

Australian/New Zealand Standard™

**Plugs and socket-outlets for household  
and similar purposes**

**Part 1: General requirements  
(IEC 60884-1, Ed.3.1 (2006) MOD)**



## **AS/NZS 60884.1:2013**

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-004, Electrical Accessories. It was approved on behalf of the Council of Standards Australia on 4 March 2013 and on behalf of the Council of Standards New Zealand on 4 April 2013.

This Standard was published on 19 April 2013.

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The following are represented on Committee EL-004:

Australian Industry Group  
Consumer Electronics Suppliers Association  
Consumer Federation of Australia  
Electrical Compliance Testing Association  
Electrical Regulatory Authorities Council  
Engineers Australia  
International Accreditation New Zealand  
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*This Standard was issued in draft form for comment as DR AS/NZS 60884.1.*

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# Australian/New Zealand Standard™

## Plugs and socket-outlets for household and similar purposes

### Part 1: General requirements (IEC 60884-1, Ed.3.1 (2006) MOD)

First published as AS/NZS 60884.1:2013.

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ISBN 978 1 74342 398 1

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-004, Electrical Accessories.

This Standard will exist in parallel with AS/NZS 3112, *Approval and test specification—Plugs and socket-outlets*. This Standard and AS/NZS 3112 cover the requirements for plugs and socket outlets and either Standard may be used.

The objective of this Standard is to provide requirements and test methods for plugs and socket-outlets.

The essential safety requirements in AS/NZS 3820, *Essential safety requirements for electrical equipment* that could be applicable to plugs and socket-outlets are covered by this Standard.

This Standard is an adoption with national modifications and has been reproduced from IEC 60884-1, Ed.3.1 (2006), *Plugs and socket-outlets for household and similar purposes—Part 1: General requirements*, and has been varied as indicated to take account of Australian/New Zealand conditions. The modifications are set out in Appendix ZZ.

This Standard is structured in the following layout:

- (a) Preface
- (b) IEC 60884-1, Ed. 3.1 (2006) (unedited from the contents pages to the final clause of the source document)
- (c) Appendix ZZ—Australian/New Zealand variations to the source document.

The variations listed in Appendix ZZ address issues including the following:

- (i) Requirements for mounting and installing fixed socket-outlets.
- (ii) Requirements for plugs, including rewirable plugs and plug pins.
- (iii) Dimensional requirements for plug and socket-outlets.
- (iv) Requirements for switches.
- (v) Flammability.

As this Standard is reproduced from an International Standard, the following applies:

- (1) In the source text ‘this part of IEC 60884’ should read ‘this Australian/New Zealand Standard’.
- (2) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

| <i>Reference to International Standard</i> |                                                                               | <i>Australian/New Zealand Standard</i> |                                                                               |
|--------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------|
| IEC                                        |                                                                               | AS                                     |                                                                               |
| 60050                                      | International Electrotechnical Vocabulary                                     | 1852                                   | International electrotechnical vocabulary                                     |
| 60050-826                                  | Electrical installations of buildings                                         | 1852.826                               | Electrical installations of buildings                                         |
| 60068                                      | Environmental testing                                                         | 60068                                  | Environmental testing                                                         |
| 60068-2-30                                 | Part 2-30: Tests—Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle) | 60068.2.30                             | Part 2.30: Tests—Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle) |
| 60068-2-32                                 | Part 2-32: Tests—Test Ed: Free fall (Procedure 1)                             | 60068.2.32                             | Part 2.32: Tests—Test Ed: Free fall (Procedure 1)                             |

|            |                                                                                                    |            |                                                                                                                        |
|------------|----------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------|
| IEC        |                                                                                                    | AS/NZS     |                                                                                                                        |
| 60227      | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V                | 3191       | Electric flexible cords                                                                                                |
| 60227-5    | Part 5: Flexible cables (cords)                                                                    | 60227.5    | Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V<br>Part 5: Flexible cables (cords) |
| 60245      | Rubber insulated cables—Rated voltages up to and including 450/750 V                               | 3191       | Electric flexible cords                                                                                                |
| 60695      | Fire hazard testing                                                                                | 60695      | Fire hazard testing                                                                                                    |
| 60695-2-10 | Part 2-10: Glowing/hot-wire based test methods—Glow-wire apparatus and common test procedure       | 60695.2.10 | Part 2.10: Glowing/hot-wire based test methods—Glow-wire apparatus and common test procedure                           |
| 60695-2-11 | Part 2-11: Glowing/hot-wire based test methods—Glow-wire flammability test method for end-products | 60695.2.11 | Part 2.11: Glowing/hot-wire based test methods—Glow-wire flammability test method for end-products                     |
| ISO        |                                                                                                    | AS         |                                                                                                                        |
| 2093       | Electroplated coatings of tin—Specification and test methods                                       | 4169       | Electroplated coatings—Tin and tin alloys (ISO 2093:1986, MOD)                                                         |

Only international references that have been adopted as Australian or Australian/New Zealand Standards have been listed.

The terms ‘normative’ and ‘informative’ are used to define the application of the annex or appendix to which they apply. A normative annex or appendix is an integral part of a standard, whereas an informative annex or appendix is only for information and guidance.

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## FOREWORD

This consolidated version of IEC 60884-1 is based on the third edition (2002) [documents 23B/658/FDIS and 23B/664/RVD] and its amendment 1 (2006) [documents 23B/816/FDIS and 23B/821/RVD].

It bears the edition number 3.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annexes A and B form an integral part of this standard.

Annex C is for information only.

NOTE In this standard, the following print types are used.

- Requirements proper: in roman type;
- *Test specification: in italic type;*
- Explanatory matter: in smaller roman type.

## AUSTRALIAN/NEW ZEALAND STANDARD

**Plugs and socket-outlets for household and similar purposes****Part 1:****General requirements (IEC 60884-1, Ed.3.1 (2006) MOD)****1 Scope**

This part of IEC 60884 applies to plugs and fixed or portable socket-outlets for a.c. only, with or without earthing contact, with a rated voltage greater than 50 V but not exceeding 440 V and a rated current not exceeding 32 A, intended for household and similar purposes, either indoors or outdoors.

The rated current is limited to 16 A maximum for fixed socket-outlets provided with screwless terminals.

This standard does not cover requirements for flush mounting boxes: however, it covers only those requirements for surface-type mounting boxes which are necessary for the tests on the socket-outlet.

NOTE 1 General requirements for mounting boxes are given in IEC 60670.

This standard also applies to plugs incorporated in cord sets, to plugs and portable socket-outlets incorporated in cord extension sets and to plugs and socket-outlets which are a component of an appliance, unless otherwise stated in the standard for the relevant appliance.

This standard does not apply to

- plugs, socket-outlets and couplers for industrial purposes;
- appliance couplers;
- plugs, fixed and portable socket-outlets for ELV;

NOTE 2 ELV values are specified in IEC 60364-4-41.

- fixed socket-outlets combined with fuses, automatic switches, etc.

NOTE 3 Socket-outlets with pilot lights are allowed provided that pilot lights comply with the relevant standard, if any.

*Plugs and fixed or portable socket-outlets complying with this standard are suitable for use at ambient temperatures not normally exceeding 25 °C, but occasionally reaching 35 °C.*

NOTE 4 Socket-outlets complying with this standard are only suitable for incorporation in equipment in such a way and in such a place that it is unlikely that the surrounding temperature exceeds 35 °C.

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

**2 Normative references**

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

IEC 60050-151:2001, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

- IEC 60050-442:1998, *International Electrotechnical Vocabulary – Part 442: Electrical accessories*
- IEC 60050-826:1982, *International Electrotechnical Vocabulary – Part 826: Electrical installations of buildings*
- IEC 60068-2-30:1980, *Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*
- IEC 60068-2-32:1975, *Environmental testing – Part 2: Tests – Test Ed: Free fall (Procedure 1)*
- IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*
- IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*
- IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*
- IEC 60417-2:1998, *Graphical symbols for use on equipment – Part 2: Symbol originals*
- IEC 60423:1993, *Conduits for electrical purposes – Outside diameters of conduits for electrical installations and threads for conduits and fittings*
- IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*
- IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*
- IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*
- IEC 60884-2-6:1997, *Plugs and socket-outlets for household and similar purposes – Part 2-6: Particular requirements for switched socket-outlets with interlock for fixed electrical installations*
- IEC 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm<sup>2</sup> up to 35 mm<sup>2</sup> (included)*
- IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*
- IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*
- ISO 1456:1988, *Metallic coatings – Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium*
- ISO 1639:1974, *Wrought copper alloys – Extruded sections – Mechanical properties*<sup>1)</sup>
- ISO 2039-2:1987, *Plastics – Determination of hardness – Part 2: Rockwell hardness*
- ISO 2081:1986, *Metallic coatings – Electroplated coatings of zinc on iron or steel*
- ISO 2093:1986, *Electroplated coatings of tin – Specification and test methods*

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<sup>1)</sup> Withdrawn

### 3 Definitions

For the purposes of this part of IEC 60884, the definitions given in IEC 60050(151) as well as the following definitions apply.

