

BRITISH STANDARD 4343 : 1968

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METRIC UNITS

SPECIFICATION FOR INDUSTRIAL PLUGS, SOCKET-OUTLETS AND COUPLERS FOR A.C. AND D.C. SUPPLIES

**SPECIFICATION FOR
INDUSTRIAL PLUGS,
SOCKET-OUTLETS AND COUPLERS
FOR A.C. AND D.C. SUPPLIES**

BS 4343 : 1968

Incorporating amendment issued April 1980 (AMD 3369)

BRITISH STANDARDS INSTITUTION

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THIS BRITISH STANDARD, having been approved by the Electrical Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 30 September, 1968.

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

*As amended
April, 1980*

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 7. Rubber-insulated cables and flexible cords for electric power and lighting (for working voltages up to and including 11 kV).
- BS 2004. PVC-insulated cables and flexible cords for electric power and lighting.
- BS 3258. Silicone-rubber-insulated cables and flexible cords.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BSI references relate to the work on this standard:
Committee references ELE/4 and ELE/4/11
Draft for comment D64/1152

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CO-OPERATING ORGANIZATIONS

The Electrical Industry Standards Committee under whose supervision this British Standard was prepared consists of representatives from the following Government departments and scientific and industrial organizations:

- Associated Offices' Technical Committee
- * Association of Consulting Engineers
- Association of Mining Electrical and Mechanical Engineers
- * Association of Supervising Electrical Engineers
- * British Electrical and Allied Manufacturers' Association
- British Radio Equipment Manufacturers' Association
- British Railways Board
- Crown Agents for Oversea Governments and Administrations
- * Electric Cable Makers' Confederation
- Electric Lamp Industry Council
- * Electric Light Fittings Association
- * Electrical Contractors' Association (Incorporated)
- * Electrical Research Association
- * Electricity Council, the Central Electricity Generating Board
and the Area Boards in England and Wales
- Electronic Engineering Association
- * Engineering Equipment Users' Association
- * Institution of Electrical Engineers
- Ministry of Technology
- Ministry of Defence
- Ministry of Defence, Army Department
- Ministry of Defence, Navy Department
- * Ministry of Labour (H.M. Factory Inspectorate)
- * Ministry of Power
- * Ministry of Public Building and Works
- Municipal Passenger Transport Association Incorporated
- National Inspection Council for Electrical Installation Contracting
- * National Physical Laboratory (Ministry of Technology)
- Oil Companies Materials Association
- * Post Office
- Public Transport Association (Incorporated)
- South of Scotland Electricity Board

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Electrical Association for Women
- Electrical Power Engineers Association
- Fire Offices Committee
- Home Office
- Ministry of Public Building and Works—Building Research
Station
- National Federation of Building Trades Employers
- Women's Advisory Committee of the BSI.

BRITISH STANDARD SPECIFICATION FOR INDUSTRIAL PLUGS, SOCKET-OUTLETS AND COUPLERS FOR A.C. AND D.C. SUPPLIES

FOREWORD

For some years it has been recognized that a British Standard was required for three-phase plugs and socket-outlets for use in industry, but since the United Kingdom was actively participating in the preparation of an international standard for these accessories by the International Commission on Rules for the Approval of Electrical Equipment (CEE), it was decided to wait until this work was completed.

Accessories conforming to this British Standard, except for the pilot fittings of 16 ampere and 32 ampere ratings will also conform to the second edition of CEE Publication No. 17 (now in course of printing) and will be interchangeable with accessories made to the CEE specification. A summary of the differences between this standard and the CEE publication is given in Appendix D.

This British Standard specifies detailed requirements and tests for plugs, socket-outlets and couplers for industrial use, with or without pilot contacts. It also includes figures specifying the arrangement of contacts and dimensions essential for interchangeability of these accessories for the standard ratings, with the necessary gauges.

Although this British Standard, in respect of single-phase accessories, to some extent overlaps BS 196, 'Protected-type non-reversible plugs, socket-outlets, cable-couplers and appliance-couplers, with earthing contacts for single-phase a.c. circuits up to 250 volts', accessories made to the two different standards are not interchangeable with each other.

Where no tolerances are shown, nominal values are assumed.

NOTE. Metric units are to be regarded as the standard in this specification. Conversion to British units should be based on the tables in BS 350, 'Conversion factors and tables', or in BS 2856, 'Precise conversions of inch and metric sizes on engineering drawings'.

Exceptions are: cable sizes which are given in inches because no British Standards for metric dimensional cables have yet been published, and screw thread sizes.

Other British Standards for plugs and socket-outlets for electric power supply are:

- BS 74, 'Charging plugs-and-sockets for electric battery vehicles'.
- BS 279, '100-ampere flameproof plugs and sockets (restrained type)'.
- BS 546, 'Two-pole and earthing-pin plugs, socket-outlets and socket-outlet adaptors for circuits up to 250 volts'.
- BS 1363, '13 A Plugs, switched and unswitched socket-outlets and boxes'.
- BS 1395, '30-ampere flameproof plugs and sockets and cable-couplers'.

BS 1778, '15-ampere three-pin plugs, socket-outlets and connectors (theatre type)'.

SPECIFICATION

1. SCOPE

This British Standard specifies plugs, socket-outlets, cable-couplers and appliance-couplers and these are referred to generally throughout the specification as accessories. The accessories are for single-phase and three-phase supplies with a voltage between phases not exceeding 750 V and a frequency not exceeding 500 Hz, or for d.c. supplies, with a rated current up to 125 A.

The accessories are intended for use in industry, either indoors or outdoors, agriculture and for use on board ship.

NOTE. The ambient temperature in ships' engine rooms may exceed 40°C and in such situations plugs and sockets may require de-rating so that the maximum permitted temperature is not exceeded.

The accessories are intended for continuous use in an ambient temperature having a peak value not exceeding 40°C with an average value not exceeding 35°C over 24 hour periods.

Requirements for special types for use in extra low-voltage installations are also included.

This specification does not apply to accessories of flameproof construction.

2. DEFINITIONS

For the purposes of this British Standard the following definitions apply.

(1) *A plug and socket-outlet.* A means enabling the connection at will, of a flexible cable to fixed wiring. It consists of two parts:

a socket-outlet, provided with contact tubes, which is the part intended to be installed with the fixed wiring;

a plug, provided with contact pins, which is the part integral with or attached to the flexible cable connected to the equipment or to a connector.

A socket-outlet may be incorporated in the output circuit of an isolating transformer.

(2) *A cable-coupler.* A means enabling the connection, at will, of two flexible cables. It consists of two parts:

A connector, provided with contact tubes which is the part integral with or intended to be attached to the flexible cable connected to the supply;

a plug, provided with contact pins which is the part integral with or intended to be attached to the flexible cable connected to the equipment or to a connector.

NOTE. The plug of a cable-coupler is identical to the plug of a plug and socket-outlet. In general, a connector has the same contact arrangement as a socket-outlet.

(3) *An appliance-coupler.* A means enabling the connection at will, of a flexible cable to the equipment. It consists of two parts:

- a connector*, provided with contact tubes, which is the part integral with or intended to be attached to the flexible cable connected to the supply;
- an appliance-inlet*, provided with contact pins, which is the part incorporated in or fixed to the equipment, or intended to be fixed to it.

NOTE 1. In general, the connector of an appliance-coupler is identical to the connector of a cable-coupler and an appliance-inlet has the same contact arrangement as a plug.

NOTE 2. The use of the accessories in (1), (2) and (3) above is shown in Fig. 1.

(4) *A rewirable plug or connector.* An accessory so constructed that the flexible cable can be replaced.

(5) *A non-rewirable plug or connector.* An accessory so constructed that the flexible cable cannot be separated from the accessory without making it permanently useless.

(6) *An interlock.* A device, either electrical or mechanical, which prevents the contacts of a plug becoming live before it is in proper engagement with a socket-outlet or connector, and which either prevents a plug from being withdrawn while its contacts are live or makes the contacts dead before separation.

(7) *A retaining device.* A mechanical arrangement which holds a plug or connector in position when it is in proper engagement and prevents its unintentional withdrawal.

(8) *Rated current.* The current value assigned to the accessory by the maker.

(9) *Maximum rated voltage.* The maximum voltage, (for 3-phase supply the line voltage), at which any component part may be used.

(10) *Rated (operating) voltage.* The nominal voltage of the supply with which the accessory is to be used.

NOTE. Where the terms 'voltage' and 'current' are used they imply r.m.s. values.

(11) *Functional insulation.* The insulation necessary for the proper functioning of the accessory and for basic protection against electric shock.

(12) *Supplementary insulation (protective insulation).* An independent insulation provided in addition to the functional insulation, in order to ensure protection against electric shock in the event of a failure of the functional insulation.

(13) *Double insulation.* Insulation comprising both functional insulation and supplementary insulation.

(14) *Reinforced insulation.* An improved functional insulation with such mechanical and electrical qualities that it provides the same degree of protection against electric shock as double insulation.

(15) *Pillar terminal.* A terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws.

NOTE. The clamping pressure may be applied directly by the shank of the screw or through an intermediate clamping member to which pressure is applied by the shank of the screw.

(16) *Screw terminal*. A terminal in which the conductor is clamped under the head of the screw. The clamping pressure may be applied directly by the head of the screw or through an intermediate part, such as a washer, clamping-plate or anti-spread device.

