

BRITISH STANDARD

**BS 3676-1:
1989**

*Incorporating
Amendments Nos. 1
and 2 and
Corrigendum No. 1*

Switches for household and similar fixed electrical installations

Part 1: Specification for general requirements

ICS 29.120.40

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ASTA Certification Services
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 Association of Control Manufacturers — TACMA (BEAMA Ltd.)
 Association of Manufacturers of Domestic Electrical Appliances
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The following body was also represented in the drafting of the standard, through subcommittees and panels:

Electronic Components Industry Federation

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Foreword

This Part of BS 3676:1989, including Amendments Nos. 1 and 2, has been prepared by Technical Committee PEL/23 (formerly PEL/4). It is based on IEC Publication 669-1 published by the International Electrotechnical Commission (IEC) and takes into account proposals for modifying that standard that have been discussed in the European Committee for Electrotechnical Standardization (CENELEC).

This Part of BS 3676:1989 supersedes BS 3676:1963 which is withdrawn.

Amendment No. 2 has been prepared to cover a situation brought about by the publication of BS EN 60669-1 (which supersedes BS 3676-1:1989) and the need to keep BS 3676-1:1989 up to date until such time as it is withdrawn. The foreword of the European Standard EN 60669-1 makes reference to the “date of withdrawal” of the relevant national standard. In this case the relevant national standard is BS 3676-1:1989, which will be withdrawn on 2005-10-15.

Corrigendum No. 1 has been issued to delete text in clause 16 and in 18.1.

To facilitate future CENELEC harmonization, the format of the IEC Standard has been closely followed. Certain tables and figures are not appropriate for the British Standard, and have been omitted, but the numbering sequence of the IEC Standard has been maintained as far as possible. The numbering system is therefore not fully consistent with BSI style.

This part of BS 3676:1989 calls for the use of substances and procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

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 to iv, pages 1 to 46, an inside back cover and a back cover.

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Sideline in this document indicates the most recent changes by amendment

1 Scope

This part of this British Standard specifies requirements and tests for manually operated general purpose switches with a rated voltage not exceeding 440 V a.c. or d.c. and a rated current not exceeding 63 A a.c. or d.c., intended for household and similar fixed electrical installations, either indoors or outdoors. The rated current is limited to 10 A a.c. or d.c. for switches provided with screwless terminals.

The requirements specified in this part of BS 3676 have particular reference to safety in normal use.

This standard also applies to switches such as:

- a) switches supplied with boxes;
- b) switches intended for mounting in boxes to BS 4662;
- c) switches intended for mounting in boxes other than BS 4662;
- d) switches incorporating pilot lights;
- e) electromagnetic remote control switches;
- f) switches incorporating a time delay device;
- g) electronic switches.

Particular requirements for electronic switches, electromagnetic remote-control switches and time-delay switches will be given in Part 2 of this standard at a later date. With regard to electronic switches, attention is drawn to BS 5518 which will remain the appropriate standard for such switches until the publication of a section of Part 2 of this standard covering electronic switches.

Switches complying with BS 3676-1 are suitable for use in air temperatures from $-5\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$ with an average value over a period of 24 h not exceeding $+25\text{ }^{\circ}\text{C}$. Switches complying with BS 3676-1 are suitable for use where the altitude of the site of installation does not exceed 2 000 m.

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

This part of BS 3676 does not apply to circuit-breakers for household and similar installations, to switches for appliances and to (in-line) cord switches.

2 Definitions

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

For the purposes of this part of BS 3676 the following definitions apply.

2.1

switch

a device designed to make or break the current in one or more electric circuits

2.2

isolating switch

a switch designed to make and break the current in all current carrying poles of an electric circuit to provide the safe isolation of equipment from the supply

2.3

functional switch

a switch not intended for safety isolating purposes

2.4

operation or movement

the transfer of the moving contacts from one position of rest to another

2.5

terminal

a conductive part of a device, provided for re-usable electrical connection to external circuits

2.6

clamping unit

the part(s) of a terminal necessary for the mechanical clamping and the electrical connection of the conductor(s)

2.7

terminal with screw clamping

a terminal intended for the connection, by clamping only, of external rigid or flexible conductors

2.8

pillar terminal

a terminal with screw clamping in which the conductor is inserted into a 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 3.