NOTE 1 Where the terms "voltage" and "current" are used, they imply r.m.s. values, unless otherwise specified.

NOTE 2 Throughout this standard the word "earthing" is used for "protective earthing".

NOTE 3 The term "accessory" is used as a general term covering plugs and socket-outlets; the term "portable accessory" covers plugs and portable socket-outlets. Examples of the use of accessories are shown in figure 1a.

NOTE 4 Throughout this standard the term "socket-outlet" covers both fixed and portable socket-outlets, except where the reference is specific to one type or the other.

#### 3.1

##### **plug**

accessory having pins designed to engage with the contacts of a socket-outlet, also incorporating means for the electrical connection and mechanical retention of flexible cable

#### 3.2

##### **socket-outlet**

accessory having socket-contacts designed to engage with the pins of a plug and having terminals for the connection of cable

#### 3.3

##### **fixed socket-outlet**

socket-outlet intended to be connected to fixed wiring

#### 3.4

##### **portable socket-outlet**

socket-outlet intended to be connected to, or integral with, the flexible cable and which can easily be moved from one place to another while connected to the supply

#### 3.5

##### **multiple socket-outlet**

combination of two or more socket-outlets

NOTE An example is shown in figure 1b.

#### 3.6

##### **socket-outlet for appliances**

socket-outlet intended to be built in, or fixed to, appliances

#### 3.7

##### **rewirable plug or rewirable portable socket-outlet**

accessory so constructed that the flexible cable can be replaced

#### 3.8

##### **non-rewirable plug or non-rewirable portable socket-outlet**

accessory so constructed that it forms a complete unit with the flexible cable after connection and assembly by the manufacturer of the accessory (see also 14.1)

#### 3.9

##### **moulded-on accessory**

non-rewirable portable accessory, the manufacture of which is completed by insulating material moulded around pre-assembled component parts and the terminations for the flexible cable

[IEV 442-01-14, modified]

**3.10****mounting box**

box intended for mounting in or on a wall, floor or ceiling, etc., for flush or surface application, intended for use with fixed socket-outlet(s)

**3.11****cord set**

assembly consisting of one flexible cable fitted with one plug and one single connector, intended for the connection of an electrical appliance to the electrical supply

**3.12****cord extension set**

assembly consisting of one flexible cable fitted with one plug and one single or multiple portable socket-outlet

**3.13****terminal**

insulated or non-insulated connecting device intended for reusable electrical connection of the external conductors

**3.14****termination**

insulated or non-insulated connecting device intended for non-reusable electrical connection of the external conductors

**3.15****clamping unit**

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

**3.16****screw-type terminal**

terminal for the connection and subsequent disconnection of a conductor or the interconnection of two or more conductors, capable of being dismantled, the connection being made, directly or indirectly, by means of screws or nuts of any kind

**3.17****pillar terminal**

screw-type terminal 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 2.

**3.18****screw terminal**

screw-type terminal in which the conductor is clamped under the head of the screw.

The clamping pressure may be applied directly to the head of a screw or through an intermediate part, such as a washer, clamping plate or anti-spread device

NOTE Examples of screw terminals are shown in figure 3.

**3.19****stud terminal**

screw-type 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

NOTE Examples of stud terminals are shown in figure 3.

**3.20****saddle terminal**

screw-type terminal 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 4.

**3.21****mantle terminal**

screw-type 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

NOTE Examples of mantle terminals are shown in figure 5.

**3.22****screwless terminal**

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

**3.23****thread-forming screw**

screw having an uninterrupted thread, which by screwing in, forms a thread by displacing material

NOTE An example of a thread-forming screw is shown in figure 6.

**3.24****thread-cutting screw**

screw having an interrupted thread, which by screwing in, forms a thread by removing material

NOTE An example of a thread-cutting screw is shown in figure 7.

**3.25****rated voltage**

voltage assigned to the plug or socket-outlet by the manufacturer, which will be that specified in the standard sheet, if any

**3.26****rated current**

current assigned to the plug or socket-outlet by the manufacturer, which will be that specified in the standard sheet, if any

**3.27****shutter**

movable part incorporated into a socket-outlet arranged to shield at least the live socket-outlet contacts automatically when the plug is withdrawn

**3.28****type test**

test of one or more devices made to a certain design to show that the design meets certain specifications

**3.29****routine test**

test to which each individual device is subjected during and/or after manufacture to ascertain whether it complies with certain criteria

**3.30****base**

part of the socket-outlet supporting the socket-contacts

**3.31****live part**

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

[IEV 826-03-01]

**3.32****cable anchorage**

that part of an accessory which has the ability to limit the displacement of a fitted flexible cable against pull, push and turning forces

**3.33****main part**

part carrying the socket contacts

**4 General requirements**

Accessories and surface-type mounting boxes shall be so designed and constructed that, in normal use, their performance is reliable and without danger to the user or the surroundings within the meaning of this standard.

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

**5 General remarks on tests**

**5.1** *Tests shall be made to prove compliance with the requirements laid down in this standard, where applicable.*

*Tests are made as follows:*

- *type tests shall be made on representative specimens of each accessory;*
- *routine tests shall be made on each accessory manufactured according to this standard, where applicable.*

*Subclauses 5.2 to 5.5 are applicable to type tests and 5.6 to routine tests.*

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

*Non-rewirable accessories are tested with the type and size of flexible cable as delivered; those not incorporated in a cord set or a cord extension set, or which are not a component of equipment, shall be provided, for testing, with at least 1 m of flexible cable.*

*Non-rewirable multiple portable socket-outlets are tested with flexible cables as delivered.*

*Socket-outlets which do not comply with any accepted standard sheet are tested together with the corresponding boxes.*

*Socket-outlets which require a box to complete their enclosure are tested with their boxes.*

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

*In case of doubt, the tests are made at an ambient temperature of  $(20 \pm 5)$  °C.*

*Plugs and socket-outlets are tested separately.*

*The neutral, if any, is treated as a pole.*

**5.4** *Three specimens are subjected to all the relevant tests.*

*For the tests of 12.3.11, additional specimens of socket-outlets having in total at least five screwless terminals are required.*

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

*For each of the tests of 13.22 and 13.23, three additional specimens of separate membranes, or of accessories incorporating membranes, are required.*

*For non-rewirable accessories, six additional specimens are required for the test of 23.2 and 23.4.*

*For the tests of Clauses 20 and 21 additional specimens may be necessary (see Clauses 20 and 21, and Figure 43).*

*For the test of 24.10, three additional specimens are required.*

*For the test of clause 28, three additional specimens may be necessary.*

NOTE A table showing the number of specimens needed for the tests is given in annex B.

**5.5** *The specimens are submitted to all the relevant tests and the requirements are satisfied if all the tests are met.*

*If one specimen does not satisfy a test due to an assembly or a manufacturing fault, that test and any preceding one which may have influenced the results of the test shall be repeated, and also the tests which follow shall be made in the required sequence on another full set of specimens, all of which shall comply with the requirements.*

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

**5.6** Routine tests are specified in annex A.

## 6 Ratings

**6.1** Accessories should preferably be of a type and preferably have a voltage and current rating as shown in table 1.

**Table 1 – Preferred combinations of types and ratings**

| Type                                                                                                                                                                                                                                                                                 | Rated voltage<br>V | Rated current<br>A |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|
| 2P (non-rewirable plugs only)                                                                                                                                                                                                                                                        | 130 or 250         | 2,5                |
| 2P (plugs only)                                                                                                                                                                                                                                                                      | 130 or 250         | 6                  |
| 2P<br>2P +                                                                                                                                                                                        | 130 or 250         | 10<br>16<br>32     |
| 2P + <br>3P + <br>3P + N +  | 440                | 16<br>32           |
| NOTE Standardized values and configurations of existing systems are reported in IEC 60083.                                                                                                                                                                                           |                    |                    |

NOTE In the following countries fixed 2P socket-outlets are not allowed: AT, CH, DE, IT.

**6.2** In a cord extension set, the rated current of the portable socket-outlet shall not be higher and the rated voltage shall not be less than that of the plug.

*Compliance is checked by inspection of the marking.*

**6.3** Accessories should preferably have a degree of protection IP20, IP40, IP44, IP54 or IP55.

## 7 Classification

### 7.1 Accessories classification

**7.1.1** Classification according to the degree of protection against access to hazardous parts and against harmful effects due to the ingress of solid foreign objects

- IP2X: accessories protected against access to hazardous parts with a finger and against harmful effects due to ingress of solid foreign objects of 12,5 mm diameter and greater

- IP4X: accessories protected against access to hazardous parts with a wire and against harmful effects due to ingress of solid foreign objects of 1,0 mm diameter and greater
- IP5X: accessories protected against access to hazardous parts with a wire and dust protected

**7.1.2** Classification according to the degree of protection against harmful effects due to the ingress of water

- IPX0: accessories not protected against ingress of water
- IPX4: accessories protected against splashing water
- IPX5: accessories protected against water jets

NOTE For an explanation of IP codes see IEC 60529.