(17) *Stud terminal*. A terminal in which the conductor is clamped under a nut. The clamping pressure may be applied directly by a suitably shaped nut or through an intermediate part, such as a washer, clamping-plate or anti-spread device.

(18) *Saddle terminal*. A terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts.

(19) *Lug terminal*. A screw terminal or a stud terminal, designed for clamping a cable lug or bar by means of a screw or nut.

(20) *Mantle terminal*. A terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut. The conductor is clamped against the base of the slot by a suitably shaped washer under the nut, by a central peg if the nut is a cap nut, or by equally effective means for transmitting the pressure from the nut to the conductor within the slot.

3. GENERAL REQUIREMENT

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

In general, compliance is checked by carrying out all the tests specified.

4. GENERAL NOTES ON TESTS

a. Tests according to this specification are type tests.

b. Unless specified elsewhere in this standard, the samples are tested as delivered and under normal conditions of use, at an ambient temperature of $20 \pm 5^\circ\text{C}$, the tests being made at rated frequency.

c. Unless specified elsewhere in this standard, the tests are carried out in the order of the clauses.

d. Three samples are subjected to all the tests. If, however, the test of Clause 20 has to be made with both d.c. and a.c., the test with a.c. is made on three additional samples.

e. Accessories do not comply with this specification if there are more failures than that of one sample in one of the tests. If one sample fails in a test, that test and those preceding, which may have influenced the results of that test, are repeated on another set of three samples, all of which shall then comply with the repeated tests.

NOTE. In general, it will only be necessary to repeat the test which caused the failure, unless the sample fails in one of the tests of Clauses 21 and 22, in which case the tests are repeated from that of Clause 20 onwards.

The applicant may submit, together with the first set of samples, the additional set which may be wanted should one sample fail. The testing station will then, without further request, test the additional samples and will only reject if a further failure occurs. If the additional set of samples is not submitted at the same time, a failure of one sample will entail a rejection.

5. STANDARD RATING

a. Maximum rated voltages are:

- 50 V a.c. and d.c.
- 250 V d.c. 415 V a.c.
- 500 V a.c. and d.c.
- 750 V a.c. and d.c.

b. Rated currents are:

- 16, 32, 63 and 125 A.

Compliance with requirements of Subclauses *a* and *b* is checked by inspection of the marking.

6. CLASSIFICATION

Accessories shall be classified:

(1) According to purpose:

- plugs and socket-outlets,
- cable-couplers, comprising a connector and a plug,
- appliance-couplers, comprising a connector and an appliance-inlet.

(2) According to degree of protection against moisture:

- ordinary accessories,
- splash-proof accessories,
- watertight accessories.

(3) According to earthing facilities:

- accessories without earthing contact,
- accessories with earthing contact.

(4) According to method of connecting the cable:

- rewirable plugs and connectors,
- non-rewirable plugs and connectors.

(5) According to interlocking facilities:

- accessories without interlock,
- accessories with mechanical interlock,
- accessories with electrical interlock.

NOTE. Ordinary accessories do not incorporate any special protection against moisture; they need not have hinged lids.

7. MARKING

a. Accessories shall be marked with:

- Rated current in amperes.
- Maximum rated voltage or voltages in volts (see Subclause 7*c*).
- Rated (operating) voltage in volts (see Subclause 7*c*).
- Symbol for nature of supply, if the accessory is not intended for both a.c. and d.c. or if the rating is different for a.c. and d.c.
- Frequency or frequency range if different from 50/60 Hz.

The number of this British Standard *i.e. BS 0000.

Maker's name or trade mark.

Type reference, which may be a catalogue number.

Symbol for degree of protection against moisture, if applicable.

Symbol indicating the position of the earthing contact or of the minor keyway.

In addition to the marking prescribed, the rated (operating) voltage may be indicated by means of a colour, in which case the colour code shown in Table 1 shall be used. These colours shall not be used for lids or enclosures of accessories which are not colour-coded.

TABLE 1

Rated (operating) a.c. voltage, 50/60 Hz†	Colour
V	
25	violet
50	white
110-130	yellow
220-240	blue
380-415	red
500-750	black

b. When symbols are used, they shall be as follows:

amperes

A

volts

V

alternating current

~

direct current

==

splash-proof construction

⚠

watertight construction

☔

For accessories having a maximum rated voltage exceeding 50 V, the symbol indicating the position of the earthing contact shall be a numeral followed by the letter h. The numeral is derived from the position of the earth contact-tube in relation to the keyway, when compared with the face of a clock, the socket-outlet or connector being viewed from the front with the keyway at the sixth hour.

* See NOTE 2 at the end of Clause 7.

† For frequencies over 60 Hz up to and including 500 Hz, the colour green may be used, if necessary, in combination with the colour shown in the table for the rated (operating) voltage.

For accessories having a maximum rated voltage not exceeding 50 V, the symbol indicating the position of the minor keyway shall be a numeral followed by the letter h. The numeral is derived from the position of the minor keyway in relation to the major keyway, the socket-outlet or connector being viewed from the front with the major keyway at the sixth hour.

For plugs and appliance inlets, the symbol indicating the position of the earthing contact or of the minor keyway shall be the same as for the corresponding socket-outlet or connector.

NOTE 1. The relevant drawings of Standard Sheets I, II, IV and V, show accessories with the symbol 6h, and those of Standard Sheets VIII and IX show accessories with the symbol 12h.

NOTE 2. Ordinary accessories are not marked with any symbol for protection against moisture.

For the marking of rated current, maximum rated voltage and rated (operating) voltage, figures may be used alone. The figure for the d.c. voltage rating, if any, shall then be placed before the figure for the a.c. voltage rating, and separated from it by a line or dash, these figures being placed after or below that for the rated current and separated from the latter by a line.

If the voltage rating figures are separated by an oblique line, the current and voltage rating figures shall not be separated by an oblique line.

The symbol indicating the position of the earthing contact or of the minor keyway shall be placed before or above the figure indicating the rated (operating) voltage and separated from it by a line.

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

NOTE. The indication of the rated current, the position of the earth contact or the minor keyway, the rated (operating) voltage and the type of current may be given as follows:

$$16 \text{ A } 6 \text{ h}/240 \text{ V} \sim \text{ or } 16/6\text{h}/240 \sim \text{ or } 16 \frac{6\text{h}}{240 \sim}$$

c. For socket-outlets and appliance-inlets, the marking for rated current, nature of supply if necessary, maker's name or trade mark, type reference shall be on the main part, on the outside of the enclosure or on the lid if the latter cannot be removed without the aid of a tool.

Except for flush-type socket-outlets and appliance-inlets, these markings shall be easily discernible when the accessory is mounted and wired as in normal use, if necessary after removal of the enclosure.

The marking for maximum rated voltage shall be on the main part, and it shall not be visible when the accessory is mounted and wired as in normal use.

The marking for rated (operating) voltage, type reference and the symbol indicating the position of the earthing contact or of the minor keyway and, if required, the symbol for degree of protection against moisture shall be on a place which is visible after installation of the accessory, on the outside of the enclosure or on the lid if it cannot be removed without the aid of a tool.

With the exception of the type reference, these markings shall be easily discernible when the accessory is mounted and wired as in normal use.

NOTE. The 'main part' of a socket-outlet or an appliance-inlet is the part which carries the contact members.

The marking for rated current, nature of supply, maker's name or trade mark and rated (operating) voltage may be repeated on the lid. The type reference may be marked on the main part.

d. For plugs and connectors, the marking specified in Subclause *a* shall be easily discernible when the accessory is wired ready for use.

NOTE. The term 'ready for use' does not imply the plug or connector is in engagement with its complementary accessory.

*As amended
April, 1980*

e. For rewirable accessories appropriate terminals shall be indicated as specified below.

2 pole + earth. With the letter L for one terminal and the symbol $\perp$ for the earthing terminal.

NOTE. Because 2 pole + earth accessories are sometimes connected to a supply from an isolating transformer, there may be no neutral connection. The unmarked terminal can be used for the other live connection or the neutral connection according to the supply.

3 pole + earth. With the symbols R1, S2 and T3 for the phase terminals and the symbol $\perp$ for the earthing terminal.

3 pole + neutral + earth. With the symbols R1, S2 and T3 for the phase terminals, the letter N for the neutral terminal and the symbol $\perp$ for the earthing terminal.

The contact tubes of socket outlets and connectors shall be positioned and marked as in standard sheets I and IV. The contact pins of the plugs and appliance inlets shall be positioned as in standard sheets II and V.

These symbols shall be close to the relevant terminals and shall not be placed on screws, removable washers or other removable parts.

NOTE. The terminals for pilot conductors need not be indicated.

f. Marking shall be indelible and easily legible.

Test. Compliance with the requirements of Subclauses *a* to *f* is checked by inspection if necessary during the test of Subclause 11*d*. In addition, after the humidity treatment of Subclause 18*b*, the marking is rubbed vigorously by hand for 15 seconds with a piece of cloth soaked with water and again for 15 seconds with a piece of cloth soaked with petroleum spirit. The marking is again checked by inspection after the test of Subclause 27*b*.

NOTE 1. Special attention is paid to the marking of maker's name or trade mark and to that of the nature of supply, if any.

NOTE 2. The mark BS 4343 on or in relation to the product is a claim by the manufacturer that it complies with the requirements of the standard.

