इंटरनेट मानक

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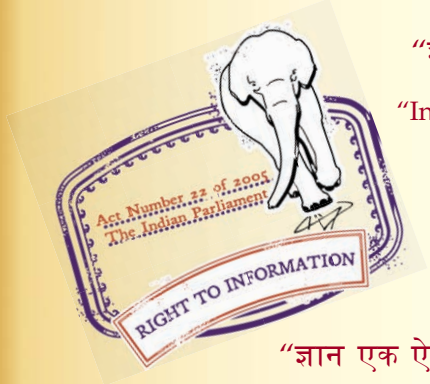
Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 1293 (2005): Plugs and socket- outlets of rated voltage up to and including 250 volts and rated current up to 16 amperes [ETD 14: Electrical Wiring Accessories]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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भारतीय मानक

250 वोल्ट तक की रेटित वोल्टता वाले और 16 एम्पीयर तक की रेटित करंट वाले प्लग और सॉकेट निकास की विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO AND INCLUDING 16 AMPERES — SPECIFICATION

(Third Revision)

ICS 29.120.30

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 2005

Price Group 17

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Wiring Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was first published in 1958. The first revision was brought out in 1967 and the second revision was brought out in 1988. This revision has been undertaken to bring it in line with latest International practices. This standard covers the requirements and test methods for plugs and fixed or portable socket-outlets for ac and with and without earthing contact with a rated voltage above 50 V, but not exceeding 250 V and a rated current not exceeding 16A intended for household and similar purposes for indoors and outdoors. This standard also covers plugs incorporated in cord sets and to plugs and portable socket-outlets incorporated in cord extension sets.

In view of greater prevalence of the use of two pin plugs and socket-outlets in every household, it has become necessary to standardize such plugs. However the user must ensure proper earthing practices in their installation in line with IS 732 : 1989 'Code of practice for electrical wiring installations' and IS 3043 : 1987 'Code of practice for earthing'. Two pin plugs are intended to be used only for class II appliances.

This standard is based on IEC 60884-1 (2002) 'Plugs and socket outlet for household and similar purposes — Part 1 : General requirements', issued by the International Electrotechnical Commission except for following modifications:

a) Accessories ratings covered are only up to and including 16A and 250 V.

b) Combined socket-outlet has been covered.

c) Ambient test condition.

d) Schedule of routine, acceptance and type tests have been included.

e) Rated voltage covered up to and including 250 V.

The test methods are technically equivalent to corresponding ISO/IEC publications as stated below:

Title/Clause Ref. of the Test	*IS No.*	*ISO/IEC*
Clause 9 to 30	1293 : 2005	IEC 60884-1 (2002)
Damp heat cycling test	9000 (Part 5/Sec 1 & 2) : 1981	IEC 60068-2-30 (1980)
Glow wire test	11000 (Part 2/Sec 1) : 1984	IEC 60068-2-1 (1980)
Electroplated coating of nickel plus chromium and of copper plus nickel plus chromium	1068 : 1993	ISO 1456 : 1988
Electroplated coating of tin	1359 : 1992	ISO 2093 : 1986
Electroplated coating of Zinc on iron and steel	1573 : 1986	ISO 2081 : 1986

After the publication of this standard IS 6538 : 1971 'Specification for three-pin plugs made of resilient material' shall be withdrawn since the requirements have been covered in this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules of rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO AND INCLUDING 16 AMPERES — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard applies to plugs and fixed or portable socket-outlets for ac only, with and without earthing contact, with a rated voltage above 50 V but not exceeding 250 V and a rated current not exceeding 16A, intended for household and similar purposes, either indoors or outdoors.

This standard does not cover requirement 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.

NOTES

1 Requirements for mounting boxes are given in IS 14772.

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

2 Particular requirements are under consideration for:

a) Adaptors;

b) Fused plugs;

c) Cable reels; and

d) Plugs, fixed and portable socket-outlets for extra low voltage (ELV) and safety extra low voltage (SELV).

This standard does not apply to:

a) Plugs, socket-outlets and couplers for industrial purposes;

b) Appliance couplers;

c) Fixed socket-outlets combined with fuses, automatic switches, etc; and

d) Plugs, fixed and portable socket-outlets for ELV.

3 Socket-outlets with pilots lights are allowed provided that pilot light 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 35°C but occasionally reaching 45°C.

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 ambient surrounding the socket-outlet reaches a temperature exceeding 45°C.

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

2 REFERENCES

2.1 The following standards are necessary adjuncts to this standard:

IS No.	*Title*
292 : 1983	Leaded brass ingots and casting (*second revision*)
694 : 1990	PVC insulated cables for working voltages up to and including 1 100 V (*third revision*)
1068 : 1993	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium (*third revision*)
1359 : 1992	Electroplated coating of tin (*third revision*)
1573 : 1986	Electroplated coating of zinc on iron and steel (*second revision*)
2824 : 1975	Method for determining the comparative tracking index of solid insulating materials under moist conditions (*first revision*)
3010	Appliances connectors and appliance-inlets (non-reversible three pin type):
(Part 1) : 1965	Appliances connectors
(Part 2) : 1965	Appliances inlet
9000 (Part 5/Sec 1 and 2) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 5 Damp heat cycling test, Section 1, 16 + 8 h cycle, Section 2, 12 + 12 h cycle
9968 (Part 1) : 1988	Elastomer-insulated cables: Part 1 For working voltages up to and including 1 100 V (*first revision*)
11000 (Part 2/ Sec 1) : 1984	Fire hazard testing: Part 2 Test method, Section 1 Glow wire test and guidance

IS No.	*Title*
12063 : 1987	Classification of degree of protection provided by enclosures of electrical equipment
14340 : 1996	Brass for current-carrying parts in electrical wiring accessories
14772 : 2000	General requirements for enclosures for accessories for household and similar fixed electrical installations

3 TERMINOLOGY

The following definitions shall apply for the purpose of this standard.

