specified in table 5A, is suspended from the end of the conductor. The duration of the test shall be 15 min.

During the test, the conductor shall neither slip out of the clamping unit nor break near the clamping unit, nor shall the conductor be damaged in such a way as to render it unfit for further use.

Table 5A

Conductor cross-section mm ²	Diameter of bushing hole ²⁾ mm	Height ¹⁾ H mm	Mass for conductor kg
0,5 0,75	6,5 6,5	260 260	0,3 0,4
1,0 1,5	6,5 6,5	260 260	0,4 0,4
2,5 4,0	9,5 9,5	280 280	0,7 0,9
6,0 10,0	9,5 9,5	280 280	1,4 2,0
16,0 25,0	13,0 13,0	300 300	2,9 4,5
35,0	14,5	320	6,8

¹⁾ Tolerance for height H ± 15 mm.

²⁾ If the bushing hole diameter is not large enough to accommodate the conductor without binding, a bushing having the next largest hole size may be used.

12.2.6 Terminals with screw clamping shall be so designed that they clamp the conductor reliably between metal surfaces.

Compliance is checked by inspection and by the following test:

The terminals are fitted with rigid stranded conductors of the smallest and largest cross-sectional area specified in table 2, the terminal screws being tightened with a torque equal to two-thirds of the torque shown in the appropriate column of table 5.

If the screw has a hexagonal head with a slot, the torque applied is equal to two-thirds of the torque shown in column 3 of table 5.

Each conductor is then subjected to a pull as specified in table 3, applied without jerks, for 1 min, in the direction of the axis of the conductor space.

Table 3

Cross-section of conductor accepted by terminal mm ²	0,5 up to 0,75 inclusive	From 0,75 up to 1,5 inclusive	From 1,5 up to 2,5 inclusive	From 2,5 up to 4 inclusive	From 4 up to 6 inclusive	From 6 up to 10 inclusive	From 10 up to 16 inclusive	From 16 up to 25 inclusive
Pull N	30	40	50	50	60	80	90	100

If the clamp is provided for two conductors, the appropriate pull is applied consecutively to each conductor.

During the test, the conductor shall not move noticeably in the terminal.

If the clamp is intended for connection of more than 2 conductors, reference is made for the testing to the requirements given in the appropriate part of IEC 998.

The test is repeated with rigid solid conductors if any, according to CENELEC HD 21.3, if the first test has been made with rigid stranded conductors. In the case where rigid stranded conductors do not exist, the test is made with rigid solid conductors only.

See Annex ZB for special national conditions.

12.2.7 Terminals with screw clamping shall be so designed or placed that neither a rigid solid conductor nor a wire of a stranded conductor can slip out while the clamping screws or nuts are tightened.

This requirement does not apply to lug terminals.

Compliance is checked by the following test:

The terminals are fitted with conductors having the largest cross-sectional area specified in table 2.

The terminals are checked both with solid conductors and with stranded conductors.

Terminals intended for the looping-in of two or three conductors are checked, being fitted with the permissible number of conductors.

The terminals are fitted with conductors having the composition shown in table 4.

Table 4

Cross-sectional area mm ²	Number of wires and nominal diameter of wires mm	
	Solid conductor	Stranded conductor
1	1 x 1,13	7 x 0,42
1,5	1 x 1,38	7 x 0,52
2,5	1 x 1,78	7 x 0,67
4	1 x 2,25	7 x 0,86
6	1 x 2,76	7 x 1,05
10	1 x 3,57	7 x 1,35
16	—	7 x 1,70
25	—	7 x 2,14

Before insertion into the clamping means of the terminal, wires of rigid (solid or stranded) conductors are straightened and rigid stranded conductors may be, in addition, twisted to restore them approximately to their original shape.

The conductor is inserted into the clamping means of the terminal for the minimum distance prescribed or, where no distance is prescribed, until it just projects from the far side of the terminal and in the position most likely to allow the wire to escape. The clamping screw is then tightened with a torque equal to two-thirds of the torque shown in the appropriate column of table 5.

After the test, no wire shall have escaped from the clamping unit.

12.2.8 Terminals with screw clamping shall be so fixed or located within the switch that, when the clamping screws or nuts are tightened or loosened, the terminals shall not work loose from their fixing to the switch.

NOTES

1 These requirements do not imply that the terminals is designed so that their rotation or displacement is prevented, but any movement is sufficiently limited so as to prevent non-compliance with this standard.