The British Standards Institution is the owner of a registered certification trade mark. This is shown below, enclosed in the words 'Approved to British Standard'. This mark can be used only by manufacturers licensed under the certification mark scheme operated by the BSI. The presence of this mark on or in relation to a product is an assurance that the goods have been produced to comply with the requirements of the British Standard under a system of supervision, control and testing operated during manufacture and including periodical inspection at the manufacturer's works in accordance with the certification mark scheme of the BSI.

Further particulars of the terms of licence may be obtained from the Director, British Standards Institution, 2 Park Street, London, W.1.



8. DIMENSIONS

a. Accessories shall comply with the appropriate standard sheets as specified below:

Accessories having a maximum voltage exceeding 50 V:

16 A and 32 A: Sheets I, II and III,

63 A and 125 A: Sheets IV and V,

Accessories having a maximum rated voltage not exceeding 50 V:

16 A and 32 A: Sheets VIII and IX,

Test. Compliance shall be checked by means of gauges and by measurement.

Gauges according to Figs. 2, 2*a*, 3, 3*a* and 6, are used for 16 A and 32 A accessories having a maximum rated voltage not exceeding 50 V.

Gauges according to Figs. 22 to 29 are used for accessories having a rated voltage exceeding 50 V.

b. Accessories shall comply with the Standard Sheets, especially with regard to safety, interchangeability and non-interchangeability.

c. It shall not be possible to engage plugs or connectors with socket-outlets or appliance-inlets having different ratings or different contact combinations.

Moreover, the design shall be such that:

The earth pin cannot make contact with the neutral contact tube or the neutral pin with the earth contact tube.

The phase pins cannot make contact with the neutral contact tube, the earth contact tube, or the pilot contact tube.

The neutral pin or the earth pin cannot make contact with the phase contact tubes or the pilot contact tube.

The pilot pin cannot make contact with the neutral contact tube, the earth contact tubes or with the phase contact tubes.

NOTE. Conformity to the relevant Standard Sheets and to Subclauses *f* and *g* ensures compliance with this requirement.

d. It shall not be possible to engage plugs with socket-outlets or connectors having different earthing contact or keyway positions.

Test. Compliance shall be checked by inspection and by means of gauges as follows:

Gauges shown in Figs. 2, 2*a* and 6 for socket-outlets and connectors 16 A and 32 A having a maximum rated voltage not exceeding 50 V.

Gauges shown in Figs. 3 and 3*a* for plugs and appliance inlets 16 A and 32 A

having a maximum rated voltage not exceeding 50 V.

Gauges shown in Fig. 22 for plugs and appliance-inlets 16 A and 32 A having a maximum rated voltage exceeding 50 V.

Gauges shown in Fig. 23 for plugs and appliance-inlets 63 A and 125 A having a maximum rated voltage exceeding 50 V.

Gauges shown in Fig. 24 for socket-outlets and connectors 16 A and 32 A having a maximum rated voltage exceeding 50 V.

Gauges shown in Fig. 25 for socket-outlets and connectors 63 A and 125 A having a maximum rated voltage exceeding 50 V.

For accessories with enclosures of resilient material, the test shall be made at a temperature of $35 \pm 2^\circ\text{C}$, both the accessories and the gauges being at this temperature.

A force of 200 N shall be applied for 1 minute.

NOTE. For accessories of rigid material, such as metal, thermosetting resins, ceramic material and the like, conformity to the relevant Standard Sheets ensures compliance with this requirement, so that, in general, the tests by means of gauges will not be necessary.

e. It shall not be possible to make improper connections between plugs and socket-outlets or connectors or between appliance-inlets and connectors or socket-outlets.

Test. Compliance shall be checked by manual test and, for accessories with enclosures of resilient material, by means of the gauge shown in Fig. 7.

For 16 A and 32 A socket-outlets and connectors having a maximum rated voltage not exceeding 50 V, the gauges shown in Figs. 2, 2a and 6 are used.

For 16 A and 32 A plugs and appliance-inlets having a maximum-rated voltage not exceeding 50 V, the gauges shown in Figs. 3 and 3a are used.

For 16 A and 32 A plugs and appliance-inlets having a maximum rated voltage exceeding 50 V the gauge shown in Fig. 22 is used.

For 63 A and 125 A plugs and appliance-inlets having a maximum rated voltage exceeding 50 V, the gauge shown in Fig. 23 is used.

For 16 A and 32 A socket-outlets and connectors having a maximum rated voltage exceeding 50 V, the gauge shown in Fig. 24 is used.

For 63 A and 125 A socket-outlets and connectors having a maximum rated voltage exceeding 50 V, the gauge shown in Fig. 25 is used.

The gauges are applied with a force of 200 N for 1 minute. For accessories with enclosures of resilient material, the gauge is applied at a temperature of $35 \pm 2^\circ\text{C}$, both the accessory and the gauge being at this temperature.

NOTE. Improper connections include single pole connection and other connections which do not comply with the requirements for protection against electric shock.

For accessories of rigid material, such as metal, thermosetting resins, ceramic and other materials with similar properties, conformity to the relevant Standard Sheets ensures compliance with this requirement.

f. For accessories having maximum rated voltages exceeding 50 V, the position of the earthing contact shall be as shown in Table 2.

TABLE 2

Type	Frequency	Rated (operating) voltage	Earthing contact position*	
			16 A and 32 A Accessories	63 A and 125 A Accessories
2 P + $\frac{\text{—}}{\text{—}}$	Hz	V		
	50 and 60	110 to 130 220 to 240 415 500 750	4 6 9 — —	4 6 9 — —
		For supply from an isolating transformer	12	—
	100 up to and including 300	over 50	—	—
	Over 300 up to and including 500	over 50	—	—
	direct current	over 50 up to and including 250 over 250	3 8	3 8
3 P + $\frac{\text{—}}{\text{—}}$	50 and 60	110 to 130 220 to 240 415	4 9 6	4 9 6
	60	440†	11	11
	50 and 60	500 750 Supply from an isolating transformer	7 5 12	7 5 —
	100 up to and including 300	over 50	10	—
	Over 300 up to and including 500	over 50	2	—
	50 and 60	110 to 130 127/220 to 138/240 240/415 500 750	4 9 6 — —	4 9 6 — —
3 P + N + $\frac{\text{—}}{\text{—}}$	60	250/440†	11	11
	100 up to and including 300	over 50	—	—
	Over 300 up to and including 500	over 50	—	—

The positions shown by a dash (—) are not standardized.

Position 1 h is reserved for future standardization.

For single phase and three-phase (3P + N + $\frac{\text{—}}{\text{—}}$) 500 and 750 voltages, the earthing contact positions are not standardized.

* The earthing contact position is given in relation to the keyway, as specified in Subclause 7b.

† Mainly for marine installations.

g. For accessories having a rated (operating) voltage not exceeding 50 V, the position of the minor keyway shall be as shown in Table 3.

TABLE 3

Rated (operating) voltage	Frequency	Minor keyway position*
V	Hz	
25	50 and 60	no minor key
50	50 and 60	12
up to 50	100 up to and including 200	4
	300	2
	400	3
	Over 400 up to and including 500	11
	Direct current	10

Position 1 h, 8 h and 9 h are reserved for future standardization. For constructional reasons, positions 5 h, 6 h and 7 h cannot be used.

Test. Compliance with the requirements of Subclauses *f* and *g* shall be checked by inspection.

9. PROTECTION AGAINST ELECTRIC SHOCK

a. Accessories shall be so designed that live parts of socket-outlets and connectors, when they are wired as in normal use, and live parts of plugs and appliance-inlets, when they are in partial or complete engagement with the complementary accessories, are not accessible.

Moreover it shall not be possible to make contact between a pin of a plug or appliance-inlet and a contact-tube of a socket-outlet or connector, while any pin is accessible.

Furthermore the earthing pins and tubes of accessories with enclosures of insulating material shall not be accessible while the earth pin is in contact with the earth contact tube.

Test. Compliance shall be checked by inspection and, if necessary, by a test on the sample wired as in normal use.

• The minor keyway position is given in relation to the major keyway as specified in Subclause 7*b*.

The standard test finger as shown in Fig. 8 is applied in every possible position, an electrical indicator with a voltage not less than 40 V being used to show contact with the relevant parts.

NOTE. Neutral contact tubes and pilot contacts of socket-outlets and connectors are deemed to be live parts.

Test. Conformity to the relevant Standard Sheets ensures compliance with the requirement so far as the inaccessibility of contacts during insertion of a plug or connector into the complementary accessories is concerned.

b. Accessories with earthing contact shall be so designed that:

When inserting the plug or connector, the earth connection is made before the phase connections are made.

When withdrawing the plug or connector, the phase connections are broken before the earth connection is broken.

Moreover, accessories with earthing contacts and neutral contacts shall be so designed that:

For accessories having a rated current not exceeding 32 A, when inserting the plug or connector the earth connection is made before the neutral connection, the neutral connection is made before the phase connections and when withdrawing the plug or connector the phase connections are broken before the neutral connection and the neutral connection is broken before the earth connection.

Test. Conformity to the Standard Sheets ensures compliance with these requirements.

c. It shall not be possible to interchange the insulating inserts of plugs and appliance-inlets with those of socket-outlets or connectors.

Test. Compliance shall be checked by manual test.

10. PROVISION FOR EARTHING

a. Accessories with earthing contacts shall be provided with an internal earthing terminal; metal clad socket-outlets with earthing contacts shall be provided with an earthing terminal visible from the outside, intended for the connection of an external earthing conductor.