2.9

screw terminal

a terminal with screw clamping 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

NOTE Examples of screw terminals are shown in Figure 4.

2.10

stud terminal

a 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, a clamping plate or an anti-spread device

NOTE Examples of stud terminals are shown in Figure 4.

**2.11
saddle terminal**

a 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 5.

**2.12
lug terminal**

a screw terminal or a 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 6.

**2.13
mantle terminal**

a 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 7.

**2.14
screwless terminal**

a 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 disconnected, 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

**2.15
mechanical time-delay device**

a device which, through a mechanical auxiliary, operates some time after the instant at which the conditions which cause it to operate are established

**2.16
base**

a part of the switch retaining current-carrying parts and, in general, the mechanism, in position

**2.17
rated voltage**

the voltage assigned to the switch by the maker

**2.18
rated current**

the current assigned to the switch by the maker

**2.19
type test**

a test of one or more switches to show that all switches made to the same specification and having the same essential details would pass an identical test

**2.20
actuating member**

that part which is moved, pulled, pushed or turned to operate the switch mechanism

**2.21
pole**

a conducting path in a switch equipped with a set of contacts for making, breaking and carrying the current through the switch

**2.22
surface switch**

a switch provided with a seating surface so that when mounted, it projects wholly above the surface on which it is mounted

**2.23
flush switch**

a switch for mounting behind or incorporated with a switch plate, the back of the plate being flush with the surface of the wall or box

**2.24
semi flush switch**

a switch for mounting with its base partially sunk into the surface of a wall or box

**2.25
panel switch**

a switch for mounting to a panel or box having an aperture through which the intended accessible surface of the switch protrudes

**2.26
architrave switch**

a switch having a cover plate of such proportions that it may be accommodated within a narrow box

**2.27
pull cord switch**

a switch intended for mounting on a suitable overhead surface and operated by means of a cord or the like

**2.28
pull cord**

the cord by which the pull cord switch is manually operated

2.29 operating member

that part of a pull cord switch which connects the internal mechanism with the pull cord. It is usually attached to the actuating member of the switch

2.30 live parts

current carrying parts and those metal parts in contact with them during normal use

NOTE Metal parts of the earthing circuit are not considered to be current carrying parts

2.31 flexible cord or cable outlet switch

a switch having provision for an outlet for a flexible cord or cable

NOTE Flexible cables below and including nominal conductor cross-sectional areas of 4 mm² are referred to as flexible cords.

2.32 polarity

the voltage difference between terminals intended for the connection of live and neutral conductors in switches of pattern numbers 2, 0.3, 6/2

2.33 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, and which has stored energy return, e.g. a spring

3 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 surroundings. Such switches and boxes shall be capable of meeting all the relevant requirements and tests specified in this part of BS 3676. Where tolerances are not specified in this standard the values are to be regarded as nominal.

4 Requirements for type testing

4.1 Tests according to this part of BS 3676 are type tests.

A manufacturer or responsible vendor who claims compliance with BS 3676-1, for any product, shall submit representative type test samples of that product to the relevant tests of this standard in the order specified below. The results of such tests shall be recorded and retained for reference and inspection.

4.2 Unless otherwise specified, the samples shall be tested as delivered and under normal conditions of use.

Switches shall be tested together with their appropriate boxes.

4.3 Unless otherwise specified, the tests shall be carried out in the order of the clauses, at an ambient temperature of 20 ± 5 °C.

4.4 For switches which are marked with one rated voltage and one rated current, one set of 15 samples is required.

For switches marked with two rated voltages and two corresponding rated currents, two sets of 15 samples are required, one set for each current rating.

For switches marked with two rated voltages and one rated current, the test shall be carried out at the higher voltage and one set of 15 samples is required.

For switches marked with ratings which are different for a.c. and d.c., one set of 15 samples is required for a.c. testing, plus three additional samples for d.c. testing.