**7.1.3** Classification according to the provision for earthing

- Accessories without earthing contact
- Accessories with earthing contact

**7.1.4** Classification according to the method of connecting the cable

- Rewirable accessories
- Non-rewirable accessories

**7.1.5** Classification according to the type of terminals

- Accessories with screw-type terminals
- Accessories with screwless terminals for rigid conductors only
- Accessories with screwless terminals for rigid and flexible conductors

## **7.2 Socket-outlets classification**

**7.2.1** Classification according to the degree of protection against electric shock

Socket-outlets are classified according to the degree of protection against electric shock when mounted as for normal use:

- a) socket-outlets with normal protection (see 10.1), or
- b) socket-outlets with increased protection (see 10.7).

NOTE Socket-outlets with increased protection may be socket-outlets with or without shutters.

**7.2.2** Classification according to the existence of shutters

Socket-outlets are classified according to the existence of shutters, in

- a) socket-outlets without shutters, or
- b) socket-outlets with shutters (see 10.5).

NOTE In the following countries, socket-outlets without shutters are not allowed: IT.

### 7.2.3 Classification according to the method of application/mounting of the socket-outlet:

Socket-outlets are classified according to the method of application/mounting of the socket-outlet, in

- a) surface type,
- b) flush type,
- c) semi flush type,
- d) panel type,
- e) architrave type,
- f) portable type,
- g) table type (single or multiple),
- h) floor recessed type, or
- i) appliance type socket-outlets.

### 7.2.4 Classification according to the method of installation

Socket-outlets are classified according to the method of installation, as a consequence of the design, in

- a) fixed socket-outlets where the cover or cover-plate can be removed without displacement of the conductors (design A), or
- b) fixed socket-outlets where the cover or cover-plate cannot be removed without displacement of the conductors (design B).

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

### 7.2.5 Classification according to the intended use

Socket-outlets are classified according to intended use, in

- a) socket-outlets for circuits where a single earthing circuit provides protective earthing for connected equipment and exposed conductive parts of the socket-outlet, if any;
- b) socket-outlets for circuits where electrical noise immunity is desired for the earthing circuit of connected equipment. The equipment earthing circuit is electrically separated from the protective earthing circuit provided for the exposed conductive parts of the socket-outlet, if any.

## 7.3 Plugs classification

Plugs are classified according to the class of equipment to which they are intended to be connected in

- plugs for equipment of class 0,
- plugs for equipment of class I, or
- plugs for equipment of class II.

For the description of the classes of equipment, see IEC 61140.

NOTE Plugs for equipment of class 0 are permitted in the following countries: DK, FI, JP, NL, PT, SE.

## 8 Marking

### 8.1 Accessories shall be marked as follows:

- rated current in amperes;
- rated voltage in volts;
- symbol for nature of supply;
- manufacturer's or responsible vendor's name, trade mark or identification mark;
- type reference which may be a catalogue number;
- first characteristic numeral for the degree of protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects, if declared to be higher than 2, in which case the second characteristic numeral shall also be marked;
- second characteristic numeral for the degree of protection against harmful effects due to ingress of water, if declared to be higher than 0, in which case the first characteristic numeral shall also be marked.

If the system allows plugs of a certain IP rating to be introduced into socket-outlets having another IP rating, attention should be drawn to the fact that the resulting degree of protection of the combination plug/socket-outlet is the lower of the two. They shall be stated in the manufacturer's literature related to the socket-outlet.

NOTE 1 The degrees of protection are based on IEC 60529.

In addition, socket-outlets with screwless terminals shall be marked with the following:

- an appropriate marking indicating the length of insulation to be removed before the insertion of the conductor into the screwless terminal,
- an indication of the suitability to accept rigid conductors only, for those socket-outlets having this restriction.

NOTE 2 The additional markings may be put on the socket-outlet, on the packaging unit and/or given in an instruction sheet which accompanies the socket-outlet.

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

|                                                                                                                |                                                                                            |
|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Amperes.....                                                                                                   | A                                                                                          |
| Volts.....                                                                                                     | V                                                                                          |
| Alternating current.....                                                                                       | ~                                                                                          |
| Neutral .....                                                                                                  | N                                                                                          |
| Protective earth .....                                                                                         |       |
| Degree of protection, when relevant.....                                                                       | IPXX                                                                                       |
| Degree of protection for fixed accessories to be installed on rough surfaces<br>(test wall of figure 15) ..... |  IPXX |
| For screwless terminals: suitability to accept rigid conductors only .....                                     | r                                                                                          |

NOTE 1 Details of construction of symbols are given in IEC 60417-2.

NOTE 2 In the IP code the letter "X" is replaced by the relevant number.

NOTE 3 Lines formed by the construction of the tool are not considered as part of the marking.

For the marking with rated current and rated voltage the figures may be used alone. These figures shall be placed on one line separated by an oblique line or the figure for rated current shall be placed above the figure for rated voltage, separated by a horizontal line.

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

NOTE 4 The marking for current, voltage and nature of supply may be, for example, as follows:

$$16 \text{ A } 440 \text{ V} \sim \text{ or } 16/440 \sim \text{ or } \frac{16}{440} \sim$$

**8.3** For fixed socket-outlets the following marking shall be placed on the main part:

- rated current, rated voltage and nature of supply;
- either the name, trade mark or identification mark of the manufacturer or of the responsible vendor;
- length of insulation to be removed before the insertion of the conductor into the screwless terminal, if any;
- the type reference, which may be a catalogue number.

NOTE 1 The type reference may be the series reference only.

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

NOTE 2 Additional type references may be marked on the main part, or on the outside of the associated enclosure.

The IP code, if applicable, shall be marked so as to be easily discernible when the socket-outlet is mounted and wired as for normal use.

Fixed socket-outlets classified according to item b) of 7.2.5 shall be identified by a triangle which shall be visible after installation unless they have an interface configuration which is different from that used in normal circuits.

NOTE 4 In the following countries an orange triangle is required by the national installation rules: CA, US.

**8.4** For plugs and portable socket-outlets the marking specified in 8.1, other than the type reference, shall be easily discernible when the accessory is wired and assembled.

Plugs and portable socket-outlets for equipment of class II shall not be marked with the symbol for class II construction.

NOTE The type reference of rewirable portable accessories may be marked on the inside of the enclosure or cover.

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

Earthing terminals for the connection of the protective conductor shall be indicated by the symbol .

These markings shall not be placed on screws, or any other easily removable parts.

NOTE 1 "Easily removable parts" are those parts which can be removed during the normal installation of the socket-outlet or the assembly of the plug.

NOTE 2 Terminations in non-rewirable accessories need not be marked.

Terminals provided for the connection of conductors not forming part of the main function of the socket-outlets shall be clearly identified unless their purpose is self-evident, or indicated in a wiring diagram which shall be fixed to the accessory.

The indication of such terminals may be achieved by

- their being marked with graphical symbols according to IEC 60417-2 or colours and/or alphanumeric system, or
- their being marked with their physical dimensions or relative location.

Leads of neon or indicator lamps are not considered to be conductors in the context of this subclause.

**8.6** For surface-type mounting boxes forming an integral part of socket-outlets having an IP code higher than IP20, the IP code shall be marked on the outside of its associated enclosure so as to be easily discernible when the socket-outlet is mounted and wired as in normal use.

**8.7** It shall be indicated either by marking or in a manufacturer's catalogue or instruction sheet in which position or with which special provisions (for example, box, type of mounting surface, plug, etc.) the declared degree of protection of flush-type and semi-flush-type fixed socket-outlets having an IP code higher than IPX0 is ensured.

*Compliance is checked by inspection.*

**8.8** Marking shall be durable and easily legible.

*Compliance is checked by inspection and by the following test.*

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

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

NOTE 2 It is recommended that the petroleum spirit used consists of a solvent hexane with an aromatic content of maximum 0,1 volume percentage, a kauributanol value of approximately 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a density of approximately 0,68 g/cm<sup>3</sup>.

## 9 Checking of dimensions

**9.1** Accessories and surface-type mounting boxes shall comply with the appropriate standard sheets and corresponding gauges for plug and socket-outlets systems, if any.

Insertion of plugs into fixed or portable socket-outlets shall be ensured by their compliance with the relevant standard sheets.

*Compliance is checked as follows.*

*Socket-outlets are first subjected to 10 insertions and 10 withdrawals of a plug complying with the corresponding standard sheet having the maximum dimensions for the pins following which dimensions are checked by measurement and/or by means of gauges.*

*The manufacturing tolerances of these gauges shall be as shown in table 2 if not otherwise specified. The most unfavourable dimensions of the standard sheet shall be used for the design of the gauges.*

NOTE In some cases (for example, distances between centres), it may be necessary to check both the extreme dimensions.