The earthing contacts shall be directly and reliably connected to the earthing terminals.

b. Accessible metal parts of accessories with earthing contacts which may become live in the event of an insulation fault, shall be reliably connected to the internal earthing terminal.

NOTE. For the purpose of this requirement, screws for fixing bases, covers and the like, are not deemed to be accessible metal parts, which may become live in the event of an insulation fault.

If accessible metal parts are screened from live parts by metal parts which are connected to an earthing terminal or an earthing contact, or if they are separated from live parts by double insulation or reinforced insulation, they are not, for the purpose of this requirement, regarded as likely to become live in the event of an insulation fault.

Test. Compliance with the requirements of Subclauses *a* and *b* shall be checked by inspection.

c. Earthing contacts shall be capable of carrying a current equal to that specified for the phase contacts without overheating.

Test. Compliance shall be checked by the test of Clause 22.

d. The earthing contacts shall be so shrouded or guarded that they are protected against mechanical damage, and the use of side earthing contacts is precluded.

Test. Compliance shall be checked by inspection.

11. TERMINALS

a. Rewirable accessories shall be provided with terminals in which connection is made by means of screws, nuts or equally effective devices.

b. Parts of terminals other than screws, nuts, washers, stirrups, clamping-plates and the like, shall be either of:

Copper, or an alloy containing at least 58 % copper or other metal no less resistant to corrosion than copper and having mechanical properties no less suitable. Steel screws shall be adequately protected against corrosion.

c. If the body of an earthing terminal is not part of the metal frame or housing of the accessory, the body shall be of material as prescribed in Subclause *b* for parts of terminals for supply conductors. If the terminal body is part of the metal frame or housing, the clamping screw or nut shall be of such material.

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

NOTE. The requirement regarding the avoidance of the risk of corrosion does not preclude the use of adequately coated metal screws or nuts.

Test. Compliance with the requirements of Subclauses *a* to *c* shall be checked by inspection and by chemical analysis.

d. Terminals shall allow the connection of conductors having nominal cross-sectional areas as shown in Table 4.

Test. For terminals other than lug terminals, compliance shall be checked by inspection, by measurement and by fitting conductors of the smallest and largest cross-sectional areas specified.

NOTE. For lug-type terminals complying with Standard Sheet XV, the lug accepted by a particular size of terminal is assumed to accept the range of nominal cross-sectional areas of conductors prescribed for that terminal.

TABLE 4

Rating of the accessory		Internal terminals*					External earthing terminal of socket-outlet	
Voltage	Current	Nominal cross-sectional area of conductors		Terminal size†		Nominal cross-sectional area	Terminal size†	Terminal size†
		Plugs, connectors and appliance-inlets (flexible cables)	Socket-outlets (cables for fixed wiring)	Plugs, connectors and appliance-inlets	Socket-outlets			
V Not exceeding 50	A 16 and 32 2 Pole	in* 0.007 to 2-0.007	in* 0.007 to 2-0.007	7‡	7‡	in* —	—	—
	16 and 32 3 Pole	0.007 to 2-0.0225	0.007 to 2-0.0225	6	5	—	—	—
	16	0.0017 to 0.0048	0.002 to 0.0045	2	3	0.01	—	4
Exceeding 50	32	0.003 to 0.01	0.003 to 0.0145	5	6	0.01	—	4
	63	0.007 to 0.03	0.007 to 0.06	7	9	0.0225	—	7
	125	0.0225 to 0.1	0.0225 to 0.1	10	9	0.06	—	9

* For metric cable sizes see table in Appendix A.

† Pilot terminals, if any, shall allow the connection of conductors having the same nominal cross-sectional areas as the internal terminals of 16 A accessories having rated voltages exceeding 50 V.
‡ See appropriate Standard Sheets.

‡ The terminal size for two-pole accessories is greater than that for three-pole accessories to allow the simultaneous connection of two conductors having the same cross-sectional area.

e. Terminals 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.

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

f. Terminals shall be so designed that they can be properly fixed to the accessory. They shall not work loose when the clamping-screws or nuts are tightened or loosened.

Screws and nuts for clamping the conductors shall not serve to fix any other component.

The clamping means for the conductors may be used to stop rotation or displacement of the pins or contact tubes.

Test. Compliance with the requirements of Subclauses *e* and *f* shall be checked by inspection, by measurement and by the test of Subclause 25*a*.

NOTE. These requirements do not preclude terminals that are floating or terminals so designed that rotation or displacement of the terminals is prevented by the clamping-screw or nut, provided that their movement is appropriately limited and does not impair the correct operation of the accessory.

Terminals may be prevented from working loose by fixing with two screws, by fixing with one screw in a recess such that there is no appreciable play, or by other suitable means.

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

g. Terminals shall be so designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without damage to the conductor.

Terminals of sizes up to and including 5 shall allow the conductor to be connected without special preparation and shall be so designed or placed that the conductor cannot slip out when the clamping screws or nuts are tightened.

Test. For terminals other than lug terminals, compliance shall be checked by inspection of the terminals and of the conductors, after conductors of the smallest and largest cross-sectional areas specified in Subclause *d* have been clamped and loosened, the maximum torque applied to clamp the conductor being equal to two thirds of the torque specified in Table 16. If the screw has a hexagonal head with a slot, the torque applied is equal to two-thirds of the torque shown in column C of Table 16.

Test. For lug terminals, compliance shall be checked by inspection of the terminals after clamping a rectangular gauge strip of thickness *c* and width 2*g*,

with a clearance hole for a screw of nominal diameter d situated at a distance g from the end, these letters having the values shown in Standard Sheet XV. The maximum torque applied to clamp the gauge strip is two thirds of the torque specified in Table 16.

NOTE. The term 'special preparation' covers soldering of the strands 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 stranded conductor to consolidate the end.

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

h. Terminals shall comply with the Standard Sheets as specified below, except that for Standard Sheets XII, XIII, XIV, the length of thread in the fixed part or nut and the length of thread on the screw or stud may be reduced if the mechanical strength of the terminal is adequate and at least two full threads of every clamping screw are in engagement when a conductor of the most unfavourable cross-sectional area is clamped.

Standard Sheet XII applies to pillar terminals.

Standard Sheet XIII applies to screw terminals and stud terminals.

Standard Sheet XIV applies to saddle terminals.

Standard Sheet XV applies to lug terminals.

Mantle terminals shall comply with Standard Sheet XII with regard to the dimensions D and e .

Terminals which are essentially of the pillar type, but with the part with the hole for the conductor slotted to enable the conductor to be moved laterally into position, shall comply with Standard Sheet XII, except that the maximum gap between the conductor restraining parts on the side where the slot is located shall comply with Standard Sheet XIII.

If the required length of thread in a terminal screw hole is obtained by plunging, the edge of the extrusion shall be reasonably smooth and the length of thread shall exceed the specified minimum value by at least 0.5 mm.

Test. Compliance shall be checked by inspection, by measurement and, for terminals with a reduced length of thread, by the tests of Subclause *i*.

The maximum gap between the conductor restraining parts is checked by means of a steel gauge pin with a diameter equal to $e \pm 0.05$ mm.

For terminals without a pressure plate or a similar device, complying with Standard Sheet XII, the clamping screw is screwed fully home without a conductor in position. It shall not then be possible to insert the gauge pin between the threaded part of the screw and the wall of the conductor space.

For terminals complying with Standard Sheet XIII, and for terminals with pressure plates or a similar device, complying with Standard Sheet XII, where it is not appropriate to insert the gauge pin in all positions, a conductor is clamped in the terminal.

For terminals complying with Standard Sheet XI, the conductor is in the

form of a rod with a diameter equal to that corresponding to the middle cross-sectional area of the range specified for the particular terminal, and having a flat end perpendicular to the axis.

For terminals complying with Standard Sheet XIII, the conductor is solid and has a diameter D as specified in the Standard Sheet for the particular terminal.

With this conductor in position, it shall not be possible to insert the gauge pin, applied in a direction parallel to the axis of the conductor, into any gap through which a wire of a stranded conductor might escape.

The minimum distance between the clamping screw and the end of the conductor when fully inserted, which is specified in Standard Sheet XII, is checked by means of the rod conductor specified above, which shall pass into the conductor space for a distance beyond the threaded hole at least equal to the minimum distance specified.

NOTE 1. The following negative deviations from the specified values are allowed for the minimum thread diameter of the screw:

0.15 mm for screws with a nominal diameter not exceeding 5 mm.

0.22 mm for screws with a nominal diameter over 5 mm but not exceeding 10 mm.

0.27 mm for screws with a nominal diameter over 10 mm.

NOTE 2. This subclause does not exclude terminals of types other than those shown in the Standard Sheets. Such terminals must, however, comply with the other requirements of Clause 11.

If the thread in the fixed part or nut is recessed, the total length of the shank of headed screws must be increased accordingly.

If one or more of the dimensions are larger than the minimum values specified in the Standard Sheets, the other dimensions need not be correspondingly increased, but departures from the specified values must not impair the function of the terminal.

NOTE 3. For terminals with a pressure plate, complying with Standard Sheet XII, the gauge pin is applied to the gap between the pressure plate and the wall of the conductor space.

i. Terminals complying with Standard Sheet XII, but with a reduced length of thread, are fitted with a conductor of the smallest cross-sectional area specified in Table 4, tightly clamped, or a conductor of the largest cross-sectional area specified in that Table, lightly clamped, whichever is the more unfavourable.