Each set of 15 samples shall be tested in accordance with the test schedule in Table W.

For switches marked with the letter X, three additional samples shall be tested in accordance with sequence f) of the test schedule.

For switches other than ordinary, three additional samples shall be tested in accordance with sequence g) of the test schedule.

For switches having membranes in inlet openings, three additional samples shall be tested in accordance with sequence h) and three additional samples shall be tested in accordance with sequence i) of the test schedule.

Push button switches intended to operate bells, electromagnetic remote control switches or time-delay switches are not submitted to the tests of clause 17 and 18.2.

For the tests of 11.3.11, additional samples of switches having in total at least five screwless terminals are required.

4.5 If no sample fails in the complete series of tests given in 4.4, switches of that type shall be deemed to comply with this standard.

Alternatively, if one sample fails in any group in the complete series of tests specified in 4.4, then switches of that type shall be deemed to have failed to comply with this standard, unless that switch can be shown to be not representative of normal production or design, in which case a further set of samples shall be submitted to the test or tests in that group. If there is no failure in this re-test then switches of that type shall be deemed to comply with this standard.

If more than one sample fails in the complete series of tests given in 4.4 the switches of that type shall be deemed to have failed to comply with this standard.

5 Ratings

5.1 Switches shall preferably have rated voltages of 130 V, 250 V and 440 V (for a.c. and/or d.c.) and 250 V, 277 V, 380 V and 415 V (for a.c. only).

For push-button switches intended to operate bells, electromagnetic remote control switches or time-delay switches, the standard rated voltages are 130 V and 250 V.

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

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

The rated current shall be not less than 6 A, except that rated currents of 1 A, 2 A and 4 A are allowed for push-button switches intended to operate bells, electromagnetic remote control switches or time-delay switches.

For fluorescent lamp circuits, unless otherwise specified, the maximum current is:

- a) 0.25 times rated current of the switch, when capacitors are connected in parallel;
- b) 0.5 times rated current of the switch, when the capacitors are connected in series.

The derating for fluorescent lamp circuits is not necessary if the switches pass the tests described in 18.2 of this standard and are marked accordingly.

Compliance with the requirements of 5.1 and 5.2 is checked by inspection of the marking and by the tests of this standard.

6 Classification

6.1 Switches are classified under the headings of 6.1.1 to 6.1.9.

6.1.1 Classification according to the nature of the supply:

- a) switches for a.c. only;
- b) switches for d.c. only;
- c) switches for both a.c. and d.c.

6.1.2 Classification according to the possible connections (see Figure 1):

- a) single-pole switches (Pattern No. 1);
- b) double-pole switches (Pattern No. 2);
- c) three-pole switches (Pattern No. 3);
- d) three-pole plus switched neutral switches (Pattern No. 03);
- e) two-way switches (Pattern No. 6);

- f) two-circuit switches with a common incoming line (Pattern No. 5);
- g) two-way switches with one "off" position (Pattern No. 4);
- h) two-way double-pole switches (Pattern No. 6/2);
- i) two-way double-pole reversing switches or intermediate switches (Pattern No. 7).

NOTE Two or more switches having the same or different pattern numbers may be mounted on a common base.

6.1.3 Classification according to the application:

- a) isolating switches;
- b) functional switches.

6.1.4 Classification according to the degree of protection against electric shock:

- a) unenclosed switches;
- b) enclosed switches (degree of protection IP2X).

NOTE 1 The degrees of protection are based on BS 5490.

NOTE 2 For unenclosed switches, the protection against electric shock is given by the box 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 9.

6.1.5 Classification according to the degree of protection against harmful ingress of water:

- a) ordinary switches having no special protection against harmful ingress of water;
- b) splash-proof switches with degree of protection IPX4;
- c) jet-proof switches with degree of protection IPX5.

NOTE For the purposes of this part of BS 3676 the term "ordinary" applies only to the degree of protection against harmful ingress of water.

6.1.6 Classification according to the method of actuating the switch:

- a) rotary switches;
- b) tumbler switches;
- c) rocker switches;
- d) push-button switches;
- e) pull cord switches.