(The use of the accessories is shown in Fig. 1A).

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(s).

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(s).

3.3 Fixed Socket-Outlet — A socket-outlet which is intended to be connected to the fixed wiring.

3.4 Portable Socket-Outlet — Socket-outlet which is intended to be connected to, or integral with, flexible cables, 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. (Example of portable multiple socket-outlet is shown in Fig. 1B).

3.6 Combined Socket-Outlets — A socket assembly with provision of plugging two or more types or rating of plugs but in which only one or two plugs can be plugged in at a time. (Typical examples of combined socket-outlets are shown in Fig 1C).

3.7 Socket-Outlet for Appliances — Socket-outlet intended to be built in or fixed to appliances.

3.8 Rewirable Plug or Rewirable Portable Socket-Outlet — Accessory so constructed that the flexible cable can be replaced.

3.9 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**).

3.10 Moulded-on Accessory — Non-rewirable accessory the manufacture of which is completed by insulating material moulded around pre-assembled component parts and the terminations of the flexible cable.

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

3.12 Cord Set — Assembly consisting of a flexible cable fitted with a non-rewirable plug and a non-rewirable connector, intended for the connection of an electrical appliance to the electrical supply. (Example of cord set is shown in Fig 1A).

3.13 Cord Extension Set — Assembly consisting of a flexible cable fitted with a non-rewirable plug and a non-rewirable portable socket-outlet. (Example of cord extension set is shown in Fig 1A).

3.14 Terminal — Insulated or non-insulated connecting device serving for reusable electrical connection of the external conductors.

3.15 Termination — Insulated or non-insulated connecting device intended for non-reusable electrical connection of the external conductors.

3.16 Clamping Unit — Part or parts of a terminal necessary for the mechanical clamping and the electrical connection of the conductor(s).

3.17 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.

3.17.1 *Pillar Terminal* — Screw-type terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws. The clamping pressure may be applied directly by the shank of the screw or through an intermediate member to which pressure is applied by the shank of the screw. (Example of pillar terminals is given in Fig. 34.)

3.17.2 *Screw Terminal* — Screw-type terminal in which the conductor is clamped under the head of the screw. The clamping pressure may be applied directly by the head of the screw or through an intermediate part, such as a washer, clamping plate or anti-spread device. (Example of screw terminals is given in Fig. 35.)

3.17.3 *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. (Example of stud terminals is given in Fig. 35.)

3.17.4 *Saddle Terminal* — Screw-type terminal in

which the conductor clamped under a saddle by means of two or more screws or nuts. (Example of saddle terminals are given in Fig. 36.)

3.17.5 *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. (Example of mantle terminals is given in Fig. 37.)

3.18 Screwless Terminal — Connecting device for the connection and subsequent disconnection of one conductor or the dismountable interconnection of two or more conductors capable of being dismantled, the connection being made, directly or indirectly, by means of springs, wedges, eccentrics or cones, etc, without special preparation of the conductor concerned, other than removal of insulation.

3.19 Rated Voltage — Voltage assigned to the plug or socket-outlet by the manufacturer.

3.20 Rated Current — Current assigned to the plug or socket-outlet by the manufacturer.

3.21 Shutter — Movable part incorporated into a socket-outlet arranged to shield at least the live socket-outlet contacts automatically when the plug is withdrawn.

3.22 Thread-Forming Screw — Tapping screw having an uninterrupted thread, which by screwing in, forms a thread by displacing material. (Example of a thread-forming screw is shown in Fig. 38.)

3.23 Thread-Cutting Screw — Tapping screw having an interrupted thread, which by screwing in, makes thread by removing material. (Example of thread-cutting tapping screw in Fig. 39.)

3.24 Type Test —Tests carried out to prove conformity with the requirement of the specification. These are intended to prove the general qualities and design of the given type of plug or socket-outlets.

3.25 Acceptance Test — Test carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.26 Routine Test —Test carried out on each item to check requirements which are likely to vary during production.

3.27 Class I Appliances — An appliance in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that accessible conductive parts are connected to the protective earthing conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulations.

3.28 Class II Appliances — An appliance in which protection against electric shock does not rely on basic insulation, only, but in which additional safety precautions, such as, double insulation or reinforced insulation are provided, there being no provision for protective earthing or reliance upon installation condition.

3.29 Safety Extra Low Voltage (SELV) — A nominal voltage not exceeding 32 V between conductors and between conductors and earth or, for three phase supply, not exceeding 18.5 V between conductors, and the no-load voltage not exceeding 38 V and 22 V respectively.

3.30 Crimp Type Terminal — Termination having the means of permanent connection made by crimping the part of terminal itself. It may also be made out of sheet metal or solid metal.

NOTES

1 Where the terms voltage and current are used in this standard, they imply rms values, unless otherwise specified.

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

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.

4 Through-out 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.

4 GENERAL REQUIREMENT

4.1 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 surroundings. In general, compliance is checked by carrying out all the relevant test specified.

5 GENERAL NOTES ON TESTS

5.1 Tests according to this standard are type tests.

5.1.1 Schedule of routine, acceptance and type tests are given in **31**.

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 equipments shall be provided for testing, with at least 1 m of flexible cable of relevant specification.

Non-rewirable multiple portable socket-outlets are tested with flexible cables having a length of about 2.5 m.

Socket-outlet which does not comply with any

accepted standard dimensions specified in this standard are tested together with their 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 test are made at an ambient temperature of 27 ± 5°C.

Plugs and socket-outlets are tested separately.