Terminals complying with Standard Sheets XIII or XIV, but with a reduced length of thread, are fitted with a conductor of the largest cross-sectional area specified in Table 4, lightly clamped.

At least two threads shall be in full engagement.

The terminals are then fitted with conductors of the smallest and largest cross-sectional areas specified in Table 4, fixed wiring (solid or stranded) for socket-outlets and appliance-inlets and flexible for plugs and connectors, and the terminal screws are tightened, the maximum torque applied being equal to two thirds of the torque specified in Table 16. Each conductor is subjected to a pull of the value, in newtons, shown in Table 5; the pull is applied without jerks, for 1 minute, in the direction of the axis of the conductor space.

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

TABLE 5

Terminal size	2	3	4	5	6	7	8	9	10
Pull in N	50	50	60	80	90	100	120	150	200

NOTE. The CEE publication No. 17 does not include terminal sizes 8, 9 and 10.

j. Lug terminals shall only be used for accessories having a rated current of at least 63 A; if such terminals are provided they shall be fitted with spring washers or equally effective locking means.

k. Each terminal shall be located in proximity to its corresponding terminal or terminals of different polarity, and to the internal earthing terminal, if any, unless there is a sound technical reason for the contrary.

Test. The compliance with Subclauses *j* and *k* shall be checked by inspection.

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

Test. Compliance shall be checked by inspection and by manual test.

NOTE. In general, the designs shown in the Standard Sheets, other than some that comply with Standard Sheet XII, 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.

m. Terminals shall be so located or shielded that:

Screws becoming loose from the terminals cannot establish any connection between live parts and metal parts connected to the earthing terminals.

Conductors becoming detached from live terminals cannot touch metal parts connected to the earthing terminal.

Conductors becoming detached from the earthing terminal cannot touch live parts.

These requirements apply also to terminals for pilot conductors.

Test. Compliance shall be checked by inspection and by manual test.

n. When the conductors have been correctly fitted there shall be no risk of accidental contact between live parts of different polarity or between such parts and accessible metal parts, and should a wire of a stranded conductor escape from a terminal, there shall be no risk that wires emerge from the enclosure.

The requirement with regard to the risk of accidental contact between live parts and accessible metal parts does not apply to accessories having rated voltages not exceeding 50 V.

Test. Compliance shall be checked by inspection and, where the risk of accidental contact between live parts and other metal parts is concerned, by the following test:

An 8 mm length of insulation is removed from the end of a flexible conductor having a cross-sectional area chosen in the middle of the range specified in Table 4. One wire of the stranded conductor is left free and the other wires are fully inserted into and clamped in the terminal.

The free wire is bent, without tearing the insulation back, in every possible direction, but without making sharp bends round barriers.

The free wire of a conductor connected to a live terminal shall neither touch any metal part which is not a live part nor emerge from the enclosure, and that of a conductor connected to the earthing terminal shall not touch any live part.

NOTE. The test may be repeated with the free wire in another position.

12. INTERLOCKS AND RETAINING DEVICES

a. A mechanical interlock shall be incorporated in:

16 A and 32 A a.c. accessories having rated (operating) voltages exceeding 500 V.

16 A d.c. accessories having rated (operating) voltages exceeding 250 V.

32 A d.c. accessories having rated (operating) voltages exceeding 50 V.

If 16 A and 32 A accessories having rated (operating) voltages exceeding 50 V are provided with a mechanical interlock, it shall comply with Standard Sheet III.

63 A and 125 A accessories of rated (operating) voltage exceeding 50 V shall have provision for an electrical interlock in the form of a pilot contact shown on Standard Sheets IV and V.

If, for 63 A accessories having rated (operating) voltages exceeding 50 V a mechanical interlock is provided the dimensions shown in Fig. 9 shall be observed.

Any mechanical interlock shall be linked with the operation of a switch so that the plug cannot be inserted into or withdrawn from the socket-outlet or connector while the contact tubes are live.

Socket-outlets and connectors shall be so designed that after engagement with any complementary accessory, the interlock operates correctly.

The switch required for a mechanical interlock may be incorporated in the socket-outlet or connector.

b. Accessories shall be provided with a retaining device as indicated in Table 6.

TABLE 6

Rated current of the accessory	Classification according to degree of protection against moisture	Plugs and appliance-inlets		Socket-outlets and connectors		
		Retaining means	Standard sheet reference		Retaining means	Standard sheet
			Maximum rated voltage exceeding 50 V	Maximum rated voltage not exceeding 50 V		
A 16 and 32	ordinary	catch	II.1	IX.1	lever or lid	I.1 VIII.1
	splash-proof	catch	II.1	IX.1	lid	I.1 VIII.1
	watertight	catch and bayonet ring	II.2	IX.2	two-ramp system	I.2 VIII.1
63	splash-proof	catch	V.1	—	lid and two-ramp system	IV.1 —
	watertight	bayonet ring	V.2	—	two-ramp system	IV.2 —
125	watertight	bayonet ring	V.2	—	two-ramp system	IV.2 —

Test. Compliance with the requirements of Subclauses *a* and *b* shall be checked by inspection and by measurement.

13. RESISTANCE TO AGEING OF RUBBER AND THERMOPLASTIC (RESILIENT) MATERIALS

Accessories with enclosures of rubber or thermoplastic material and parts of rubber, such as sealing rings and gaskets, shall be sufficiently resistant to ageing.

Test. Compliance shall be checked by an accelerated ageing test by suspending the samples freely in a heating cabinet, ventilated by natural circulation.

The temperature in the cabinet and the duration of the ageing test are:

70 ± 2°C and 10 days (240 hours) for rubber.

80 ± 2°C and 7 days (168 hours) for thermoplastic material.

After the samples have been allowed to attain approximate room temperature, they are examined and shall show no crack visible to the naked eye, nor shall the material have become sticky or greasy.

After the test the samples shall show no damage which would lead to non-compliance with this specification.

If there is a doubt as to whether the material has become sticky, the sample is placed on one of the pans of a balance and the other pan is loaded with a weight equal to the weight of the sample plus 500 g. Equilibrium is then restored by pressing the sample with the forefinger wrapped in a dry piece of coarse woven cloth.

No traces of the cloth shall remain on the sample of the material and the sample shall not stick to the cloth.

NOTE. The use of an electrically heated cabinet is recommended. Natural circulation may be provided by holes in the walls of the cabinet.

14. GENERAL CONSTRUCTION

a. Accessories having a rated current exceeding 32 A shall be splash-proof or watertight.

Accessories having a rated current exceeding 63 A shall be watertight.

Test. Compliance shall be checked by inspection of the marking and by the relevant tests of Subclause 18*a*.

b. Accessible surfaces of accessories shall be free from burrs, flash and similar sharp edges.

c. Screws or other means for fixing the part carrying the contact tubes or the part carrying the pins to its mounting surface in a box or in an enclosure shall be easily accessible. These fixings and those which fix the enclosure shall not serve to fix any other part.

Test. The compliance with Subclauses *b* and *c* shall be by inspection.

d. It shall not be possible for the user to alter the position of the earthing contact, or the neutral contact, if any, in relation to the keyway of the socket-outlet or connector or to the key of the plug or appliance-inlet.

Test. Compliance shall be checked by a manual test to ensure that only one mounting position is possible.

15. CONSTRUCTION OF SOCKET-OUTLETS

a. Contact tubes of socket-outlets shall be self-adjusting so as to ensure adequate contact pressure.

Contact tubes other than the earth contact tube shall be floating.

Earth contact tubes need not be floating provided that they have the necessary resilience in all directions.

Test. Compliance shall be checked by inspection and by the following test.

The sample is mounted so that the axes of the contact tubes are vertical with the contact openings downwards.

A gauge of hardened steel with a finely ground finish and free from grease, having the dimensions shown as for the maximum gauge in Table 7, is inserted into each contact tube and the force necessary to withdraw the gauge is measured.

A similar gauge having the dimensions shown in Table 7 for the minimum gauge is then inserted and the withdrawal force again measured.

A supplementary weight is attached to each gauge. This supplementary weight, together with the weight of the gauge, exert a force which shall be within the limits shown in Table 7.

TABLE 7

Nominal pin diameter	Maximum gauge		Minimum gauge	
	Diameter of gauge	Maximum total force	Diameter of gauge	Minimum total force
mm	mm	N	mm	N
5	5 ± 0.01	12.5	4.8 ± 0.01	2.5
6	6 ± 0.01	25	5.8 ± 0.01	5
7	7 ± 0.01	25	6.8 ± 0.01	5
8	8 ± 0.01	50	7.8 ± 0.01	10
10	10 ± 0.01	75	9.8 ± 0.01	15
12	12 ± 0.01	100	11.8 ± 0.01	20

b. The pressure exerted by the contact tubes of socket-outlets on the pins of a plug shall be not so great as to prevent the easy insertion and withdrawal of the plug, but sufficient to prevent it from working out of the socket-outlet in normal use.

Test. Compliance shall be checked by determining the force necessary to withdraw the test plug from the sample, with the sample mounted so that the axes of the contact tubes are vertical, and with the contact openings downwards as shown in Fig. 10.

A test plug, provided with pins having the dimensions of the maximum gauge specified in Table 7, is inserted into the sample. A principal weight and a supplementary weight are used, the supplementary weight being such that it exerts a force equal to one-tenth of the principal weight plus the weight of the plug.