Table 2 – Gauge tolerances

| Gauge for checking                                                                              | Gauge tolerance<br>mm                                                                                        |
|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Pin diameter or pin thickness                                                                   | 0<br>–0,01                                                                                                   |
| Dimension of entry holes corresponding to pin diameter and to distance between contact surfaces | +0,01<br>0                                                                                                   |
| Pin length and width                                                                            | 0<br>–0,1                                                                                                    |
| Pin spacing                                                                                     | $\begin{matrix} 0 \\ -0,02 \end{matrix}$ or $\begin{matrix} +0,02 \\ 0 \end{matrix}$ (according to the case) |
| Distance from the engagement face to point of first electrical contact (for socket-outlet)      | $\begin{matrix} 0 \\ -0,05 \end{matrix}$ or $\begin{matrix} +0,05 \\ 0 \end{matrix}$ (according to the case) |
| Guiding elements                                                                                | ±0,03                                                                                                        |

**9.2** It shall not be possible, within a given system, to engage a plug with

- a socket-outlet having a higher voltage rating or a lower current rating;
- a socket-outlet with a different number of live poles; exceptions may be admitted for socket-outlets which are specially constructed for the purpose of allowing engagement with plugs of a lower number of poles, provided that no dangerous situation can arise, for example a connection between a live pole and an earthing contact or the interruption of the earthing circuit;
- a socket-outlet with earthing contact, if the plug is a plug for class 0 equipment.

It shall not be possible to engage a plug for equipment of class 0 or of class I with a socket-outlet exclusively designed to accept plugs for class II equipment.

*Compliance is checked by inspection or by manual test using gauges, the manufacturing tolerances of which shall be as specified in table 2.*

In case of doubt, the impossibility of insertion is checked by applying the appropriate gauge for 1 min with a force of 150 N for accessories with a rated current not exceeding 16 A, or 250 N for other accessories.

Where the use of elastomeric or thermoplastic material is likely to influence the result of the test, it is carried out at an ambient temperature of  $(35 \pm 2) ^\circ\text{C}$ , both the accessories and the gauges being at this temperature.

NOTE For accessories of rigid material, such as thermosetting resins, ceramic material and the like, conformity to the relevant standard sheets ensures compliance with the requirement.

**9.3** Deviations from the dimensions specified in the standard sheets may be made, but only if they provide a technical advantage and do not adversely affect the purpose and safety of accessories complying with the standard sheet, especially with regard to interchangeability and non-interchangeability.

Accessories with such deviations shall, however, comply with all other requirements of this standard as far as they reasonably apply.

## 10 Protection against electric shock

NOTE For the purposes of this clause, lacquer, enamel and sprayed insulating coatings are not considered as insulating material.

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

Live parts of plugs shall not be accessible when the plug is in partial or complete engagement with a socket-outlet.

NOTE In the following countries this requirement does not apply when the plug is partially engaged: CH, CA, DK, JP, US.

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

*The test is made on the specimen mounted as for normal use and fitted with conductors of the smallest nominal cross-sectional area, the test being then repeated using conductors of the largest nominal cross-sectional area, specified in table 3.*

*The standard test finger, test probe B of IEC 61032, is applied in every possible position, an electrical indicator with a voltage between 40 V and 50 V being used to show contact with the relevant parts.*

*For plugs, the test finger is applied when the plug is in partial and complete engagement with a socket-outlet.*

*For accessories where the use of thermoplastic or elastomeric material is likely to influence the requirements, one additional test is made but at an ambient temperature of  $(35 \pm 2)^\circ\text{C}$ , the accessories being at this temperature.*

*During this additional test the accessories are subjected for 1 min to a force of 75 N, applied through the tip of a straight unjointed test finger, test probe 11 of IEC 61032. 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 accessory, but is not applied to membranes or the like and is applied to thin-walled knock-outs but with a force of 10 N.*

*During this test, accessories, with their associated mounting means, shall not deform to such an extent that those dimensions shown in the relevant standard sheets which ensure safety are unduly altered and no live parts shall be accessible.*

*Each specimen of plug or portable socket-outlet is then pressed between two flat surfaces with a force of 150 N for 5 min, as shown in figure 8. The specimen is checked 15 min after removal from the test apparatus, and shall not show such deformation as it would result in undue alteration of those dimensions shown in the relevant standard sheets which ensure safety.*

**10.2** Parts which are accessible when the accessory is wired and mounted as for normal use, with the exception of small screws and the like, isolated from live parts, for fixing bases and covers or cover-plates of socket-outlets, shall be made of insulating material; however, the covers or cover-plates of fixed socket-outlets and accessible parts of plugs and portable socket-outlets may be made of metal if the requirements given in 10.2.1 or 10.2.2 are fulfilled.

**10.2.1** Metal covers or cover-plates are protected by supplementary insulation made by insulating linings or insulating barriers fixed to covers or cover-plates or to the body of accessories, in such a way that the insulating linings or insulating barriers cannot be removed without being permanently damaged, or 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 and there is no risk of accidental contact between live parts and metal covers or cover-plates, for example through their fixing screws, even if a conductor should come away from its terminal, and if precautions are taken in order to prevent creepage distances or clearances becoming less than the values specified in table 23.

In the case of single-pole insertion, the requirement given in 10.3 applies.

*Compliance is checked by inspection.*

The above linings or barriers shall comply with the tests of clauses 17 and 27.

**10.2.2** Metal covers or cover-plates are automatically connected, through a low resistance connection, to the earth during fixing of the cover or the cover-plate itself.

The creepage distances and the clearances between the live pins of a plug when fully inserted and the earthed metal cover of a socket-outlet shall comply with items 2 and 7 of table 23, respectively; in addition, in the case of single-pole insertion, the requirement given in 10.3 applies.

NOTE 1 Fixing screws or other means are allowed.

NOTE 2 In the following countries this alternative is not allowed: FI, DK (only IPX0 equipment), NO, FI, SE (only portable accessories).

*Compliance is checked by inspection and by the tests of 11.5.*

**10.3** It shall not be possible to make contact between a pin of a plug and a live socket-contact of a socket-outlet while any other pin is accessible.

*Compliance is checked by manual test and by means of gauges based on the most unfavourable dimensions of the standard sheet, the tolerances of the gauges shall be as specified in table 2.*

*For accessories with enclosures or bodies of thermoplastic material, the test is made at an ambient temperature of  $(35 \pm 2) ^\circ\text{C}$ , both the accessory and the gauge being at this temperature.*

*For socket-outlets with enclosures or bodies of rubber or polyvinyl chloride, the gauge is applied with a force of 75 N for 1 min.*

*For fixed socket-outlets provided with metal covers or cover-plates, a clearance, between a pin and a socket-contact, of at least 2 mm is required, when another pin is or other pins are in contact with the metal covers or cover-plates.*

NOTE 1 Single-pole insertion may be prevented by the use of at least one of the following means:

- a sufficiently large cover or cover-plate;
- other means (for example, shutters).

NOTE 2 In the following countries the use of a shutter as the only means to prevent single-pole insertion is not allowed: AT, BE, CA, CZ, DE, ES, FI, NL, PT, UK, US.

**10.4** External parts of plugs, with the exception of assembly screws and the like, current-carrying and earthing pins, earthing straps and metal rings around pins and accessible metal parts fulfilling the requirements of 10.2, shall be of insulating material.

The overall dimensions of rings, if any, around pins shall not exceed 8 mm concentric with respect to the pin.

*Compliance is checked by inspection.*

**10.5** Shuttered socket-outlets shall, in addition, be so constructed that live parts are not accessible without a plug in engagement, with the gauges shown in figures 9 and 10.

The gauges shall be applied to the entry holes corresponding to the live contacts only and shall not touch live parts.

To ensure this degree of protection, socket-outlets shall be so constructed that live contacts are automatically screened when the plug is withdrawn.

The means for achieving this shall be such that they cannot easily be operated by anything other than a plug and shall not depend upon parts which are liable to be lost.

An electrical indicator with a voltage between 40 V and 50 V included is used to show contact with the relevant part.

*Compliance is checked by inspection and for socket-outlets with a plug completely withdrawn by applying the above gauges as follows.*

*The gauge according to figure 9 is applied to the entry holes corresponding to the live contacts with a force of 20 N.*

*The gauge is applied to the shutters in the most unfavourable position, successively in three directions, to the same place for approximately 5 s in each of the three directions.*

*During each application the gauge shall not be rotated and it shall be applied in such a way that the 20 N force is maintained. When moving the gauge from one direction to the next, no force is applied but the gauge shall not be withdrawn.*

*A steel gauge, according to figure 10, is then applied with a force of 1 N and in three directions, for approximately 5 s in each direction, with independent movements, withdrawing the gauge after each movement.*

*For socket-outlets with enclosures or bodies of thermoplastic material, the test is made at an ambient temperature of  $(35 \pm 2)^\circ\text{C}$ , both the socket-outlets and the gauge being at this temperature.*

**10.6** Earthing contacts, if any, of a socket-outlet shall be so designed that they cannot be deformed by the insertion of a plug, to such an extent that safety is impaired.

*Compliance is checked by the following test.*

*The socket-outlet is placed in such a position that the socket-contacts are in a vertical position.*

*A test plug, corresponding to the type of socket-outlet, is inserted into the socket-outlet with a force of 150 N which is applied for 1 min.*

*After this test, the socket-outlet shall still comply with the requirements of clause 9.*

**10.7** Socket-outlets with increased protection shall be so constructed that, when mounted and wired as in normal use, live parts shall not be accessible.