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

5.4 Three samples are subjected to all the relevant tests.

For the tests of Screwless Terminals for External Conductor (*see* **12.3.11**) additional samples of socket-outlets having in total at least 5 screwless terminals are required.

For the test of Screwless Terminals for External Conductor (*see* **12.3.12**), three additional samples of socket-outlets are necessary: in each sample one clamping unit is tested.

For each of the tests of construction of fixed socket-outlet (*see* **13.22** and **13.23**), three additional samples of separate membranes, or of accessories incorporating membranes, are required.

For non-rewirable accessories, six additional samples are required for the tests of Flexible Cable and their connection (*see* **23.2** and **23.4**).

For the test of Mechanical Strength (*see* **24.10**), three additional samples are required.

For the test of Resistance of Insulating Material to Abnormal Heat, to Fire and to Tracking (*see* **28**), three additional samples may be necessary.

5.5 Accessories are deemed not to comply with this standard if there are more failures than that of one sample in one of the tests.

If one sample fails in a test, that test and those preceding, which may have influenced the result of that test, are repeated on another set of samples of the number specified in **5.4**, all of which shall then comply with the repeated tests.

NOTES

1 In general, it will only be necessary to repeat the tests which caused the failure, unless the sample fails in one of the tests of **20** to **22** inclusive, in which case the tests are repeated from that of **19** onwards.

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

6 RATINGS

6.1 Accessories shall preferably be of a type and preferably have voltage and current ratings as shown in Table 1.

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

Compliance is checked by inspection of the marking.

An example of cord extension set is shown in Fig. 1A.

7 CLASSIFICATION

7.1 Accessories are Classified

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

— ordinary accessories, that is with degree of protection not higher than IPX0 or IPX1, when mounted on a vertical surface as for normal use,

NOTE — For the purpose of this standard the term ordinary applies only to the degree of protection against harmful ingress of water.

— Splash-proof accessories, that is with degree of protection IPX4, and

Table 1 Preferred Combination of Types and Ratings

(*Clause* 6.1)

Type	Rated Voltage V	Rated Current A
(1)	(2)	(3)
2 pole (non-rewirable plugs only)	230, 240 and 250	2.5
2 pole (plugs only)	230, 240 and 250	6
2 pole + ⏚	230, 240 and 250	6[1)] 10 16

NOTE — Standardized dimensions of the plugs and socket-outlet are given in Annex A.

[1)] International practices provide for 10A socket-outlets for all appliances requiring up to and including 10A whereas in India, the socket of 6A is still in use. The manufacturer would develop 10A socket- outlets with the same physical dimensions as of the present 6A socket-outlets. After satisfactory development of 10A socket-outlets, the 6A socket-outlets are to be phased out in future.

— Jet-proof accessories, that is with degree of protection IPX5.

7.1.2 According to the provision for earthing:

a) Accessories without earthing contact; and

b) Accessories with earthing contact.

7.1.3 According to the method of connecting the cable:

a) Rewirable accessories; and

b) Non-rewirable accessories.

7.1.4 According to the type of terminals:

a) Accessories with screw-type terminals;

b) Accessories with screwless terminals for rigid conductors only; and

c) Accessories with screwless terminals for rigid and flexible conductors.

7.2 Socket-Outlets are Classified

7.2.1 According to the degree of protection against electric shock when mounted as for normal use:

a) With normal protection (*see* **10.1**); and

b) With increased protection (*see* **10.7**).

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

7.2.2 According to the existence of enclosures:

a) Unenclosed; and

b) Enclosed.

NOTE — For unenclosed socket-outlets, the protection against electric shock is given by the enclosure in which the socket-outlet is intended to be mounted.

7.2.3 According to the existence of shutters:

a) Without shutters; and

b) With shutters (*see* **10.5**).

7.2.4 According to the method of application/ mounting of the socket-outlet:

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; and

j) Appliances type.

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

a) Fixed socket-outlets where the cover or cover-plate or parts of them can be removed without displacement of the conductors (design A); and

b) Fixed socket-outlets where the cover or cover-plate or parts of them 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 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.

7.3 Plugs are classified according to the class of appliances to which they are intended to be connected:

a) Plugs for appliances of Class I; and

b) Plugs for appliances of Class II.

8 MARKING

8.1 Accessories shall be marked with:

a) Rated current, in amperes;

b) Rated voltage, in volts;

c) Symbol for nature of supply;

d) Manufacture or responsible vendor's name, trade-mark or identification mark;

e) Type reference, which may be a catalogue number;

f) Symbol for degree of protection against ingress of solid foreign bodies, if higher than IP2X;

g) Country of manufacture; and

h) Symbol for degree of protection against harmful ingress of water, if applicable, in which case the symbol for degree of protection against ingress of solid foreign bodies shall be marked even, if not higher than IP2X.

If the system allows plugs of a certain IP ratings to be introduced into socket-outlets having another IP rating, attention shall 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 — The degree of protection are based on IS 12063.

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

— an appropriate marking indicating the length of insulation to be removed before the insertion of the conductor into the screwless terminal; and

— an indication of the suitability to accept rigid conductors only, for those socket-outlets having this restriction.

NOTES

1 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.

2 For two pin (two pole) plugs following information shall be given on the cartons:

"Plugs of two poles are suitable for class II appliances only."

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

— amperes.....A

— volts.....V

— alternating current.....~

— neutral.....N

— earth..... ⏚

— splash-proof construction.....IPX4

— jet-proof construction.....IPX5

— terminal for line (live).....L

NOTES

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

2 In the IP code the letter "X" concerning protection against ingress of solid objects shall be replaced by the relevant number.