The principal weight, together with the supplementary weight and the test plug, exert a force equal to the maximum withdrawal force shown in Table 8. The principal weight is hung on without jolting the test plug and the supplementary weight is allowed to fall from a height of 5 cm onto the principal weight.

The plug shall not remain in the sample.

Following this, a test plug provided with pins having the dimensions of the minimum gauge specified in Table 7, is inserted into the sample. The weight of the test plug together with an additional weight, if necessary, exert a force equal to the minimum withdrawal force shown in Table 8.

The plug shall not come out.

TABLE 8

Rated current of the accessory	Withdrawal force	
	maximum	minimum
A	N	N
16	100	20
32	150	30
63	275	55
125	400	80

c. Socket-outlets shall be so constructed as to permit:

The conductors to be easily introduced into the terminals and secured therein.

The correct positioning of the conductors without their insulation coming into contact with live parts of polarity, different from that of the conductors.

The covers or enclosures to be fixed easily after connection of the conductors.

d. Parts providing protection against electric shock shall have adequate mechanical strength; they shall be securely fixed in such a way that they will not work loose in normal use. It shall not be possible to remove these parts without the aid of a tool.

Enclosures shall be secured in position by at least two independent means which require the use of a tool for their operation.

e. Cable entries shall allow the introduction of the conduit or the protective covering of the cable so as to afford complete mechanical protection.

Test. Compliance with the requirements of Subclauses c to e shall be checked by inspection and by an installation test with conductors of the largest cross-sectional area specified in Table 4.

f. Insulating linings, barriers and the like shall have adequate mechanical strength and shall be secured in a reliable manner.

Test. Compliance shall be checked by inspection and by the tests of clauses 18*b* and 24.

NOTE. The fixing of insulating linings by means of a self-setting varnish is allowed.

g. Splash-proof socket-outlets shall be totally enclosed when fitted with screwed conduits, lead covered or armoured cables and without a plug in position. In addition, they shall incorporate means for ensuring the required degree of protection against moisture when a plug is completely engaged.

The means for achieving total enclosure and that for ensuring the required degree of protection against moisture, shall be securely fixed to the socket-outlet.

Lid springs, if any, shall be of corrosion resistant material, such as bronze or stainless steel.

Socket-outlets designed for only one mounting position shall be provided with a drain hole, at least 5 mm in diameter, or at least 20 mm² in area with a width of at least 3 mm, which is effective in that mounting position.

Test. Compliance shall be checked by inspection; by measurement and by the tests of Clauses 18, 19 and 21.

NOTE. Total enclosure when the plug is not in position may be achieved by means of a lid which also carries the retaining device for holding the plug in position when it is completely engaged.

A drain hole in the back of the enclosure of a socket-outlet intended to be mounted on a vertical wall is deemed to be effective only if the design of the enclosure ensures a clearance of at least 5 mm from the wall, or provides a drainage channel of at least the size specified.

h. Watertight socket-outlets shall be totally enclosed when fitted with lead covered cables and without a plug in position. In addition, they shall incorporate means for ensuring the required degree of protection against moisture when a plug is completely engaged.

The required degree of protection against moisture when the plug is not in position, shall be achieved by means of a cover.

The means for ensuring the required degree of protection against moisture shall be securely fixed to the socket-outlet.

Test. Compliance shall be checked by inspection and by the test of Clauses 18 and 19.

i. Splash-proof and watertight socket-outlets, having a maximum rated voltage exceeding 50 V, shall be provided with an earthing terminal.

Test. Compliance shall be checked by inspection.

16. CONSTRUCTION OF PLUGS AND CONNECTORS

a. The enclosure of plugs and connectors shall completely enclose the terminals, the end of the flexible cable and the cable anchorage. The construction of rewirable plugs and connectors shall be such that the conductors can be

properly connected and the cores kept in place so that there is no risk of contact between them from the point of separation of the cores to the terminals.

The pin assembly of a plug shall be protected by a surrounding shroud.

Plugs and connectors shall be so constructed that the part protecting the pins or the contact tubes, cannot be removed without making the accessory permanently useless.

Test Compliance shall be checked by inspection and, if necessary, by a manual test.

b. The various parts of a plug or connector shall be reliably fixed to one another in such a way that they will not work loose in normal use. It shall not be possible to dismantle plugs or connectors without the aid of a tool.

Test. Compliance shall be checked by manual test and by the test of Subclause 24*d*.

c. If an insulating lining is provided, it shall be secured to the enclosure in a reliable manner.

Test. Compliance shall be checked by inspection and by the tests of Subclauses 18*b* and 24*d*.

NOTE. Self-setting varnish is allowed for fixing insulating linings.

d. Pins of plugs shall be solid, locked against rotation and shall not be removable without dismantling the plug.

NOTE. Pins of plugs may be either floating or fixed.

e. Contact tubes of connectors shall be self-adjusting so as to ensure adequate contact pressure.

For connectors, contact tubes other than the earth contact tube shall be floating.

Earth contact tubes need not be floating provided that they have the necessary resilience in all directions.

Test. Compliance shall be checked by inspection and by the test of Subclause 15*a*.

f. The pressure exerted by the contact tubes of connectors on the pins of a plug shall be not so great as to prevent the easy insertion and withdrawal of the plug, but sufficient to prevent it from working out of the connector in normal use.

Test. Compliance shall be checked by the test of Subclause 15*b*.

g. Splash-proof and watertight plugs shall incorporate means (which can only be dismantled by the use of a tool) for ensuring the required degree of protection against moisture when in complete engagement with the complementary accessory.

Test. Compliance shall be checked by inspection and by the tests of Clauses 18 and 19.

h. Splash-proof and watertight connectors shall be totally enclosed when fitted with a flexible cable as in normal use and when not in engagement with the complementary accessory. In addition, they shall incorporate means for

ensuring the required degree of protection against moisture when in complete engagement with the complementary accessory.

The required degree of protection against moisture when the complementary accessory is not in position shall be achieved by means of a lid or cover.

The means for ensuring the required degree of protection against moisture shall be securely fixed to the connector.

Lid springs shall be of corrosion resistant material, such as bronze or stainless steel.

Test. Compliance shall be checked by inspection and by the tests of Clauses 18, 19 and 21.

i. Splash-proof and watertight plugs and connectors, having a maximum rated voltage exceeding 50 V, shall be provided with an earthing terminal.

Test. Compliance shall be checked by inspection.

17. CONSTRUCTION OF APPLIANCE-INLETS

a. Pins of appliance inlets shall be solid, locked against rotation and shall not be removable without the aid of a tool.

NOTE. Pins of appliance inlets may be either floating or fixed.

The pin assembly of appliance-inlets shall be protected by a surrounding shroud.

Test. Compliance shall be checked by inspection and by manual test.

b. Splash-proof and watertight appliance inlets shall incorporate means (which can only be dismantled by the use of a tool) for ensuring the required degree of protection against moisture when an appropriate connector is completely engaged.

Test. Compliance shall be checked by inspection and by the tests of Clauses 18 and 19.

18. MOISTURE RESISTANCE

a. The enclosure of splash-proof and watertight accessories shall provide the degree of protection against moisture in accordance with the classification of the accessory.

Test. Compliance shall be checked by the appropriate treatment specified below which is made on accessories fitted with cables or conduits for which they are designed. Glands, fixing screws of enclosures and covers are tightened with a torque equal to two-thirds of the torque applied in the Tables 15 and 16, as appropriate. Screwed caps are tightened as in normal use.

Socket-outlets are mounted on a vertical surface so that the drain hole, if any, is in the lowest position. Connectors are placed in the most unfavourable position.

Socket-outlets and connectors are tested with, and also without, the complementary accessory in engagement; the means for ensuring the required degree of protection against moisture being positioned as in normal use.

Plugs and appliance-inlets are only tested when in engagement with the complementary accessory.

(1) Splash-proof accessories are sprayed with water for 10 minutes by means of the spray apparatus shown in Fig. 11, which comprises a tube formed into a semi-circle. The radius of the circle is 200 mm or a multiple of 200 mm and is as small as is compatible with the size and position of the sample. The tube is perforated so that jets of water are directed towards the centre of the circle, and the water pressure at the inlet to the apparatus is equivalent to a head of about 10 m.

The tube is caused to oscillate through an angle of 120° , 60° on either side of the vertical. The time for one complete oscillation ($2 \times 120^\circ$) is about 4 seconds.

The sample is mounted at the centre of the semi-circle formed by the tube, so that its lowest part is level with the axis of oscillation. The sample is turned about its vertical axis during the test.

Immediately afterwards, the sample is subjected for 5 minutes to splashing in all directions by means of the splash apparatus shown in Fig. 12.

During this test, the water pressure is so regulated that the water splashes up 15 cm above the bottom of the bowl. The bowl is placed on a horizontal support 5 cm to 10 cm below the lowest edge of the sample; the bowl is moved around so as to splash the sample from all directions. Care is taken that the sample is not hit by the direct jet.

(2) Watertight accessories are immersed for 24 hours in water at a temperature of $20 \pm 5^\circ\text{C}$, the highest point of the accessory being about 5 cm below the water level.

Immediately after the treatment specified under (1) or (2), the samples shall withstand an electric strength test as specified in Subclause 19c, and inspection shall show that water has not entered the sample to any appreciable extent and has not reached live parts.

b. Accessories shall be proof against humid conditions which may occur in normal use.