6.1.7 Classification according to the method of installation:

- a) surface-type switches;
- b) flush-type switches;
- c) semi flush-type switches;
- d) panel-type switches;
- e) architrave-type switches;
- f) flexible cord or cable outlet switches.

Table W — Test schedule

Sequence	Samples	Switch type	Clause no
a)	3	All (switches with screw type terminals)	4, 5, 6, 7, 8, 9, 10, 14.1, 11.2, 12
	3	All (switches with screwless terminals)	4, 5, 6, 7, 8, 9, 10, 11.3.11, 14.1, 11.3 (excluding 11.3.11), 12
See notes 1 and 2			
b)	3	All	4, 13, 14, (excluding 14.2 and 14.4), 15, 16, 17 and 18.1
See note 3			
c)	3		4, 19, 20, 21
d)	3		4, 22, 23.3, 24
e)	3		4, 23.2
f)	3	For switches marked with the letter "X" following the rated current	4, 14 (excluding 14.2 and 14.4), 15, 16, 18.2
g)	3	For switches other than ordinary	4, 14.2
h)	3	For switches having membranes in inlet openings	4, 14.1, 14.4.1
i)	3		4, 14.4.2

NOTE 1 The order of tests given in sequence a) above is preferred but not mandatory except where required within the text of the appropriate clause.

NOTE 2 For the tests of 11.3.11, additional samples of switches having in total at least five screwless terminals are required.

NOTE 3 Switches suitable for ac/dc operation are tested in accordance with 17.1 and 17.2, separate samples being used for each test.

6.1.8 Classification according to the method of installation, as a consequence of the design:

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

NOTE If a switch has a base 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. It is considered to be of design A, provided the supplementary plate meets the requirements specified for covers and cover plates.

6.1.9 Classification according to type of terminal:

- a) switches with screw-type terminals;
- b) switches with screwless terminals for rigid conductors only;
- c) switches with screwless terminals for rigid and flexible conductors.

6.2 Preferred combinations of number of poles and ratings are shown in Table 1.

Table 1 — Preferred combinations of number of poles and ratings

Rated current	Number of poles		
	Rated voltages from 120 V up to 250 V inclusive	Rated voltage over 250 V a.c. only	Rated voltages over 250 V d.c. only
A			
1, 2 and 4	1	—	—
6	1 2	1 2	— —
10	1 2 — —	1 2 3 4	— 2 — —
16, 20, 25, 32, 45 and 63	1 2 3 4	1 2 3 4	— 2 — —

7 Markings

7.1 Switches shall be marked with the following.

- The number of this British Standard, i.e. BS 3676¹⁾
- Rated current is amperes, followed by the letter "X" where the fully rated fluorescent load test is met (see 18.2)
- Rated voltage(s) in volts.
- Nature of supply, if the switch is not intended for both a.c. and d.c. or if the rating is different for a.c. and d.c.
- Maker's or responsible vendor's name or trade mark or identification mark.
- Symbol for isolating switch, if applicable.
- Symbol for degree of protection against ingress of solid foreign bodies, if higher than IP2X.
- Symbol for degree of protection against harmful ingress water, if applicable, in which case the symbol for degree of protection against ingress of solid foreign bodies shall be marked, even if not higher than IP2X.
- Where cord anchorages are intended to clamp effectively cords and/or cables other than those cross-sectional areas appropriate to the rating of the switch as given in Table 2, then the minimum and maximum sizes for which anchorage is provided shall be indicated.

It may be marked in an area adjacent to the anchorage, e.g. "6 mm – 16 mm" or "6 – 16". The information shall be put on the switch and/or the packaging unit.

- 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.

NOTE 1 Ordinary switches are not marked with any symbol for protection against harmful ingress of water.

NOTE 2 Marking of the pattern number given in 6.1.2 is recommended if the connections are not clear from an inspection of the switch.

NOTE 3 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".

7.2 When symbols are used, they shall be as follows.

Amperes	A or AX (see 7.1)
Volts	V
Alternating current	

Direct current	
Line (phase)	L
Neutral	N
Earth	or

NOTE 1 It is recommended that, where practicable, the symbol should be used.