3 Ordinary accessories are not marked with any symbol for protection against harmful ingress of water.

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

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

16 A 250 V ~ or 16/250 ~ or 16/250 ~

8.3 For fixed socket-outlets the marking with rated current, rated voltage and nature of supply, either the name, trade-mark or identification mark of the manufacturer or of the responsible vendor and the type reference shall be on the main part.

NOTE — The type reference may be the series references only.

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

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

NOTES

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

2 The term "main part" means the part carrying the socket contacts.

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 equipments of class II shall not be marked with the symbol for class II construction.

NOTE — The type reference of rewirable 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 shall be indicated by the symbol ' ⏚ '.

The marking shall not be placed on screws, or any other easily removable parts.

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

The identification of accessory terminals may be achieved by:

— their marking with graphical symbols or colours and/or,

— alpha-numeric system, or

— their physical dimensions or relative location.

Leads of neons or indicator lamps are not considered to be conductors for the purpose of this sub-clause.

NOTES

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.

2 Termination in non-rewirable need not be marked.

8.6 Fixed socket-outlets other than ordinary shall be marked with the symbol for the degree of protection against harmful ingress of water so that it is visible when the accessory is installed. For surface type mounting boxes, the marking may be made on boxes forming an integral part of the socket-outlet, provided the symbol is visible when the accessory is installed.

Compliance is checked by inspection.

8.7 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 socked with water and again for 15 s with a piece of cloth soaked with petroleum spirit".

NOTES

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

2 It is recommended that the petroleum spirit used consist of a solvent hexane with an aromatic content of maximum 0.1 percentage by volume, a kauributanol value of 29, an initial boiling point of approximately 65°C, a dry point of approximately 69°C and a specific density of approximately 0.68 g/cm³.

8.8 The accessories may also be marked with the Standard Mark.

8.8.1 The use of the Standard Mark is governed by the provision of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to the manufacturers or the producers may be obtained from the Bureau of Indian Standards.

9 CHECKING OF DIMENSIONS

9.1 Plugs and socket-outlets shall comply with the appropriate gauge (*see* Annex B). The dimensions of plugs and socket-outlets are given in Annex A.

Insertion of plugs into fixed or portable socket-outlet shall be ensured by their compliance with the relevant gauges.

Compliance is 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 shall be used for the design of the gauges.

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

Socket-outlets are subjected, before the above checking, to ten insertions and ten withdrawals of a plug complying with the corresponding plugs as given in Annex A having the maximum dimensions for the pins.

Table 2 Gauge Tolerances

(*Clause* 9.1)

Sl No.	Gauge for Checking mm	Gauge Tolerance
(1)	(2)	(3)
i)	Pin diameter	$^{0}_{-0.01}$
ii)	Dimension of entry holes corresponding to pin diameter and to distance between contact surfaces	$^{+0.01}_{0}$
iii)	Pin length and width	$^{0}_{0.1}$
iv)	Pin spacing (according to the case)	$^{0}_{-0.2}$ or $^{+0.2}_{0}$
v)	Distance from engagement face to point of first touch of socket contact (according to the case)	$^{0}_{-0.05}$ or $^{+0.05}_{0}$
vi)	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; and

b) Socket-outlet with a different number of live poles; exceptions may be admitted for socket-outlets which are specially constructed for the purpose to allow 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.

It shall not be possible to engage a plug for appliance of Class I with a socket-outlet exclusively designed to accept plugs for Class II equipments.

Compliance is checked by inspection or by manual test using gauges, the manufacturing tolerances of which shall be as specified in **9.1**.

In case of doubt the impossibility of insertion is checked by applying the appropriate gauge for 1 min with a force of 150 N.

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 40 ± 2°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 dimensions as given in Annex B ensures compliance with the requirement.

9.3 Deviations from the dimensions specified in Annex A may be made, but only if they provide a technical advantage and do not adversely affect the safety of accessories complying with the dimensions as given in Annex A, 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

10.1 Socket-outlet shall be so designed that, when they are wired and mounted 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.

The specimen is mounted as for normal use and fitted with conductors of the smallest cross-sectional areas

and the test is then repeated using conductors of the largest cross-sectional areas as specified in Table 3.

For socket-outlets, the standard test finger shown in Fig. 2, is applied in every possible position.

For plugs, the test finger is applied in every possible position when the plug is in partial or complete engagement with a socket-outlet.

An electrical indicator with a voltage not less than 40 V and not more than 50 V, is used to show contact with the relevant part.

For accessories where the use of elastomeric or thermoplastic material is likely to influence the requirement, the test is repeated but at an ambient temperature of 40 ± 2°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 of the same dimensions as the standard test finger. This finger, with an electrical indicator as described above, is applied to all places where yielding of the insulating material could impair the safety of the accessory, but it is not applied to membrances or the like and is applied to thin walled knock-out with a force of 10 N.

During this test, the accessories, with its associated mounting means, shall not deform to such an extent that dimensions shown in Annex A which ensure safety are unduly altered and no live part shall be accessible.

Each sample 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 Fig. 22. Fifteen minutes after removal of the test apparatus, the samples shall not show such deformation as would result in undue alteration of those dimensions shown in Annex A 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 fixed socket-outlets, shall be made of insulating material; however the covers or cover-plate of fixed 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 lining or insulating barrier fixed to covers or cover-plates or to the body of the accessories, in such a way that the insulating linings or insulating barrier 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 **27**.

In the case of single pole insertion, the requirements given in **10.3** applies.

Compliance is checked by inspection.

The above lining or barriers shall comply with the test of **17** and **27**.

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

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, for the case of single pole insertion, the requirement given in **10.3** applies.

NOTE — Fixing screws or other means are allowed.

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

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

10.3 It shall not be possible to make connection 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 the gauges whose dimensions are the less favourable for this kind of test; the tolerances of the gauges shall be specified in **9.1**.