*Compliance is checked by inspection and by applying with a test wire of 1,0 mm diameter (see figure 10) a force of 1 N on all accessible surfaces in the most unfavourable conditions without a plug inserted.*

*For socket-outlets with enclosures or bodies of thermoplastic material, the test is made at an ambient temperature of  $(35 \pm 2)$  °C, both the socket-outlets and the gauge being at this temperature.*

*During this test, it shall not be possible to touch live parts with the gauge.*

*An electrical indicator as described in 10.1 shall be used.*

## **11 Provision for earthing**

**11.1** Accessories with earthing contacts shall be so constructed that when inserting the plug the earth connection is made before the current-carrying contacts of the plug become live.

When withdrawing the plug, the current-carrying pins shall separate before the earth connection is broken.

*Compliance is checked by inspection of the manufacturing drawings, taking into account the effect of tolerances, and by checking the specimens against these drawings.*

NOTE Conformity with the relevant standard sheets ensures compliance with this requirement.

**11.2** Earthing terminals of rewirable accessories shall comply with the appropriate requirements of clause 12.

They shall be of the same size as the corresponding terminals for the supply conductors.

Earthing terminals of rewirable accessories with earthing contact shall be internal.

Fixed socket-outlets can have an additional external earthing terminal. This earthing terminal shall be of a size suitable for conductors of at least 6 mm<sup>2</sup>.

Earthing terminals of fixed socket-outlets shall be fixed to the base or to a part reliably fixed to the base.

Earthing contacts of fixed socket-outlets shall be fixed to the base or to the cover, but, if fixed to the cover, they shall be automatically and reliably connected to the earthing terminal when the cover is put in place, the contact pieces being silver-plated or having a protection no less resistant to corrosion and abrasion.

This connection shall be ensured under all conditions which may occur in normal use, including loosening of cover-fixing screws, careless mounting of the cover, etc.

Except as mentioned above, parts of the earthing circuit shall be in one piece or shall be reliably connected together by riveting, welding, or the like.

NOTE 1 The requirement regarding the connection between an earthing contact fixed to a cover and an earthing terminal may be met by the use of a solid pin and a resilient socket-contact.

NOTE 2 For the purpose of the requirements of this subclause, screws are not considered as parts of contact pieces.

NOTE 3 When considering the reliability of the connection between parts of the earthing circuit, the effect of possible corrosion is taken into account.

**11.3** Accessible metal parts of fixed socket-outlets with earthing contact, which may become live in the event of an insulation fault, shall be permanently and reliably connected to the earthing terminal.

NOTE 1 This requirement does not apply to the metal cover-plates mentioned in 10.2.1.

NOTE 2 For the purpose of this requirement, small screws and the like, electrically separated 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.

NOTE 3 This requirement means that, for fixed socket-outlets with metal enclosures having an external earthing terminal, this terminal is interconnected with the terminal fixed to the base.

**11.4** Socket-outlets, having an IP code higher than IPX0, with an enclosure of insulating material, having more than one cable inlet, shall be provided with an internal fixed earthing terminal or adequate space for a floating terminal allowing the connection of an incoming and an outgoing conductor for the continuity of the earthing circuit unless the earthing terminal of the socket-outlet itself is so designed that it allows the connection of an incoming and an outgoing earthing conductor.

Floating terminals are not subject to the requirements of clause 12.

*Compliance with 11.2 to 11.4 is checked by inspection and by the tests of clause 12.*

*Compliance with requirements to ensure adequate space for floating terminals is checked by performing a test connection using the type of terminal specified by the manufacturer.*

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

*Compliance is checked by the following test.*

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

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

*In no case shall the resistance exceed 0,05  $\Omega$ .*

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.

**11.6** Fixed socket-outlets according to item b) of 7.2.5, for use on circuits where electrical noise immunity is desired for connected equipment, shall have the earthing socket contact and its terminal electrically separated from any metal mounting means or other exposed conductive parts which may be connected to the protective earthing circuit of the installation.

*Compliance is checked by inspection.*

## **12 Terminals and terminations**

### **12.1 General**

All the tests on terminals, with the exception of the test of 12.3.11 and 12.3.12 shall be made after the tests of clause 16.

**12.1.1** Rewirable fixed socket-outlets shall be provided with screw-type terminals or with screwless terminals.

Rewirable plugs and rewirable portable socket-outlets shall be provided with terminals with screw clamping.

If pre-soldered flexible conductors are used, care shall be taken that in screw-type terminals the pre-soldered area shall be outside the clamp area when connected as for normal use.

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.

**12.1.2** Non-rewirable accessories shall be provided with soldered, welded, crimped or equally effective permanent connections (termination); screwed or snap-on connections shall not be used.

Connections made by crimping a pre-soldered flexible conductor are not permitted, unless the soldered area is outside the crimping area.

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

### **12.2 Terminals with screw clamping for external copper conductors**

**12.2.1** Accessories shall be provided with terminals which shall allow the proper connection of copper conductors having nominal cross-sectional areas as shown in table 3.

**Table 3 – Relationship between rated current and connectable nominal cross-sectional areas of copper conductors**

| Current and type of accessory                                                                                                                                                                                                                                                                                                       | Rigid (solid or stranded) copper conductors <sup>c</sup> |                                         | Flexible copper conductors                      |                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------|-------------------------------------------------|-----------------------------------------|
|                                                                                                                                                                                                                                                                                                                                     | Nominal cross-sectional area<br>mm <sup>2</sup>          | Diameter of the largest conductor<br>mm | Nominal cross-sectional area<br>mm <sup>2</sup> | Diameter of the largest conductor<br>mm |
| 6 A                                                                                                                                                                                                                                                                                                                                 | -                                                        | -                                       | From 0,75 up to 1,5 inclusive                   | 1,73                                    |
| 10 A<br>2P and<br>2P+ <br>(fixed accessory)                                                                                                                                                                                                        | From 1 up to 2,5 inclusive <sup>a</sup>                  | 2,13                                    | -                                               | -                                       |
| 10 A<br>2P and<br>2P+ <br>(portable accessory)                                                                                                                                                                                                     | -                                                        | -                                       | From 0,75 up to 1,5 inclusive                   | 1,73                                    |
| 16 A<br>2P and<br>2P+ <br>(fixed accessory)                                                                                                                                                                                                       | From 1,5 up to 2 × 2,5 inclusive <sup>b</sup>            | 2,13                                    | -                                               | -                                       |
| 16 A<br>2P and<br>2P+ <br>(portable accessory)                                                                                                                                                                                                   | -                                                        | -                                       | From 0,75 up to 1,5 inclusive                   | 1,73                                    |
| 16 A other than 2P and<br>2P+ <br>(fixed accessory)                                                                                                                                                                                              | From 1,5 up to 4 inclusive                               | 2,72                                    | -                                               | -                                       |
| 16 A other than 2P and<br>2P+ <br>(portable accessory)                                                                                                                                                                                           | -                                                        | -                                       | From 1 up to 2,5 inclusive                      | 2,21                                    |
| 32 A<br>(fixed accessory)                                                                                                                                                                                                                                                                                                           | From 2,5 up to 10 inclusive                              | 4,32                                    | -                                               | -                                       |
| 32 A<br>(portable accessory)                                                                                                                                                                                                                                                                                                        | -                                                        | -                                       | From 2,5 up to 6 inclusive                      | 3,87                                    |
| <sup>a</sup> The terminal shall allow the connection of two 1,5 mm <sup>2</sup> conductors which have a diameter of 1,45 mm.<br><sup>b</sup> Some countries require the looping-in of three conductors of 2,5 mm <sup>2</sup> or two conductors of 4 mm <sup>2</sup> .<br><sup>c</sup> The use of flexible conductors is permitted. |                                                          |                                         |                                                 |                                         |

The conductor space shall be at least that specified in figures 2, 3, 4 or 5.

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

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

*Compliance is checked by inspection.*

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

**12.2.3** Terminals with screw clamping shall have adequate mechanical strength.

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

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

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

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

**12.2.4** Terminals with screw clamping shall be resistant to corrosion.

Terminals, the body of which is made of copper or copper alloy as specified in 26.5, are considered as complying with this requirement.

**12.2.5** Terminals with screw clamping shall be so designed and constructed that they clamp the conductor(s) without undue damage to the conductor(s).

*Compliance is checked by the following test.*

*The terminal is placed in the test apparatus according to figure 11 and fitted with rigid, solid, stranded and/or flexible conductor(s), according to table 3 first with the smallest and then with the largest nominal cross-sectional area, the clamping screw(s) or nut(s) being tightened with the torque according to table 6.*

*Where rigid stranded conductors do not exist, the test may be made with rigid solid conductors only. In this case, there is no need for further tests.*

*The length of the test conductor shall be 75 mm longer than the height (H) specified in table 9.*

*The end of the conductor is passed through an appropriate bushing in a plate positioned at a height (H) below the equipment, as given in table 9. The bushing is positioned in a horizontal plane such that its centre line describes a circle of 75 mm diameter, concentric with the centre of the clamping unit in the horizontal plane; the platen is then rotated at a rate of  $(10 \pm 2)$  r/min.*

*The distance between the mouth of the clamping unit and the upper surface of the bushing shall be within  $\pm 15$  mm of the height specified in table 9. The bushing may be lubricated to prevent binding, twisting, or rotation of the insulated conductor.*

*A mass as specified in table 9 is suspended from the end of the conductor. The duration of the test is approximately 15 min.*

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

The test shall be repeated with rigid solid conductors where they exist, if the first test has been made with rigid stranded conductors.