"Off" position	O
"On" position	I
Isolating switch construction and/or "off" position of an isolating switch	
Splash-proof construction	IPX4
Jet-proof construction	IPX5

^a The letter "X" should be replaced by the relevant number.

For the marking with rated current and rated voltage, figures may be used alone. The figure for the d.c. current rating, if any, shall then be placed before the figure for the a.c. current rating, and separated from it by an oblique line or dash, these figures being placed before or above that for the rated voltage and separated from the latter by a line.

If the current rating figures are separated by an oblique line, a second oblique line shall not be used to separate the current rating figures from the voltage rating figures.

If a symbol for nature of supply is used, it shall be placed next to the marking for rated current and rated voltage.

NOTE 2 The marking for current, voltage and nature of supply may be, for instance, as follows:

10 A 250 V	or	10/250	or	$\frac{10}{250}$
10AX 250V ~	or	10X/250 ~	or	$\frac{10X}{250} \sim$
10/16A 250V	or	10-16/250	or	$\frac{10-16}{250}$
10 A 250/380 V ~	or	$\frac{10}{250/380} \sim$		
25 A 380 V ~	or	25/380 ~	or	$\frac{25}{380} \sim$

7.3 The marking for rated current, rated voltage, nature of supply, maker's or responsible vendor's name, trade mark or identification mark, shall be on the main part of the switch.

¹⁾ Marking BS 3676 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

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

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

NOTE 1 Type references may be marked on the main part, or on the outside or the inside of the associated box.

NOTE 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.

7.4 Terminals intended for the connection of phase conductors shall be identified unless the method of connection is of no importance or is self-evident. Such identification may take the form of a letter L or, in the case of more than one such terminal, the letters L1, L2, L3 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 parts.

NOTE "Easily removable parts" are those parts which can be removed during the normal installation of the switch.

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

Earthing terminals shall be indicated by the symbols shown in 7.2. These markings shall not be placed on screws, or any other easily removable part.

Lines formed incidentally by the construction of the production tools are not considered as part of the marking.

Compliance with the requirements of 7.1 to 7.5 is checked by inspection.

7.6 Switches which are marked so that the "off" or "on" positions are indicated, shall have those indications clearly visible from the front of the switch when fitted with its cover or cover plate.

If these indications are placed on the cover or cover plates, it shall not be possible to fix the cover or cover plates in a position such that the indications are incorrect.

Where the symbol for "on" is used it shall be radial for rotary switches, perpendicular to axis of rotation of the dolly for tumbler switches and rocker switches and vertical for push-button switches when mounted vertically.

For switches having more than one actuating member the requirement shall apply to each actuating member individually.

Where indications of "on" and "off" positions are given it shall not be possible for the switch to indicate "off" with the actuating member at a position of rest if the contacts are still closed.

Switches for isolating purposes shall be of Pattern Numbers 2, 3, 03 and shall be marked such that the position of the switch contacts in the "off" or open position is clearly indicated by the position of the actuating member and/or marking.

NOTE The isolating switch symbol shown in 7.2 may be used in place of the word "off" or the symbol for "off".

Compliance with 7.6 is checked by inspection, manual operation and continuity test.

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

7.8 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.

Compliance with the requirements of 7.7 and 7.8 is checked by inspection.

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

In order to ensure that, after installation, the conditions necessary to meet the requirements of this standard are achieved, the instruction sheet should include clear information with regard to the following:

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

7.9 Marking shall be durable and easily legible and shall not be placed on screws, washers or other easily removable parts.

Compliance for legibility shall be by inspection, using normal or corrected vision without additional magnification.

Compliance for durability shall be checked by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in petroleum spirit.

After testing the marking shall be easily legible; it shall not be possible to remove easily any marking plates and they shall show no curling.

The petroleum spirit used shall consist of a solvent hexane having a maximum aromatics content of 0.1 % by volume, a Kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C, and a density at 15/15 °C of approximately 0.68 g/cm³.

NOTE The density may be determined by the method specified in BS 4714.