Compliance is checked by the humidity treatment described in this subclause followed immediately by the measurement of the insulation resistance and by the electric strength test, specified in Subclause 19c.

Cable entries, if any, are left open; if knock-outs are provided, one of them is opened.

Covers which can be removed without the aid of a tool, are removed and subjected to the humidity treatment with the main part; spring lids are open during this treatment.

The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity maintained between 91 % and 95 %. The temperature of the air, at all places where samples can be located, is maintained within 1 degC of any convenient value T between 20°C and 30°C.

Before being placed in the humidity cabinet, the samples are brought to a temperature differing from T by not more than 2 degC.

The samples are kept in the cabinet for:

2 days (48 hours) for ordinary accessories.

7 days (168 hours) for splash-proof and watertight accessories.

NOTE. In most cases, the samples may be brought to the specified temperature of $T \pm 2^\circ\text{C}$, by keeping them at this temperature for at least four hours before the humidity treatment.

A relative humidity between 91 % and 95 % can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) in water, having a sufficiently large contact surface with the air.

In order to achieve the specified conditions within the cabinet, it is necessary to ensure constant circulation of the air within and, in general, to use a cabinet which is thermally insulated.

After this treatment, the samples shall show no damage.

19. INSULATION RESISTANCE, ELECTRIC STRENGTH AND RESILIENT ENCLOSURES

a. The insulation resistance and the electric strength of accessories shall be adequate.

Test. Compliance shall be checked by the tests of Subclauses *b* and *c*, which are made immediately after the test of Subclause 18*b*, in the humidity cabinet or in the room in which the samples were brought to the prescribed temperature, after reassembly of covers which may have been removed.

Accessories with enclosures of resilient material are subjected to the additional test of Subclause *d*.

NOTE: For the purpose of these tests, the neutral contact and the pilot contact are each considered as a pole.

b. Insulation resistance. The insulation resistance is measured by applying a d.c. voltage of approximately 500 V, the measurement being made 1 minute after application of the voltage.

For socket-outlets and connectors, the insulation resistance is measured consecutively:

Between all poles connected together and the body, the measurement being made with, and without, a plug in engagement.

Between each pole in turn and all others connected to the body, with a plug in engagement.

Between any metal enclosure and metal foil in contact with the inner surface of its insulating lining, if any, leaving a gap of approximately 4 mm between the metal foil and the edge of the lining.

Between any metal part of the cable anchorage of connectors including clamping-screws and the earthing terminal, if any.

Between any metal part of the cable anchorage of connectors and metal foil wrapped round the flexible cable or cord, or a metal rod of the same diameter as the flexible cable, inserted in its place.

For plugs and appliance-inlets, the insulation resistance is measured consecutively:

Between all poles connected together and the body.

Between each pole in turn and all others connected to the body.

Between any metal enclosure and metal foil in contact with the inner surface of its insulating lining, if any, leaving a gap of approximately 4 mm between the metal foil and the edge of the lining.

Between any metal part of the cable anchorage of plugs, including clamping-screws and the earthing terminal, if any.

Between any metal part of the cable anchorage of plugs and metal foil wrapped round the flexible cable or a metal rod of the same diameter as the flexible cable inserted in its place.

The body includes all accessible metal parts, metal foil in contact with the outer surface of external parts of insulating material, other than the engagement face of connectors and plugs, fixing screws of bases, enclosures and covers, external assembly screws and earthing terminals, if any.

The insulation resistance shall not be less than 5 megohms.

c. Electric strength. A voltage of substantially sine-wave form, having a frequency of 50 Hz and the value shown in Table 9, is applied for 1 minute between the parts indicated in subclause *b*.

Initially, not more than half the prescribed voltage is applied, then it is raised rapidly to the full value.

TABLE 9

Maximum rated voltage of the accessory	Test voltage
V	V
Up to and including 50	500
over 50 up to and including 415	2 000*
over 415 up to and including 500	2 500
over 500	3 000

* This value is increased to 2 500 V for metal enclosures lined with an insulating lining.

No flashover or breakdown shall occur during the test.

NOTE. Glow discharges without drop in voltage may be neglected.

d. Resilient enclosures.

Immediately after the test of Subclause c, it shall not be possible to engage accessories with enclosures of resilient material with gauges having a different position of the key or keyway to that of the sample.

For 16 A and 32 A socket-outlets and connectors having a maximum rated voltage not exceeding 50 V, the gauges shown in Figs. 2a and 6 are used.

For 16 A and 32 A plugs and appliance-inlets having a maximum rated voltage not exceeding 50 V, the gauge shown in Fig. 3a. is used.

For 16 A and 32 A plugs and appliance-inlets with resilient shrouds having a maximum rated voltage exceeding 50 V the gauge shown in Fig. 26 is used.

For 16 A and 32 A socket-outlets and connectors with resilient shrouds having a maximum rated voltage exceeding 50 V, the gauge shown in Fig. 27 is used.

For 63 A and 125 A plugs and appliance-inlets with resilient shrouds having a maximum rated voltage exceeding 50 V, the gauge shown in Fig. 28 is used.

For 63 A and 125 A socket-outlets or connectors with resilient shrouds having a maximum rated voltage exceeding 50 V, the gauge shown in Fig. 29 is used.

The gauges are applied with a force of 200 N for 1 minute.

20. BREAKING CAPACITY

16 A and 32 A accessories without interlock shall have adequate breaking capacity.

Test. Compliance shall be checked by testing socket-outlets and connectors by means of an appropriate test plug in an apparatus similar to that shown in Fig. 13.

The test plug is inserted into and withdrawn from the socket-outlet or connector 50 times at a rate of 7.5 strokes per minute; the rate of travel of the plug at the moment of separation being about 0.8 m/s.

NOTE. A stroke is an insertion or a withdrawal of the plug.

The samples are tested at 1.1 times maximum rated voltage and 1.25 times rated current.

The test is made with d.c. in a non-inductive circuit, except that accessories for a.c. only are tested with a.c. in a circuit such that $\cos \phi$ is 0.6 ± 0.05 , and accessories with a maximum rated voltage or rated current that is higher for a.c. than for d.c. are tested both with d.c. in a non-inductive circuit and with a.c. in a circuit such that $\cos \phi$ is 0.6 ± 0.05 .

Two-pole accessories with neutral contact (2P + N and 2P + N + $\overline{N}$) for a.c. only are connected to two phases and the neutral of a three-phase system.

The test is made using the connections shown in Fig. 14, except that for accessories having a maximum rated voltage of 415 V, the metal support is permanently connected to the neutral. In all other cases for two pole accessories the selector switch C connecting the metal support and the accessible metal parts to one of the poles of the supply is operated after half the number of strokes; for three pole accessories the selector switch is operated after one third of the number of strokes, and again after two thirds, so as to connect each pole in turn.

Resistors and inductors are not connected in parallel, except that, if an air-core inductor is used, a resistor taking approximately 1% of the current through the inductor is connected in parallel with it. Iron-core inductors may be used, provided the current has substantially sine-wave form. For the tests of three-pole accessories, three-core inductors are used.

During the test, no sustained arcing shall occur.

After the test, the samples shall show no damage impairing their further use and the entry holes for the pins shall not show any serious damage.

21. NORMAL OPERATION

a. Accessories shall withstand without excessive wear or other harmful effect, the mechanical, electrical and thermal stresses occurring in normal use.

Test. Compliance shall be checked for all socket-outlets and connectors by the test of Subclause *b* and for socket-outlets and connectors with spring lids by the additional test of Subclause *c*.

b. A plug is inserted into and withdrawn from the socket-outlet or connector at a rate of 7.5 strokes per minute, by means of the apparatus described in Clause 20, which is used in the manner indicated in that clause.

Accessories without interlock which have been subjected to the test of Clause 20, are tested with a.c. at maximum rated voltage and rated current in a circuit such that $\cos \phi$ is 0.6 ± 0.05 .

For accessories having a rated current of 16 A, the plug is inserted and withdrawn 5000 times, with the current flowing.

For accessories having a rated current exceeding 16 A but less than 63 A d.c. or 125 A a.c. the plug is inserted and withdrawn 2000 times; alternate pairs of strokes being made with and without current flowing.

For accessories having a rated current of at least 63 A d.c. or 125 A a.c., the plug is inserted and withdrawn 500 times without current flowing.

Accessories with interlock are tested without current flowing, the interlock being locked and released after each complete insertion of the plug.

After each 500 strokes, the pins of the plug are wiped with a dry cloth.

The test is made using the connections indicated in Clause 20, the selector switch C being operated as prescribed in that clause.

During the test, no sustained arcing shall occur.

After the test, the sample shall show:

No wear impairing the further use of the accessory or of its interlock, if any.

No deterioration of enclosures or barriers.

No damage to the entry holes for the contact-pins that might impair proper working.

No loosening of electrical or mechanical connections.

No seeping of sealing compound.

The sample shall then withstand an electric strength test made in accordance with Subclause 19c, the test voltage being, however, decreased by 500 V.

NOTE. The humidity treatment is not repeated before the electric strength test of this subclause.

c. Lid springs are tested by completely opening and closing the lid, the number of times the lid is opened being the same as the number of insertions of the plug specified in Subclause *b*.

NOTE. This test may be combined with the test of Subclause *b*.

22. TEMPERATURE RISE

Accessories shall be so constructed that the temperature rise in normal use is not excessive.