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

*Compliance is checked by inspection and by the following test.*

*The terminals are fitted with rigid solid or stranded conductors for fixed socket-outlets and flexible conductors for plugs and portable socket-outlets using conductors of the smallest and largest nominal cross-sectional area specified in table 3, the terminal screws being tightened with a torque equal to two-thirds of the torque shown in the appropriate column of table 6.*

*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 6.*

*Each conductor is then subjected to a pull as specified in table 4, applied without jerks, for 1 min, in the direction of the axis of the conductor space.*

**Table 4 – Values for pull test for screw-type terminals**

| Nominal cross-sectional area of conductors accepted by the terminal mm <sup>2</sup> | Pull N |
|-------------------------------------------------------------------------------------|--------|
| Above 0,75 up to 1,5 inclusive                                                      | 40     |
| Above 1,5 up to 2,5 inclusive                                                       | 50     |
| Above 2,5 up to 4 inclusive                                                         | 50     |
| Above 4 up to 6 inclusive                                                           | 60     |
| Above 6 up to 10 inclusive                                                          | 80     |

*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.*

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

*Compliance is checked by the following test.*

*The terminals are fitted with conductors having the largest nominal cross-sectional area specified in table 3.*

*The terminals of fixed socket-outlets are checked both with rigid solid conductors and with rigid stranded conductors.*

*The terminals of plugs and portable socket-outlets are checked with flexible conductors.*

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

*The terminals are fitted with conductors having the composition shown in table 5.*

Table 5 – Composition of conductors

| Nominal cross-sectional area<br>mm <sup>2</sup> | Number of wires (n) and nominal diameter of conductors<br>n × mm |                       |                          |
|-------------------------------------------------|------------------------------------------------------------------|-----------------------|--------------------------|
|                                                 | Flexible conductor                                               | Rigid solid conductor | Rigid stranded conductor |
| 0,75                                            | 24 × 0,20                                                        | –                     | –                        |
| 1,0                                             | 32 × 0,20                                                        | 1 × 1,13              | 7 × 0,42                 |
| 1,5                                             | 30 × 0,25                                                        | 1 × 1,38              | 7 × 0,52                 |
| 2,5                                             | 50 × 0,25                                                        | 1 × 1,78              | 7 × 0,67                 |
| 4,0                                             | 56 × 0,30                                                        | 1 × 2,25              | 7 × 0,86                 |
| 6,0                                             | 84 × 0,30                                                        | 1 × 2,76              | 7 × 1,05                 |
| 10,0                                            | –                                                                | 1 × 3,57              | 7 × 1,35                 |

Before insertion into the clamping means of the terminal, wires of rigid (solid or stranded) conductors are straightened; rigid stranded conductors may, in addition, be twisted to restore them approximately to their original shape and flexible conductors are twisted in one direction so that there is a uniform twist of one complete turn in a length of approximately 20 mm.

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 6.

For flexible conductors the test is repeated with a new conductor which is twisted as before, but in the opposite direction.

After the test, no wire of the conductors shall have escaped from the clamping unit thus reducing creepage distances and clearances to values lower than those indicated in table 23.

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

NOTE 1 These requirements do not imply that the terminals are designed so that their rotation or displacement is prevented, but any movement is 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 rigid solid copper conductor of the largest nominal cross-sectional area specified in table 3 is placed in the terminal.

Where rigid solid conductors do not exist, the test may be made with rigid stranded conductors.

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

*The conductor is inserted into the clamping means of the terminal for the minimum distance prescribed, or where no distance is prescribed, until it just projects from the far side of the terminal and in the position most likely to allow the wire to escape.*

*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 6 or in the table of the appropriate figures 2, 3 or 4, whichever is the greater.*

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

*Where a screw has a hexagonal head with a slot, only the test with the screwdriver is made with the torque values given in column 3.*

**Table 6 – Tightening torques for the verification of the mechanical strength of screw-type terminals**

| Nominal diameter of thread<br>mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Torque<br>Nm   |                |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 <sup>a</sup> | 2 <sup>b</sup> | 3 <sup>c</sup> |
| Up to and including 2,8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0,2            | 0,4            | -              |
| Over 2,8 up to and including 3,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,25           | 0,5            | -              |
| Over 3,0 up to and including 3,2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,3            | 0,6            | -              |
| Over 3,2 up to and including 3,6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,4            | 0,8            | -              |
| Over 3,6 up to and including 4,1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,7            | 1,2            | 1,2            |
| Over 4,1 up to and including 4,7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,8            | 1,8            | 1,2            |
| Over 4,7 up to and including 5,3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0,8            | 2,0            | 1,4            |
| <sup>a</sup> Column 1 applies to screws without a head if the screw, when tightened, does not protrude from the hole and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.<br><sup>b</sup> Column 2 applies to other screws which are tightened by means of a screwdriver and to screws and nuts which are tightened by means other than a screwdriver.<br><sup>c</sup> Column 3 applies to nuts of mantle terminals which are tightened by means of a screwdriver. |                |                |                |

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

NOTE 1 For mantle terminals the specified nominal diameter is that of the slotted stud.

NOTE 2 The shape of the blade of the test screwdriver should suit the head of the screw to be tested.

NOTE 3 The screws and nuts should not be tightened in jerks.

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

*Compliance is checked by manual test.*

NOTE In general, the design of terminals shown in figures 2, 3, 4 and 5 provide sufficient resiliency to comply with this requirement; for other designs, special provisions, such as the use of an adequate resilient part which is not likely to be removed inadvertently, may be necessary.

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

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

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

*Compliance is checked by inspection.*

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

**12.2.11** For pillar terminals, the distance between the clamping screw and the end of the conductor, when fully inserted, shall be at least that specified in figure 2.

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

For mantle terminals, the distance between the fixed part and the end of the conductor, when fully inserted, shall be at least that specified in figure 5.

*Compliance is checked by measurement, after a solid conductor of the largest nominal cross-sectional area specified in table 3, has been fully inserted and fully clamped.*

### 12.3 Screwless terminals for external copper conductors

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

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

NOTE Subclause 12.3.1 is not applicable to socket-outlets provided with

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

**12.3.2** Screwless terminals shall be provided with two clamping units each allowing the proper connection of rigid or of rigid and flexible copper conductors having nominal cross-sectional areas as shown in table 7.

**Table 7 – Relationship between rated current and connectable cross-sectional areas of copper conductors for screwless terminals**

| Rated current<br>A         | Conductors                                       |                                           |                                              |
|----------------------------|--------------------------------------------------|-------------------------------------------|----------------------------------------------|
|                            | Nominal cross-sectional areas<br>mm <sup>2</sup> | Diameter of largest rigid conductor<br>mm | Diameter of largest flexible conductor<br>mm |
| From 10 up to 16 inclusive | From 1,5 up to 2,5 inclusive                     | 2,13                                      | 2,21                                         |

When two conductors have to be connected, each conductor shall be introduced in a separate independent clamping unit (not necessarily in separate holes).

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

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

*Compliance is checked by inspection.*

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

**12.3.4** Parts of screwless terminals mainly intended to carry current shall be of materials as specified in 26.5.

*Compliance is checked by inspection and by chemical analysis.*

NOTE Springs, resilient units, clamping plates and the like are not considered as parts mainly intended to carry current.

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

The conductor shall be clamped between metal surfaces.

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

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

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

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

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

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

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

- during the insertion, the operation of the clamping means of one of the conductors is independent of the operation of that of the other conductor(s);
- during the disconnection, the conductors can be disconnected either at the same time or separately;
- each conductor shall be introduced in a separate clamping unit (not necessarily in separate holes);
- it shall be possible to clamp securely any number of conductors up to the maximum as designed.

*Compliance is checked by inspection and by manual tests with the appropriate conductors (in number and size).*

**12.3.8** Screwless terminals of fixed socket-outlets shall be designed so that adequate insertion of the conductor is obvious and over-insertion is prevented if further insertion is liable to reduce the creepage distances and/or clearances required in table 23, or to influence the operation of the socket-outlet.