Marking made by engraving, moulding or a similar permanent process is deemed to comply with the requirement for durability without testing.

8 Dimensions

For flush mounted switches intended to be used in boxes complying with BS 4662, the minimum overall sizes of the cover plates, either of insulating material or metal or a combination of both, shall be greater than the associated boxes so as to afford the protection required by clause 9.

The size and disposition of the fixing screw holes shall be such as to allow satisfactory attachment to boxes having a tolerance of ± 0.8 mm on the centres of the 3.5 mm dia. fixing screws.

Compliance is checked by inspection and measurement.

9 Accessibility of live parts

9.1 Switches shall be so designed that when they are mounted and correctly 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 sample is mounted as in normal use removing those parts which may be removed without the use of a tool and fitted with conductors of the smallest cross-sectional area specified in clause 11; the test is repeated using conductors of the largest cross-sectional area specified in clause 11. For flexible cord and cable outlet switches the test is carried out without the flexible cord or cable fitted.

Test finger I of BS 3042 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 subject to the following additional test, which is carried out at an ambient temperature of 35 ± 2 °C, the switches being at this temperature.

During this 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 test finger I of BS 3042.

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. It is not applied to membranes but is applied to thin walled knock-outs with a force of 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. Membranes are tested only according to 14.4.1.

9.2 Knobs, operating members, push-buttons, rockers and the like shall be of insulating material, unless their accessible metal parts are separated from the live 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 15 and 22.

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

9.3 Accessible parts shall be 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 or cover plates;
- b) actuating members, complying with 9.2;
- c) covers, cover plates and other parts of the enclosure of metal which comply with the relevant requirements of 9.3.1.

9.3.1 Covers, cover plates and other parts of the enclosure of metal shall be either:

- a) protected by supplementary insulation, made by insulating linings or insulating barriers fixed to the covers, cover plates, or other parts of the enclosure, or to the body of the accessories, in such a way that the insulating linings or insulating barriers cannot be removed without being permanently damaged; or
- b) so designed that they cannot be replaced in an incorrect position and that, if they are omitted, the accessories are rendered inoperable or manifestly incomplete; or

c) so designed that there is no risk of accidental connection between live parts and covers, cover plates or other parts of the enclosure, for example through their fixing screws, even if a conductor should come away from its terminal; or

d) arranged such that covers or cover plates are automatically connected to earth via other parts of the accessory. Fixing screws or other means are allowed for such automatic connection.

Compliance shall be checked by inspection and:

- 1) for the linings and barriers, by the tests of clauses 15 and 22;
- 2) for the effectiveness of connection to earth by the test of 10.4.

NOTE Insulating coating sprayed on the inside or on the outside of the metal covers or cover plates is not deemed to be an insulating lining or barrier for the purpose of this sub-clause.

9.4 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 box.

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 after the test of clause 23.

9.5 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 flushtype 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 22, or, as an alternative, if they are reliably connected to earth.

Compliance is checked by inspection and, if necessary, by measurement and by the tests of clauses 9 and 15.

NOTE 1 When checking the inaccessibility of metal parts of the mechanism of unenclosed switches or of architrave-type switches, the protection provided by the normal way of mounting of the switch is taken into account.

NOTE 2 For unenclosed stack-type switches having a metal spindle pivoting in a metal base plate, the additional requirement necessitates the creepage distances and clearances between live parts and the spindle, and between metal parts of the mechanism and the base plate, being at least twice the values specified in clause 22.

9.6 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 22.

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

NOTE Lacquer or enamel is not considered to be insulating material for the purposes of 9.1 to 9.6.

9.7 Pull cord switches shall be so designed that the pull cord is insulated from current-carrying parts, and so that it is impossible to touch live metal when replacing a pull cord in the normal way. The pull cord shall itself be of suitable flexible insulating material, and not less than 1 500 mm long.

Compliance is checked by inspection.

10 Provision for earthing

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

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 may become live in the event of an insulation fault.

This requirement does not apply to the metal cover plates mentioned in 9.3.1 and knobs etc., referred to in 9.2.