2 The use of sealing compound or resin is considered to be sufficient for preventing a terminal from working loose, provided that:

- the sealing compound or resin is not subject to stress during normal use, and
- the effectiveness of the sealing compound or resin is not impaired by temperatures attained by the terminal under the most unfavourable conditions specified in this standard.

Compliance is checked by inspection, by measurement and by the following test:

A solid rigid copper conductor of the largest cross-sectional area specified in table 2 is placed in the terminal.

Screws and nuts are tightened and loosened five times by means of a suitable test screw-driver or spanner, the torque applied when tightening being equal to the torque shown in the appropriate column of table 5 or in the table of the appropriate figure 4 to 7, whichever is the highest.

Table 5

Nominal diameter of thread mm	Torque Nm					
	1	2	3	4	5	6
Up to and including 2,8	0,2	—	0,4	—	0,4	—
Over 2,8 up to and including 3,0	0,25	—	0,5	—	0,5	—
Over 3,0 up to and including 3,2	0,3	—	0,6	—	0,6	—
Over 3,2 up to and including 3,6	0,4	—	0,8	—	0,8	—
Over 3,6 up to and including 4,1	0,7	1,2	1,2	1,2	1,2	—
Over 4,1 up to and including 4,7	0,8	1,2	1,8	1,8	1,8	—
Over 4,7 up to and including 5,3	0,8	1,4	2,0	2,0	2,0	—
Over 5,3 up to and including 6,0	—	1,8	2,5	3,0	3,0	—
Over 6	—	—	—	—	—	0,8
NOTE – The above values are provisional.						

The conductor is moved each time the screw or nut is loosened.

Column 1 applies to screws without heads if the screw when tightened does not protrude from the hole, and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

Column 2 applies to nuts of mantle terminals which are tightened by means of a screw-driver.

Column 3 applies to other screws which are tightened by means of a screwdriver.

Column 4 applies to nuts of mantle terminals in which the nut is tightened by means other than a screwdriver.

Column 5 applies to screws or nuts, other than nuts of mantle terminals, which are tightened by means other than a screwdriver.

Column 6 applies to nuts of switches with central hole fixing.

Where a screw has a hexagonal head with a slot for tightening with a screwdriver and the values of columns 3 and 5 are different, the test is made twice, first applying to the hexagonal head the torque specified in column 5 and then applying the torque specified in column 3 by means of a screwdriver. If the values of columns 3 and 5 are the same, only the test with the screwdriver is made.

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

NOTES

- 1 For mantle terminals the specified nominal diameter is that of the slotted stud.
- 2 The shape of the blade of the test screwdriver should suit the head of the screw to be tested.
- 3 The screws and nuts should not be tightened in jerks.

12.2.9 Clamping screws or nuts of earthing terminals with screw clamping shall be adequately locked against accidental loosening and it shall not be possible to loosen them without the aid of a tool.

Compliance is checked by manual test.

In general, the designs of terminals shown in figures 4, 5, 6, 7 and 8 provide sufficient resiliency to comply with this requirement; for other designs, special provisions, such as the use of an adequately resilient part which is not likely to be removed inadvertently, may be necessary.

12.2.10 Earthing terminals with screw clamping shall be such that there is no risk of corrosion resulting from contact between these parts and the copper of the earthing conductor, or any other metal that is in contact with these parts.

The body of the earthing terminals shall be of brass or other metal no less resistant to corrosion, unless it is a part of the metal frame or enclosure, when the screw or nut shall be of brass or other metal no less resistant to corrosion.

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

Compliance is checked by inspection.

NOTE – Screws or nuts of plated steel withstanding the corrosion test are considered to be of a metal no less resistant to corrosion than brass.

12.2.11 For pillar terminals, the distance between the clamping screw and the end of the conductor, when fully inserted, shall be at least that specified in figure 4.

NOTE – The minimum distance between the clamping screw and the end of the conductor applies only to pillar terminals in which the conductor cannot pass right through.

For mantle terminals, the distance between the fixed part and the end of the conductor, when fully inserted, shall be at least that specified in figure 8.

Compliance is checked by measurement, after a solid conductor of the largest cross-sectional area specified, for the appropriate rated current in table 2, has been fully inserted and fully clamped.

12.2.12 Lug terminals shall be used only for switches having a rated current of 40 A and 63 A; if such terminals are provided, they shall be fitted with spring washers or equally effective locking means.

Compliance is checked by inspection

12.3 Screwless terminals for external copper conductors

12.3.1 Screwless terminals may be of the type suitable for rigid copper conductors only or of the type suitable for both rigid and flexible copper conductors.

For the latter type, the tests are carried out with rigid conductors first and then repeated with flexible conductors.