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

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

**12.3.9** Screwless terminals shall be properly fixed to the socket-outlet.

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

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

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

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

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

*The test is carried out with solid rigid copper conductors, first with conductors having the largest nominal cross-sectional area, and then with conductors having the smallest nominal cross-sectional area specified in table 7.*

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

*After each connection, the conductor is subjected to a pull of the value shown in table 8; the pull is applied without jerks, for 1 min, in the direction of the longitudinal axis of the conductor space.*

**Table 8 – Value for pull test for screwless-type terminals**

| Rated current<br>A        | Pull<br>N |
|---------------------------|-----------|
| 10 up to and including 16 | 30        |

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

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

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

*For fixed socket-outlets with screwless terminals, each conductor is subjected for 15 min to a circular motion with  $(10 \pm 2)$  r/min using an apparatus, an example of which is shown in figure 11. During this test, a mass as specified in table 9 is suspended from the end of the conductor.*

**Table 9 – Values for flexing under mechanical load test for copper conductors**

| Nominal cross-sectional area of conductor <sup>a</sup><br>mm <sup>2</sup> | Diameter of bushing hole <sup>b</sup><br>mm | Height <i>H</i><br>mm | Mass for conductor<br>kg |
|---------------------------------------------------------------------------|---------------------------------------------|-----------------------|--------------------------|
| 0,5                                                                       | 6,5                                         | 260                   | 0,3                      |
| 0,75                                                                      | 6,5                                         | 260                   | 0,4                      |
| 1,0                                                                       | 6,5                                         | 260                   | 0,4                      |
| 1,5                                                                       | 6,5                                         | 260                   | 0,4                      |
| 2,5                                                                       | 9,5                                         | 280                   | 0,7                      |
| 4,0                                                                       | 9,5                                         | 280                   | 0,9                      |
| 6,0                                                                       | 9,5                                         | 280                   | 1,4                      |
| 10,0                                                                      | 9,5                                         | 280                   | 2,0                      |

<sup>a</sup> Approximate relationship between mm<sup>2</sup> and AWG sizes can be found in IEC 60999-1.

<sup>b</sup> If the bushing-hole diameter is not large enough to accommodate the conductor without binding, a bushing having the next larger hole size may be used.

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

*After these tests, neither the terminals nor the clamping means shall have worked loose and the conductors shall show no deterioration impairing their further use.*

**12.3.11** Screwless terminals shall withstand the electrical and thermal stresses occurring in normal use.

*Compliance is checked by the following tests a) and b), which are carried out on five screwless terminals of socket-outlets which have not been used for any other test.*

*Both tests are carried out with new copper conductors.*

a) *The test is carried out loading the screwless terminals for 1 h with an alternating current as specified in table 10 and connecting rigid solid conductors 1 m long having the nominal cross-sectional area as specified in the same table.*

*The test is carried out on each clamping unit.*

**Table 10 – Test current for the verification of electrical and thermal stresses in normal use for screwless terminals**

| Rated current<br>A | Test current<br>A | Nominal cross-sectional area of the conductor<br>mm <sup>2</sup> |
|--------------------|-------------------|------------------------------------------------------------------|
| 10                 | 17,5              | 1,5                                                              |
| 16                 | 22                | 2,5                                                              |

NOTE For socket-outlets having rated currents lower than 10 A, the test current is proportionally determined and the cross-sectional area of the conductors is 1,5 mm<sup>2</sup>.

*During the test the current is not passed through the socket-outlet, but only through the terminals.*

*Immediately after this period, the voltage drop across each screwless terminal is measured with rated current flowing.*

*In no case shall the voltage drop exceed 15 mV.*

*The measurements are made across each screwless terminal and as near as possible to the place of contact.*

*If the back connection of the terminal is not accessible, the specimens may be adequately prepared by the manufacturer; care shall be taken not to affect the behaviour of the terminals.*

*Care shall be taken to ensure that, during the period of the test, including the measurements, the conductors and the measurement devices are not moved noticeably.*

- b) *The screwless terminals already subjected to the determination of the voltage drop specified in the previous test a) are tested as follows.*

*During the test, a current equal to the test current value given in table 10 is passed.*

*The whole test arrangement, including the conductors, shall not be moved until the measurements of the voltage drop have been completed.*

*The terminals are subjected to 192 temperature cycles, each cycle having a duration of approximately 1 h and carried out as follows:*

- *the current flows for approximately 30 min;*
- *for a further period of approximately 30 min no current flows.*

*The voltage drop in each screwless terminal is determined as prescribed for the test of a) after every 24 temperature cycles and after the 192 temperature cycles have been completed.*

*In no case shall the voltage drop exceed 22,5 mV or twice the value measured after the 24th cycle, whichever is the smaller.*

*After this test an inspection by normal or corrected vision without additional magnification shall show no changes evidently impairing further use such as cracks, deformations or the like.*

*In addition, the mechanical strength test according to 12.3.10 is repeated and all specimens shall withstand this test.*

**12.3.12** Screwless terminals shall be so designed that the connected rigid solid conductor remains clamped, even when it has been deflected during normal installation, for example, during mounting in a box, and the deflecting stress is transferred to the clamping unit.

*Compliance is checked by the following test which is made on three specimens of socket-outlets which have not been used for any other test.*

*The test apparatus, the principle of which is shown in figure 12a, shall be so constructed that*

- *a specified conductor properly inserted into a terminal is allowed to be deflected in any of the 12 directions differing from each other by 30°, with a tolerance referred to each direction of  $\pm 5^\circ$ , and*
- *the starting point can be varied by 10° and 20° from the original point.*

NOTE 1 A reference direction need not be specified.

*The deflection of the conductor from its straight position to the testing positions shall be effected by means of a suitable device, applying a specified force to the conductor at a certain distance from the terminal.*

*The deflecting device shall be so designed that*

- *the force is applied in a direction perpendicular to the undeflected conductor;*
- *the deflection is attained without rotation or displacement of the conductor within the clamping unit;*
- *the force remains applied while the prescribed voltage drop measurement is made.*

*Provisions shall be made so that the voltage drop across the clamping unit under test can be measured when the conductor is connected, as shown for example in figure 12b.*

*The specimen is mounted on the fixed part of the test apparatus in such a way that the specified conductor inserted into the clamping unit under test can be freely deflected.*

NOTE 2 If necessary, the inserted conductor may be permanently bent around obstacles so that these do not influence the results of the test.

NOTE 3 In some cases, with the exception of the case of guidance for the conductor, it may be advisable to remove those parts of the specimens which do not allow the deflection of the conductor corresponding to the force to be applied.

*To avoid oxidation, the insulation shall be removed from the conductor immediately before starting the test.*

*A clamping unit is fitted as for normal use with a rigid solid copper conductor having the smallest nominal cross-sectional area specified in table 11 and is submitted to a first test sequence; the same clamping unit is submitted to a second test sequence using the conductor having the largest nominal cross-sectional area, unless the first test sequence has failed.*

*The force for deflecting the conductor is specified in table 12, the distance of 100 mm being measured from the extremity of the terminal, including the guidance, if any, for the conductor, to the point of application of the force to the conductor.*

*The test is made with continuous current (i.e. the current is not switched on and off during the test); a suitable power supply should be used and an appropriate resistance should be inserted in the circuit so that the current variations are kept within  $\pm 5\%$  during the test.*

**Table 11 – Nominal cross-sectional areas of rigid copper conductors  
for deflection test of screwless terminals**

| Rated current of the socket-outlet<br>A                                                                   | Nominal cross-sectional area of the test conductor<br>mm <sup>2</sup> |                      |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------|
|                                                                                                           | First test sequence                                                   | Second test sequence |
| Up to and including 6                                                                                     | 1,0 <sup>a</sup>                                                      | 1,5                  |
| Above 6 up to and including 16                                                                            | 1,5                                                                   | 2,5                  |
| <sup>a</sup> Only for countries allowing the use of 1,0 mm <sup>2</sup> conductors in fixed installations |                                                                       |                      |

**Table 12 – Deflection test forces**

| Nominal cross-sectional area of the test conductor<br>mm <sup>2</sup>                                   | Force for deflecting the test conductor <sup>a</sup><br>N |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 1,0                                                                                                     | 0,25                                                      |
| 1,5                                                                                                     | 0,5                                                       |
| 2,5                                                                                                     | 1,0                                                       |
| <sup>a</sup> The forces are chosen so that they stress the conductors close to the limit of elasticity. |                                                           |

*A test current equal to the rated current of the socket-outlet is passed through the clamping unit under test. A force according to table 12 is applied to the test conductor inserted in the clamping unit under test in one of the 12 directions shown in figure 12a and the voltage drop across this clamping unit is measured. The force is then removed.*

*The force is then applied successively on each one of the remaining 11 directions shown in figure 12a, following the same test procedure.*

*If, for any of the 12 test directions, the voltage drop is greater than 25 mV, the force is maintained in this direction until the voltage drop is reduced to a value below 25 mV, but for not more than 1 min. After the voltage drop has reached a value below 25 mV, the force is maintained in the same direction for a further period of 30 s during which period the voltage drop shall not have increased.*

*The other two specimens of socket-outlets of the set are tested following the same test procedure, but moving the 12 directions of the force so that they differ by approximately 10° for each specimen.*

*If one specimen has failed at one of the directions of application of the test force, the tests are repeated on another set of specimens, all of which shall comply with this new series of tests.*

### 13 Construction of fixed socket-outlets

**13.1** Socket-contact assemblies shall have sufficient resilience to ensure adequate contact pressure on plug pins.

*Compliance is checked by inspection and the tests of clauses 9, 21 and 22.*

**13.2** Socket-contacts and pins of socket-outlets shall be resistant to corrosion and abrasion.

*Compliance is checked by inspection and the tests of 26.5.*

**13.3** Insulating linings, barriers and the like shall have adequate mechanical strength.

*Compliance is checked by inspection and by the tests of clause 24.*

**13.4** Socket-outlets shall be so constructed as to permit

- easy introduction and connection of the conductors in the terminals;
- easy fixing of the base to a wall or in a mounting box;
- correct positioning of the conductors;
- adequate space between the underside of the base and the surface on which the base is mounted or between the sides of the base and the enclosure (cover or box) so that, after installation of the socket-outlet, the insulation of the conductors is not necessarily pressed against live parts of different polarity.