For accessories with enclosures or bodies of thermoplastic material, the test made at an ambient temperature of 35 ± 2°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-outlet 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, or pins, is (are) in contact with the metal covers or cover-plates.

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

a) Sufficiently large cover or cover-plate,

b) Other means (for example, shutters).

10.4 External parts of plugs and portable socket-outlets, with the exception of assembly screws and the like, current-carrying and earthing pins, earthing straps and metal rings around pins, 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.

NOTE — Lacquer, enamel sprayed insulating coating are not deemed to be insulating material for the purpose of **10.1** to **10.4**

10.5 Shuttered socket-outlets shall, in addition, be so constructed that live parts are not accessible, without a plug in engagement, with the gauge shown in Fig. 4.

To ensure this degree of protection, socket-outlets shall be so constructed that the 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 it shall not depend upon parts which are liable to be lost.

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

An electrical indicator with a voltage not less than 40 V and not more than 50 V, 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 a steel gauge as shown in Fig. 4 with a force up to 1 N and with three independent straight movements applied in the most unfavourable conditions, withdrawing the gauge after each movement; socket-outlet with a plug partially inserted are checked with the test finger shown in Fig. 2.

For socket-outlets with enclosures or bodies of thermoplastic material, the test is made at an ambient temperature of 35 ± 5°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 the 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 requirement of **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 the gauge of Fig. 4, 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 40 ± 5°C, both socket-outlets and the gauge being at this temperature.

During this test live parts shall not be accessible by the gauge.

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

11 PROVISION FOR EARTHING

11.1 Accessories with earthing contact 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 samples against these drawings.

NOTE — Conformity with the dimensional requirements ensures compliance with this requirement.

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

They shall be of the same size as the corresponding terminals for the supply conductors, except that any additional external earthing terminals of fixed socket-outlets shall be at least of 6 mm².

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

NOTE — For fixed socket-outlet an additional earthing terminal may be external.

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 cover, they shall be automatically and reliably connected to the earthing terminal when 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.

NOTES

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

2 For the purpose of the requirements of this sub-clause, screws are not considered as parts of contact pieces.

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.

NOTES

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

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

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

11.4 Socket-outlets other than ordinary with an enclosure of insulating material, having more than one cable inlet, shall be in addition provided with an internal earthing terminal allowing the connection of an incoming and 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 together.

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

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 ac source having a no-load voltage not exceeding 12 V and equal to 1.5 times rated current or 25 A, whichever is the greater, is passed between the earthing terminal and each of the accessible metal parts in turn.

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

In no case shall the resistance exceed 0.05 Ω.

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

12 TERMINALS

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

12.1 General

12.1.1 Rewirable fixed socket-outlet shall be provided with screw-type terminal or with screwless terminals.

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

If pre-soldered flexible conductors are used, care shall be taken that in screw-type terminals the pre-soldered area shall be outside the squeezed 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; 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.

The conductor space shall be at least that specified in Fig. 34, 35, 36, or 37.

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

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

Compliance is checked by inspection.

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

12.2.3 Terminals with screw clamping shall have adequate mechanical strength.

Table 3 Relationship Between Rated Current and Connectable Nominal Cross-Section Areas of Copper Conductors

(*Clauses* 10.1, 12.2.1, 12.2.5, 12.2.7, 12.2.8, 12.2.11, 13.4, 24.2 *and* 27.1)

	Rigid (Solid or Stranded) Copper Conductors[1]		Flexible Copper Conductors	
Current and Type of the Accessory	Nominal Cross-Sectional Area mm²	Diameter of the Largest Conductor mm	Nominal Cross-Sectional Area mm²	Diameter of the Largest Conductor mm
(1)	(2)	(3)	(4)	(5)
6 A	–	–	From 0.75 up to 1.5 inclusive	1.73
10 A (Fixed accessory)	From 1 up to 2.5 inclusive[2]	2.13	–	–
10 A (Portable accessory)	–	–	From 0.75 up to 1.5 inclusive	1.73
16A 2 P + (Fixed accessory)	From 1.5 up to 2 × 2.5 inclusive	2.13	–	–
16A 2 P + (Portable accessory)	–	–	From 0.75 up to 1.5 inclusive	1.73

[1] The use of flexible conductors is permitted.

[2] The terminal shall allow the connection of two 1.5 mm² conductors which have a diameter of 1.45 mm.

Screws and nuts for clamping the conductors shall have an ISO metric 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**.

12.2.4 Terminals with screw clamping shall be resistant to corrosion.

Terminals, the body of which is made of copper or a 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 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 Fig. 32 and fitted with rigid (solid or stranded) conductor(s), according to Table 3, first with the smallest and then with the largest cross-sectional area, the clamping screws or nuts being tightened with the torque according to Table 6.

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 ± 2) rev/min.

The distance between the mouth of the clamping unit and the upper surface of the bushing shall be within ± 15 mm of the height 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 in the case they exist in the relevant Indian Standard, if the first test has been made with rigid stranded conductors. Where rigid stranded conductors do not exist, the test may be made with rigid solid conductors only.

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

Compliance is checked by inspection and by the following test:

The terminals are fitted with rigid solid or stranded conductors for fixed socket-outlets and flexible conductors for plugs and portable socket-outlet of the smallest and largest cross-sectional areas specified in Table 4, the terminal screws being tightened with a torque equal to two third of the torque shown in the appropriate column of Table 6.

If the screw has hexagonal head with a slot, the torque applied is equal to two-thirds of the torque shown in col 2 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.

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 cross-sectional area specified in Table 3."

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

The terminals of plugs and portable socket-outlet 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.

Terminals are fitted with conductors having the composition shown in Table 5.