10.2 Where provided, earthing terminals shall be terminals with screw clamping and shall comply with the appropriate requirements of clause 11. They shall have a capacity not less than that of the corresponding terminals for the supply conductors.

10.3 Switches having more than one cable inlet, other than ordinary switches with a box of insulating material, 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 10.1 to 10.3 is checked by inspection and by the tests of clause 11.

10.4 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.

Table 2 — Conductors to be accommodated by terminals with screw clamping

Ranges of rated currents	Rigid conductors (solid or stranded) nominal cross-sectional area	Flexible conductors cords or cables nominal cross-sectional area
A	mm ²	mm ²
Up to and including 10 ^a	From 1 to 1.5 inclusive	From 1 to 1.5 inclusive
Above 10 up to and including 16 ^a	From 1 to 2.5 inclusive	From 1 to 1.5 inclusive
Above 16 up to and including 25	From 1.5 to 4.0 inclusive	From 1.5 to 2.5 inclusive
Above 25 up to and including 32	From 4.0 to 6.0 inclusive	From 2.5 to 4.0 inclusive
Above 32 up to and including 45	From 6.0 to 10.0 inclusive	From 4.0 to 6.0 inclusive
Above 45 up to and including 63	From 10.0 to 16.0 inclusive	From 6.0 to 10.0 inclusive

^a Each supply terminal of switches, other than those of pattern numbers 3, 03 and 7, shall allow the connection of two designated largest conductors.

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 is 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.

11 Terminals

11.1 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.

Compliance is checked by inspection and by the tests of 11.2 or 11.3 as applicable.

All the tests on terminals, with the exception of the test of 11.3.11, shall be carried out after the test of clause 14.

11.2 Terminals with screw clamping for external copper conductors

11.2.1 Switches shall be provided with terminals which shall allow the proper connection of copper conductors having nominal cross-sectional areas as shown in Table 2 except that for special purposes, such as extra low voltage applications with current ratings not exceeding 4 A, provision shall be made for flexible conductors from 0.5 mm² up to 1.0 mm² inclusive.

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

11.2.2 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.

11.2.3 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 11.2.6 and 11.2.8.

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

11.2.4 Terminals with screw clamping shall be resistant to corrosion.

Terminals as specified in 21.5 are considered as complying with this requirement.

11.2.5 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 a rigid (solid or stranded) conductor(s), according to Table 2: first with the smallest and then with the largest cross-sectional area, the clamping screws or nuts being tightened with the torque according to Table 5.

Each conductor in turn is subjected separately to two circular motions as shown in Figure 2a) using the appropriate *H* value.

The conductor is moved in one direction at a constant speed of 1 turn per 5 s.

During the circular motion, the conductor is subjected to a pull having a value shown in Table 3.

The terminal shall not be subjected to additional torsion and pull forces.

During the test, the solid conductor or any strand of a stranded conductor shall not come out of or break at the terminal.

Table 3 — Pull for terminal clamping test

Conductor size (in mm ²)	1	1.5	2.5	4	6	10	16
Pull (in N)	30	40	50	50	60	80	90

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

Compliance is checked by inspection and by the following test.

The terminals are fitted with rigid (solid or stranded) conductors of the smallest and largest cross-sectional areas 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.

If the clamp is provided for two or three conductors, the appropriate pull is applied consecutively to each conductor. During the test, the conductor shall not move noticeably in the terminal.

11.2.7 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.

Terminals are fitted with conductors having the composition shown in Table 4.

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.

Table 4 — Wires used for terminal clamping test

Cross-sectional area mm ²	Number of wires and nominal diameter of wires (in mm)	
	Solid conductor	Stranded conductor
1	1 × 1.13	7 × 0.42
1.5	1 × 1.38	7 × 0.52
2.5	1 × 1.78	7 × 0.67
4	1 × 2.25	7 × 0.86
6	1 × 2.76	7 × 1.05
10	1 × 3.57	7 × 1.35
16	—	7 × 1.70

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 retaining device.

11.2.8 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 fixings to switches.

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

NOTE 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 screwdriver 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, whichever is the higher. A new conductor end is used each time the screw or nut is loosened.