NOTE This requirement does not imply that the metal parts of the terminal are necessarily protected by insulating barriers or insulating shoulders, to avoid contact due to incorrect installation of the terminal metal parts, with the insulation of the conductor.

For surface type socket-outlets to be mounted on a mounting plate, a wiring channel may be needed to comply with this requirement.

In addition, socket-outlets classified as design A shall permit easy positioning and removal of the cover or cover-plate, without displacing the conductors.

*Compliance is checked by inspection and by an installation test with conductors of the largest nominal cross-sectional area specified in table 3.*

**13.5** Socket-outlets shall be so designed that full engagement of associated plugs is not prevented by any projection from their engagement face.

*Compliance is checked by determining that the gap between the engagement face of the socket-outlet and the plug does not exceed 1 mm when the plug is inserted into the socket-outlet as far as it will go.*

**13.6** If covers are provided with bushings for the entry holes for the pins, it shall not be possible to remove them from the outside or for them to become detached inadvertently from the inside when the cover is removed.

*Compliance is checked by inspection and, if necessary, by manual test.*

**13.7** Covers, cover-plates or parts of them which are intended to ensure protection against electric shock shall be held in place at two or more points by effective fixings.

Covers, cover-plates or parts of them may be fixed by means of a single fixing, for example, by a screw, provided that they are located by another means (for example, by a shoulder).

NOTE 1 It is recommended that the fixings of covers or cover-plates be captive. The use of tight-fitting washers of cardboard or the like is deemed to be an adequate method for securing screws intended to be captive.

NOTE 2 Non-earthed metal parts separated from live parts in such a way that creepage distances and clearances have the values specified in table 23, are not considered as accessible if the requirements of this subclause are met.

Where the fixings of covers or cover-plates of socket-outlets of design A serve to fix the base, there shall be means to maintain the base in position, even after removal of the covers or cover-plates.

*Compliance is checked by the tests of 13.7.1, 13.7.2 or 13.7.3.*

**13.7.1** *For covers or cover-plates whose fixings are of the screw-type:*

*by inspection only.*

**13.7.2** *For covers or cover-plates whose fixing is not dependent on screws and whose removal is obtained by applying a force in a direction approximately perpendicular to the mounting/supporting surface (see table 13):*

– *when their removal may give access, with the standard test finger, to live parts:*

*by the tests of 24.14;*

– *when their removal may give access, with the standard test finger, to non-earthed metal parts separated from live parts in such a way that creepage distances and clearances have the values shown in table 23:*

*by the tests of 24.15;*

– *when their removal may give access, with the standard test finger, only to*

- *parts of insulating material, or*
- *earthed metal parts, or*
- *metal parts separated from live parts in such a way that creepage distances and clearances have twice the values shown in table 23, or*
- *live parts of SELV circuits not greater than 25 V a.c.:*

*by the tests of 24.16.*

**Table 13 – Forces to be applied to covers, cover-plates or actuating members whose fixing is not dependent on screws**

| Accessibility with the standard test finger after removal of covers, cover-plates or parts of them                                                                             | Tests according to subclauses | Force to be applied<br>N                                      |                |                                                                   |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------|----------------|-------------------------------------------------------------------|----------------|
|                                                                                                                                                                                |                               | Number of socket-outlets complying with 24.17 and 24.18 which |                | Number of socket-outlets not complying with 24.17 and 24.18 which |                |
|                                                                                                                                                                                |                               | shall not come off                                            | shall come off | shall not come off                                                | shall come off |
| To live parts                                                                                                                                                                  | 24.14                         | 40                                                            | 120            | 80                                                                | 120            |
| To non-earthed metal parts separated from live parts by creepage distances and clearances according to table 23                                                                | 24.15                         | 10                                                            | 120            | 20                                                                | 120            |
| To insulating parts, earthed metal parts, live parts of SELV $\leq 25$ V a.c. or metal parts separated from live parts by creepage distances twice those according to table 23 | 24.16                         | 10                                                            | 120            | 10                                                                | 120            |

**13.7.3** For covers or cover-plates the fixing of which is not dependent on screws and whose removal is obtained by using a tool, in accordance with the manufacturer's instructions given in an instruction sheet or in other documentation:

*by the same tests of 13.7.2 except that the covers or cover-plates or parts of them need not come off when applying a force not exceeding 120 N in directions perpendicular to the mounting/supporting surface.*

**13.8** A cover-plate intended for a socket-outlet with earthing contact shall not be interchangeable with a cover-plate intended for a socket-outlet without earthing contact, if such interchange results in a change of the classification of the socket-outlet according to 7.1.3.

NOTE This requirement applies to accessories of the same manufacturer.

*Compliance is checked by inspection and by an installation test.*

**13.9** Surface-type socket-outlets shall be so constructed that, when they are fixed and wired as for normal use, there are no free openings in their enclosures other than the entry openings for the pins of the plug or other openings for contacts, for example, side earthing contacts, or locking devices, etc.

Drain holes, small gaps between enclosures or boxes and conduits, cables, or earthing contacts (if any), or between enclosures or boxes and grommets or membranes and knockouts are ignored.

*Compliance is checked by inspection and by an installation test using a cable having conductors of the smallest nominal cross-sectional area specified in table 14.*

**13.10** Screws or other means for mounting the socket-outlet on a surface in a box or enclosure shall be easily accessible from the front. These means shall not serve any other fixing purpose.

**13.11** Multiple socket-outlets with a common base shall be provided with fixed links for the interconnection of the contacts in parallel. The fixing of these links shall be independent from the connection of the supply wires.

**13.12** Multiple socket-outlets, comprising separate bases, shall be so designed that the correct position of each base is ensured. The fixing of each base shall be independent of the fixing of the combination to the mounting surface.

*Compliance with the requirements of 13.10 to 13.12 is checked by inspection.*

**13.13** The mounting plate of surface-type socket-outlets shall have adequate mechanical strength.

*Compliance is checked by inspection after the test of 13.4 and by the test of 24.3.*

**13.14** Socket-outlets shall withstand the lateral strain imposed by equipment likely to be introduced into them.

*For socket-outlets having ratings up to and including 16 A and 250 V, compliance is checked by means of the device shown in figure 13.*

*Each specimen is mounted on a vertical surface with the plane through the socket-contacts horizontal. The device is then fully engaged and a weight hung on it such that the force exerted is 5 N.*

*The device is removed after 1 min and the socket-outlet is turned through 90° on the mounting surface. The test is made four times, the socket-outlet being turned through 90° after each engagement.*

*During the test the device shall not become disengaged from the socket-outlet.*

*After the tests, the socket-outlets shall show no damage within the meaning of this standard; in particular, they shall comply with the requirements of clause 22.*

NOTE Other socket-outlets are not tested.

**13.15** Socket-outlets shall not be an integral part of lampholders.

*Compliance is checked by inspection.*

**13.16** Surface-type socket-outlets having an IP code higher than IP20 shall be according to their IP classification when fitted with conduits or with sheathed cables as for normal use and without a plug in engagement.

Surface-type socket-outlets having degrees of protection IPX4 and IPX5 shall have provision for opening a drain hole.

If a socket-outlet has a drain hole, it shall be not less than 5 mm in diameter, or 20 mm<sup>2</sup> in area with a width and a length of not less than 3 mm.

If the position of the lid is such that only one mounting position is possible, the drain hole shall be effective in that position. Alternatively, the drain hole(s) shall be effective in at least two positions of the socket-outlet when this is mounted on a vertical wall, one of these with the conductors entering at the top and the other with the conductors entering at the bottom.

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

*Compliance is checked by inspection, by measurement and by the relevant tests of 16.2.*

NOTE 1 Adequate enclosure when the plug is not in position may be achieved by means of a lid.

NOTE 2 This requirement does not imply that the lid, if any, or the entry openings for the pins need be closed when the plug is not in position, provided that socket-outlets pass the relevant test for the verification of the ingress of water.

NOTE 3 A drain hole in the back of the enclosure is deemed to be effective only if the design of the enclosure ensures a clearance of at least 5 mm from the mounting surface or provides a drainage channel of at least the size specified.

**13.17** Earthing pins shall have adequate mechanical strength.

*Compliance is checked by inspection and, for pins which are not solid, by the test of 14.2 which is made after the tests of clause 21.*

**13.18** Earthing contacts and neutral contacts shall be locked against rotation and removable only with the aid of a tool, after dismantling the socket-outlet.

*Compliance is checked by inspection and by manual test.*

NOTE A design permitting the removal of a contact without the aid of a tool, after removal of an enclosure requiring the use of a tool, is not allowed.