NOTE 1 – This subclause is not applicable to switches provided with:

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

NOTE 2 – The tests of 12.3.12 are only carried out by using rigid solid conductors.

12.3.2 Screwless terminals shall be provided with clamping units which allow the proper connection of rigid or of rigid and flexible copper conductors having nominal cross-sectional areas as shown in table 6.

Table 6

Rated A	Conductors		
	Nominal cross-sectional areas mm ²	Diameter of largest rigid conductor mm	Diameter of largest flexible conductor mm
Up to and including 4	0,75-1	1,19	—
Above 4 and including 6	1-1,5	1,45	1,73
Above 6 and including 16*	1,5-2,5	2,13	2,21

* Each supply terminal of switches other than those of pattern numbers 3, 03, and 7, shall allow the connection of two 2,5 mm² conductors. In such case a terminal for rated current 10 A with separate independent clamping means for each conductor shall be used.

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

12.3.3 Screwless terminals shall allow the conductor to be connected without special preparation.

Compliance is checked by inspection.

NOTE - The term "special preparation" covers soldering of the wires of the conductor, use of terminal ends, etc., but not the reshaping of the conductor before introduction into the terminal or the twisting of a flexible conductor to consolidate the end.

12.3.4 Parts of screwless terminals mainly intended for carrying current shall be of materials as specified in 22.5.

Compliance is checked by inspection and by chemical analysis.

NOTE – Springs, resilient units, clamping plates and the like are not considered as parts mainly intended for carrying current.

12.3.5 Screwless terminals shall be so designed that they clamp the specified conductors with sufficient contact pressure and without undue damage to the conductor.

The conductor shall be clamped between metal surfaces.

Compliance is checked by inspection and by the test of 12.3.10.

12.3.6 It shall be clear how the connection and disconnection of the conductors is to be made.

The disconnection of a conductor shall require an operation, other than a pull on the conductor, so that it can be made manually with or without the help of a general purpose tool.

It shall not be possible to confuse the opening for the use of a tool to assist the connection or disconnection with the opening intended for the insertion of the conductor.

Compliance is checked by inspection and, by the test of 12.3.10.

12.3.7 Screwless terminals which are intended to be used for the interconnection of two or more conductors shall be so designed that:

- during the insertion the operation of the clamping means of one of the conductors is independent of the operation of that of the other conductor(s);
- during the disconnecting, the conductors can be disconnected either at the same time or separately;
- each conductor is introduced in a separate clamping unit (not necessarily in separate holes).

It shall be possible to clamp securely any number of conductors up to the maximum as designed.

Compliance is checked by inspection and by the tests with the appropriate conductors.

12.3.8 Screwless terminals shall be so designed that over-insertion of the conductor is prevented and adequate insertion is obvious.

NOTE – For the purpose of this requirement, an appropriate marking indicating the length of insulation to be removed before the insertion of the conductor into the screwless terminal may be put on the switch or given in an instruction sheet which accompanies the switch.

Compliance is checked by inspection and by the tests of 12.3.10.

12.3.9 Screwless terminals shall be properly fixed to the switch.

They shall not work loose when the conductors are connected or disconnected during installation.

Compliance is checked by inspection and by the tests of 12.3.10.

Covering with sealing compound without other means of locking is not sufficient. Self-hardening resins may, however, be used to fix terminals which are not subject to mechanical stress in normal use.

12.3.10 Screwless terminals shall withstand the mechanical stresses occurring in normal use.

Compliance is checked by the following tests, which are carried out with uninsulated conductors on one screwless terminal of each specimen, using a new specimen for each test.

The test is carried out with solid copper conductors, first with conductors having the largest cross-sectional area, and then with conductors having the smallest cross-sectional area specified in 12.3.2.

Conductors are connected and disconnected five times, new conductors being used each time, except for the fifth time, when the conductors used for the fourth connection are clamped at the same place. For each connection the conductors are either pushed as far as possible into the terminal or are inserted so that adequate connection is obvious.

After each connection, the conductor is subjected to a pull of 30 N; the pull is applied without jerks, for 1 min, in the direction of the longitudinal axis of the conductor space.

During the application of the pull, the conductor shall not come out of the screwless terminal.

The test is then repeated with rigid stranded copper conductors having the largest and smallest cross-sectional areas specified in 12.3.2; these conductors are, however, connected and disconnected only once.

Screwless terminals intended for both rigid and flexible conductors, shall also be tested with flexible conductors, applying five connections and disconnections.

During the test the conductors shall not move noticeably in the clamping unit.