Test. Compliance shall be checked by the following test, which is made on socket-outlets and connectors. Rewirable accessories are fitted with conductors of the largest cross-sectional area specified in Table 4, the terminal screws or nuts being tightened with a torque equal to two thirds of that specified in Table 16. To ensure normal cooling of the terminals, a length of at least 1 m of the cable is connected to the terminals.

Non-rewirable accessories are tested as delivered.

A plug is inserted into the socket-outlet or connector, and an alternating current of the value shown in Table 10 is passed through the phase, earthing and neutral contacts. In addition a current of 22 A is passed through the pilot contact, if any.

TABLE 10

Rated current of the accessory	Test current
A	A
16	22
32	42
63	82
125	162

The duration of the test is:

1 hour for accessories having a rated current not exceeding 32 A.

2 hours for accessories having a rated current exceeding 32 A.

The temperature is determined by means of particles of known melting point, colour changing indicators or thermocouples, which are so chosen and positioned that they have negligible effect on the temperature being determined.

The temperature rise of terminals and contact tubes shall not exceed 45 degC.

At the completion of this test, the conductors are examined as described in Subclause 11g.

23. FLEXIBLE CABLES AND THEIR CONNECTIONS

a. Non-rewirable plugs and connectors shall be provided with a flexible cable or cord complying with one of the British Standards specified in Table 11 or other appropriate British Standards, the nominal cross-sectional area of the conductors being not less than the value shown.

TABLE 11

For metric cable sizes, see table in Appendix B

Rated current	Type of cable	Nominal cross-sectional area
A		in ²
16		0.003
32	BS 7*	0.01
63	BS 2004†	0.03
125	BS 3258‡	0.1

* BS 7, 'Rubber-insulated cables and flexible cords for electric power and lighting (for working voltages up to and including 11 kV)'.

† BS 2004, 'PVC-insulated cables and flexible cords for electric power and lighting'.

‡ BS 3258, 'Silicone-rubber-insulated cables and flexible cords'.

The core connected to the earthing terminal shall be identified by the colour combination green/yellow.

The nominal cross-sectional area of the earthing conductor and of the neutral conductor shall be at least equal to that of the phase conductors.

The pilot conductor, if any, shall have a nominal cross-sectional area of at least 0.003 in² (1.5 mm²).

Test. Compliance shall be checked by inspection and by measurement.

b. Plugs and connectors shall be provided with a cable-anchorage such that the conductors are relieved from strain, including twisting, where they are connected to the terminals or terminations and that their covering is protected from abrasion.

Cable-anchorages shall be so designed that the cable cannot touch accessible metal parts, or internal metal parts, such as cable-anchorage screws, if these are electrically connected to accessible metal parts.

c. For rewirable plugs and rewirable connectors:

It shall be clear how the relief from strain and the prevention of twisting is intended to be effected.

Cable-anchorages shall be of insulating material or be provided with an insulating lining fixed to the metal parts.

Cable-anchorages shall present no sharp edges to the cable and shall be so designed that their components are not liable to be lost when the accessory is dismantled.

Makeshift methods, such as tying the cable into a knot or tying the ends with string, shall not be used.

Cable-anchorages and cable-inlets shall be suitable for the different types of flexible cable which may be connected.

If a cable-inlet is provided with a sleeve to prevent damage to the cable, this sleeve shall be of insulating material and shall be smooth and free from burrs.

If a bell mouthed opening is provided, the diameter of the opening shall be at least 1.5 times the diameter of the largest cable to be connected.

NOTE. Helical springs, whether bare or covered with insulating material are not allowed as cable-sleeves.

Test. Compliance shall be checked by inspection and by the test of Subclause *d*.

d. Plugs and connectors provided with a suitable cable are subjected to a pull test in an apparatus similar to that shown in Fig. 15, followed by a torque test.

Non-rewirable accessories are tested as delivered.

Rewirable accessories are tested first with one and then with the other type of cable, shown in Table 12.

Conductors of the cable of rewirable accessories are introduced into the terminals, the terminal screws being tightened just sufficiently to prevent the conductors from easily changing their position.

The cable-anchorage is used in the normal way, clamping screws being tightened with a torque equal to two-thirds of that specified in Table 16. After reassembly of the sample, with cable glands, if any, in position, the component parts of the accessory shall fit snugly and it shall not be possible to push the cable into the sample to any appreciable extent.

TABLE 12

(Inch units)

Maximum rated voltage of the accessory	Rated current of the accessory	Type of cable or cord complying with BS 7*	Nominal cross-sectional area of copper conductor	Approximate overall diameter of cables and cords Type of accessory				
				2P	3P	2P + $\frac{1}{2}$	3P + $\frac{1}{2}$	3P + N + $\frac{1}{2}$
V	A	Table No.	in ²	in	in	in	in	in
Not exceeding 50	16 and 32 2 Pole	36	0.007 2 × 0.007†	0.490 2 × 0.490†	— —	— —	— —	— —
	16 and 32 3 Pole	36	0.007	—	0.530	—	—	
		34	0.0225	—	0.950	—	—	
	16	36	0.0017	—	—	0.365	0.395	
Over 50			0.0048	—	—	0.440	0.480	
	32	36	0.003	—	—	0.405	0.440	
		34	0.01	—	—	0.725	0.785	
	63	36	0.007	—	—	0.530	0.580	
		34	0.03	—	—	1.05	1.14	
	125	34	0.0225	—	—	0.95	1.03	
			0.1	—	—	1.68	1.83	

For metric dimensioned cables and cords see Appendix C.

* BS 7, 'Rubber-insulated cables and flexible cords for electric power and lighting (for working voltages up to and including 11 kV)'.

† Test is made with two twin-core 0.007 in² cables.

The sample is fixed in the test apparatus so that the axis of the cable is vertical where it enters the sample.

Test. The cable shall be subjected 100 times to a pull of the value shown in Table 13. Each pull is applied without jerks and has a duration of 1 second.

Immediately afterwards, the cable is subjected for 1 minute to a torque of the value shown in Table 13.

TABLE 13

Rated current of the accessory	Pull	Torque
A	N	N m
16	80	0.35
32	100	0.425
63	120	0.80
125	200	1.50

During the tests, the cable shall not be damaged.

After the tests, the cable shall not have been displaced by more than 2 mm. For rewirable accessories, the ends of the conductors shall not have moved noticeably in the terminals; for non rewirable accessories, there shall be no break in the electrical connections.

For the measurement of the longitudinal displacement a mark is made on the cable while it is subjected to the pull, at a distance of approximately 20 mm from the end of the sample or the cable-anchorage, before starting the tests. If, for non-rewirable accessories, there is no definite end to the sample, an additional mark is made on the body of the sample.

After the tests, the displacement of the mark on the cable in relation to the sample or the cable anchorage is measured while the cable is subjected to the pull.

24. MECHANICAL STRENGTH

a. Accessories shall have adequate mechanical strength.

Test. Compliance shall be checked by the appropriate tests of Subclauses *b* to *e*.

Before commencing the tests of Subclauses *b* or *c*, accessories with an enclosure of resilient material are placed with their bases in a refrigerator at a temperature of minus $25 \pm 2^\circ\text{C}$ where they are maintained during at least 16 hours; then they are removed from the refrigerator and immediately subjected to the test of Subclause *b* or *c* as appropriate.

b. Blows are applied to the sample under test by means of the spring-operated impact-test apparatus shown in Fig. 16.

The apparatus consists of three main parts, the body, the striking element and the spring-loaded release cone.

The body comprises the housing, the striking element guide, the release mechanism and all parts rigidly fixed thereto. The mass of this assembly is 1250 g.

The striking element comprises the hammer head, the hammer shaft and the cocking knob. The mass of this assembly is 250 g.

The hammer head has a hemispherical face made of a polyamide resin having a Rockwell hardness of R 100, with a radius of 10 mm; it is fixed to the hammer shaft in such a way that the distance from its tip to the plane of the front of the cone, when the striking element is on the point of release, is 20 mm.

The cone has a mass of 60 g and the cone spring is such that it exerts a force of 20 N when the release jaws are on the point of releasing the striking element.

The hammer spring is such that the product of the compression, in millimetres, and the force exerted, in newtons, equals 1 000, the compression being approximately 20 mm. The spring is adjusted so as to cause an impact energy of 1 ± 0.05 N m.

The release mechanism springs are adjusted so that they exert just sufficient pressure to keep the release jaws in the engaged position.

The apparatus is cocked by pulling the cocking knob back until the release jaws engage with the groove in the hammer shaft.

The blows are applied by pushing the release cone against the sample in a direction perpendicular to the surface at the point to be tested.

The pressure is slowly increased so that the cone moves back until it is in contact with the release bars, which then move to operate the release mechanism and allow the hammer to strike.

The sample is fixed as in normal use to a rigid support. Cable entries are left open and fixing screws of covers and enclosures are tightened with a torque equal to that shown in Table 16.

Three blows are applied to every point that is likely to be weak.

After the test, the sample shall show no damage. In particular, live parts shall not have become accessible and the enclosure shall show no crack visible to the naked eye.

Watertight accessories shall withstand the immersion test specified in Subclause 18a.

Accessories with enclosures of resilient material, shall withstand the test of Subclause 19d.

NOTE. Damage to the finish, small dents which do not reduce creepage distances or clearances below the values specified in Table 17 and small chips in the enclosure which do not adversely affect the protection against electric shock or moisture may be neglected.

Cracks not visible to the naked eye and surface cracks in reinforced mouldings, may be neglected.