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 terminals for the minimum distance prescribed, where no distance is prescribed, until it just projects from the far side of the terminals and in the position most likely to allow the wire to escape.

The clamping screw is then tightened with a torque equal to two third 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 shall have escaped from the clamping unit thus reducing creepage distances and clearances to values lower than those indicated in **27**.

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 fixings to accessories.

NOTES

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

Table 4 Values for Pull Test

(*Clause* 12.2.6)

Nominal Cross-Section of Conductor Accepted by the Terminal mm²	Above 0.75 Up to 1.5 Inclusive	Above 1.5 Up to 2.5 Inclusive	Above 2.5 Up to 4 Inclusive	Above 4 Up to 6 Inclusive	Above 6 Up to 10 Inclusive
Pull (N)	40	50	50	60	80

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

— the sealing compound or resin is not subject to stress during normal use, and

— the effectiveness of the sealing compound or resin is not impaired by temperatures attained by the terminal under the most unfavourable conditions specified in this standard.

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

"A solid rigid copper conductor of the largest cross-sectional area specified in Table 3 is placed in the terminal."

Screw and nuts are tightened and loosened five times by means of a suitable test screwdriver or spanner, the torque applied when tightened being equal to the torque shown in the appropriate column of Table 6 or in the table of the appropriate figures 34, 35 and 36 whichever is the greater.

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

Column 2 applies to screw without 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.

Column 3 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.

Column 4 applies to nuts of mantle terminals which are tightened by means of a screwdriver.

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

Table 5 Composition of Conductors

(*Clause* 12.2.7)

Nominal-Cross Sectional Area mm²	Numbers of Wires and Nominal Diameter of Wires mm		
	Flexible Conductor	Rigid Solid Conductor	Rigid Stranded Conductor
(1)	(2)	(3)	(4)
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

Table 6 Tightening Torques for the Verification of the Mechanical Strength of Screw-Type Terminals

(*Clauses* 12.2.6, 12.2.7, 12.2.8 *and* 24.1)

Nominal Diameter of Thread mm	Torque Nm		
(1)	(2)	(3)	(4)
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

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

NOTES

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

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

3 The screw and nuts must 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 Fig. 34, 35, 36 and 37 provide sufficient resiliency to comply with this requirement; for other designs, special provisions, such as, the use of an adequately resilient part which is not likely to be removed inadvertently, may be necessary.

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

The body of earthing terminals shall be of brass or other metal no less resistant to corrosion, unless it is a part of 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 terminals 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 — Screw or nuts shall be of plated steel withstanding the corrosion test is 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 Fig. 34.

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 Fig. 37.

Compliance is checked by measurement, after a solid conductor of the largest 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 test have to be carried out with rigid conductors first and then repeated with flexible conductors.

NOTE — This sub-clause is not applicable to socket-outlet provided with:

— screwless terminals requiring the fixing of special devices to conductors before clamping them in the screwless terminals, for example, flat push-on conductors,

— screwless terminals requiring twisting of the conductors, for example, those with twisted joints; and

— 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 flexible copper conductors having nominal cross-sectional areas as shown in Table 7.

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

Table 7 Relationship Between Rated Current and Connectable Cross-Sectional Areas of Copper Conductors for Screwless Terminals

(*Clauses* 12.3.2 *and* 12.3.10)

Rated Current A	Nominal Cross-Sectional Areas	Conductors	
		Diameter of Largest Rigid Conductor	Diameter Flexible Conductor
	mm^2	mm	mm
(1)	(2)	(3)	(4)
From 10 up to 16 inclusive	From 1.5 up to 2.5 inclusive	2.13	2.21

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

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

Compliance is checked by inspection.

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

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

Compliance is checked by inspection and by chemical analysis.

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

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

The conductor shall be clamped between metal surfaces.

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

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

12.3.6 It shall be clear how the insertion and disconnection of the conductors is intended to be effected.

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 openings 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 test of **12.3.10**.

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

a) during the insertion, the operation of the clamping means of the one of the conductors is independent of the operation of that for the other conductor(s).

b) during the disconnection, the conductor can be disconnected either at the same time or separately; and

c) 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 test with the appropriate conductors (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 function of the socket-outlets.

NOTE — For the purpose of this requirements, an appropriate marking indicating the length of insulation to be removed before the insertion of the conductor into the screwless terminals 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 test 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 test, which is carried out with uninsulated conductors on one screwless terminals of each sample using a new samples for each test.

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

Conductors are connected and disconnected Table 7 five times, new conductors being used each time, except for the fifth time, when the conductors used for the fourth insertion are clamped at the same place. For each insertion, the conductors are either pushed as far as possible into the terminal or are inserted so that adequate connection is obvious.

After each insertion, the conductor is subjected to pull of the value shown in Table 8. The pull is applied without jerks, for 1 minute in the direction of the longitudinal axis of the conductor space.

Table 8 Value for Pull Test for Screwless-Type Terminals

(*Clause* 12.3.10)

Rated Current A	Pull N
(1)	(2)
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 cross-sectional areas specified in Table 7. These conductors are, however, inserted and disconnected only once.

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

For fixed socket-outlets with screwless terminals each conductor is subjected for 15 min to a circular motion (10 ± 2) rev/min using an apparatus, an example of which is shown in Fig. 32. The conductor is subjected to a pull having a value shown in Table 9.

During the test the conductor 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 test (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 have to be carried out with new copper conductors.

a) The test is carried out loading the screwless terminals for one hour with an alternating current, as specified in Table 10, and connecting rigid solid conductors 1 m long having the cross-sectional area as specified in Table 10.

   The test is carried on each clamping unit.

   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 measurement shall be made across each screwless terminals and as near as possible to the place of contact.

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

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

Table 9 Values for Flexing under Mechanical Level Test for Copper Conductors

(*Clauses* 12.3.10 *and* 12.3.11)

Nominal Conductor Cross-Sectional Area mm^2	Diameter of Bushing Hole[1] mm	Height (H)[2] mm	Mass for Conductor kg
(1)	(2)	(3)	(4)
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

[1] 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.

[2] Tolerance for height $H = \pm 15$ mm.

Table 10 Test Current for the Verification of Electrical and Thermal Stresses in Nominal Use for Screwless Terminals

(*Clause* 12.3.11)

Rated Current A	Test Current A	Nominal Cross-Sectional Area of the Conductor mm²
(1)	(2)	(3)
10	17.5	1.5
16	22	2.5

NOTE — For socket-outlet having a rated current lower than 10 A, the test current is proportionally determined and the cross-sectional area of the conductors is chosen equal to 1.5 mm².

b) 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 being carried out as follows:

— the current is flowing for approximately 30 min; and

— for a further 30 min approximately no current is flowing.

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 two times the value measured after the 24th cycle, whichever is the smaller.

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

Furthermore the mechanical strength test according to **12.3.10** is repeated and all samples shall withstand this test.

12.3.12 Screwless terminals shall be so designed that the connected rigid solid conductor remains clamped, even when the conductor 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 samples of socket-outlets which have not been used for any other test.

The test apparatus, the principle of which is shown in Fig. 33 A, 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° ± 5°.

— the starting point can be varied by 10° and 20° from the original point.

NOTE — A reference direction need not be specified.

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

The deflection device shall be so designed that:

— the force is applied in the direction perpendicular to the undeflected conductor;

— the deflection is attained without rotation or displacement of the conductor within the clamping unit; and

— 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 Fig. 33 B.

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.

To avoid oxidation, the insulation of the wire shall be removed immediately before starting the test.

NOTES

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

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

A clamping unit is fitted as for normal use with a rigid solid copper conductor having the smallest 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 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 current flowing (that is, the current is not switched on and off during the test); a suitable power supply should be used and a suitable resistance should be inserted in the circuit so that the current variations are kept within ± 5 percent during the test.

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 passed to the conductor inserted in the clamping unit under test in the direction of one of the 12 directions shown in Fig. 33 A 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 direction shown in Fig. 33 A following the same test procedure.

If at any of the 12 test directions the voltage drop is greater than 25 mV, the force is kept applied 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 reduced a value below 25 mV, the force is kept applied in the same direction for a further period of 30 s during which period the voltage drop shall not have increased.

The other two samples 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 sample. If one sample has failed at one of the directions of application of the test force, the tests are repeated on another set of sample, all of which shall comply with the repeated tests.

13 CONSTRUCTION OF FIXED SOCKET-OUTLETS

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

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

13.2 Socket-contact and pins of socket-outlet shall be resistant to corrosion and abrasion.

Compliance is checked by inspection and according to **26.5.**

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

Compliance is checked by inspection and by the test of **24.**

13.4 Socket-outlet shall be so constructed as to permit:

— easy introduction and connection of the conductors in the terminals;

Table 11 Nominal Cross-Sectional Areas of Rigid Copper Conductors for Deflection Test of Screwless Terminals

(*Clause* 12.3.12)

Rated Current of the Socket-Outlet	Cross-Sectional Area of the Test Conductor mm²	
	First Test Sequence	Second Test Sequence
A		
(1)	(2)	(3)
≤ 6	1.0	1.5
10	1.5	2.5

Table 12 Deflection Test Forces

(*Clause* 12.3.12)

Cross-Sectional Area of the Test Conductor mm²	Force for Deflecting the Test Conductor [1] N
(1)	(2)
1.0	0.25
1.5	0.5
2.5	1.0

[1] The forces are chosen so that they stress the conductors close to the limit of the elasticity.

— 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 side of the base and the enclosure (cover or box) flush mounted 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 terminals are necessarily protected by insulating barriers or insulating shoulders, from contact, due to incorrect installation of the terminal metal part with the insulation of the conductor.

For surface type socket-outlet 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 cross-sectional area specified, for the relevant terminal size, in Table 3.

13.5 Socket-outlet 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.

13.7 Covers, or 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).

NOTES

1 It is recommended that the fixings of covers or cover-plates be captive.

The use of tight fixing washers of cardboard or the like is deemed to be an adequate method for securing screws intended to be captive.

2 Non-earthed metal parts separated from live parts in such a way that creepage distance and clearances have the values specified in Table 3, are not considered as accessible if the requirements of this sub-clause are met.

Where the fixing 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 with the requirements of safety and construction is checked according to **13.7.1**, **13.7.2** or **13.7.3**.

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

By inspection only.

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

— where their removal may give access, with the standard test finger, to live parts by the test 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 distance and clearances have the values specified in Table 23 by the tests of **24.15**;

— when their removal may give access, with the standard test finger, only to:

- insulating parts, or
- earthed metal parts, or
- metal parts separated from live parts in such a way that creepage distances and clearances have twice the values specified in Table 23, or
- live parts of safety extra-low voltage (SELV) circuits not greater than 25 V ac by the tests of **24.16**.

13.7.3 For covers or cover-plates whose fixing is not dependent on screws and where removal is obtained by using a tool, in accordance with the manufacturer's instructions given in an instruction sheet or in a catalogue: by the same tests of **13.7.2** except that the covers or cover-plates or parts of them need not come out 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 changes the classification of the socket-outlet according to **7.1.2**.

NOTE — This requirement applies to accessories of the same manufacturer.

Table 13 Forces to be Applied to Covers, Cover-Plates or Actuating Members Whose Fixing is Not Dependent on Screws

(*Clause* 13.7.2)

Accessibility with the Test Finger After Removal of Covers, Cover-Plates or Parts of Them	Tests According Socket-Outlets to Sub-clauses	Force to be Applied N			
		Socket-Outlets Complying with 24.17 and 24.18		Socket-Outlets not Complying with 24.17 and 24.18	
		Shall not come off	Shall come off	Shall not come off	Shall come off
(1)	(2)	(3)	(4)	(5)	(6)
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 ≤ 25 V ac or metal parts separated from live parts by creepage distances twice those according to Table 23	24.16	10	120	10	120

Compliance with the requirements of **13.6, 13.7** and **13.8** is checked by inspection and by an installation test.

13.9 Ordinary surface-type socket-outlets shall be so constructed that, when they are mounted and wired as for normal use, there are no free openings in the enclosures other than the entry openings for the pins of the plug.

Compliance is checked by inspection and by an installation test with conductors of the smallest cross-sectional area specified in Table 14.

NOTE — Small gaps between enclosures and conduits or cables or between enclosures and earthing contacts, if any, are neglected.

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 of 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 socket-outlet as a whole 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-outlet shall withstand the lateral strain imposed by equipment likely to be introduced into them.

Compliance is checked by means of the device shown in Fig. 6.

Each specimen is mounted on a vertical surface with the plane through the socket-contacts horizontal. The device is then fully engaged and 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 tests, the device shall not come out.

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

13.15 Socket-outlet shall not be an integral part of lamp holders.

Compliance is checked by inspection.

13.16 Socket-outlet other than ordinary shall be totally enclosed when fitted with screws conduits or with polyvinyl chloride sheathed or similar type of cables and without a plug in position.

Surface-type socket-outlet other than ordinary shall have provisions for opening a drain hole at least 5 mm in diameter, or 20 mm^2 in area with a width and a length of at least 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 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 test of **16.2**.

NOTES

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

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.

3 A drain hole in the back of the enclosure is deemed to be effective only if the design of the enclosure ensure a clearance or at least 5 mm from the wall, or provided 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 test of **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 from the installation.

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.

13.19 Metal strips of the earthing circuit shall have no burrs which might damage the insulation of the supply conductors.

Compliance is checked by inspection.

13.20 Socket-outlet to be installed in a box shall be so designed that the conductor ends can be prepared after the box is mounted in position, but before the socket-outlet is fitted in the box.

Compliance is checked by inspection.

13.21 Inlet opening shall allow the introduction of the conduit or the protection covering of the cable so as afford complete mechanical protection.

In surface-type socket-outlet the inlet opening for conduit entries, or at least two of them if there are more than one, shall be capable of accepting conduit size of 16, 20, 25 or 32 or a combination of at least two of any of these sizes.

In surface type socket outlets, the inlet opening for cable entries shall preferably be capable of accepting cables having the dimensions specified in Table 14 or be as specified by the manufacturer.

Compliance is checked by inspection and by measurement.

NOTE — Inlet openings of adequate size may also be obtained by the use of knock-outs or of suitable insertion pieces.

13.22 Membranes (grommets) in inlet openings shall be reliably fixed and shall not be displaced by the mechanical and thermal stresses occurring in normal use.

Compliance is checked by the following test:

Membranes are tested when assembled in the accessory.

First the accessories are fitted with membranes which have been subjected to the treatment specified in **16.1**.

The accessories are then placed for 2 h in a heating cabinet as described in **16.1**, the temperature being maintained at 40 ± 2°C.

Immediately after this period, a force of 30 N is applied for 5 s to various parts of the membranes by means of the tip of a straight unjointed test finger of the same dimensions as the standard test finger shown in Fig. 2.

During these tests, the membranes shall not deform to such an extent that live parts become accessible.

For membranes likely to be subjected to an axial pull in normal use, an axial pull of 30 N is applied for 5 s.

During this test, the membranes shall not come out.

The test is then repeated with membranes which have not been subjected to any treatment.

13.23 It is recommended that membranes in inlet openings be so designed and made of such material that the introduction of the cables into the accessory is permitted when the ambient temperature is low.

NOTE — The compliance with this recommendation is required due to installation practices in cold conditions.

Table 14 External Cable Dimension Limits for Surface Type Socket-Outlets

(*Clauses* 13.9 *and* 13.21)

Rated Current A	Nominal Cross-Sectional Areas of Conductors mm²	Number of Conductors	Limits of External Dimensions of Cables mm	
			Min	*Max*
(1)	(2)	(3)	(4)	(5)
10	1 up to and including 2.5	2	6.4	13.5
		3		14.5
	1.5 up to and including 2.5	2	7.4	13.5
		3		14.5
16		4	7.6	18
	1.5 up to and including 4	5		19.5

NOTE — The limits of external dimensions of cables specified are based on IS 694 and IS 9968 (Part 1).

Compliance is checked by the following test:

The accessories are fitted with membranes which have not been subjected to ageing, treatment, those without opening being suitably pierced.

The accessories are then kept, for 2 h, in a refrigerator at a temperature of – 15 ± 2°C.

After this period, the accessories are removed from the refrigerator and immediately afterwards, while the accessories are still cold, it shall be possible to introduce, without undue force, cables of the heaviest type through the membranes.

After the tests in **13.22** and **13.23**, the membranes shall show no harmful deformation, cracks or similar damage which would lead to non-compliance with this standard.

14 CONSTRUCTION OF PLUGS AND PORTABLE SOCKET-OUTLET

14.1 A non-rewirable plug or a non-rewirable portable socket-outlet shall be such that:

— the flexible cable or cord cannot be separated from the accessory without making it permanently useless, and

— the accessory cannot be opened by hand or by using a general purpose tool, for example a screwdriver used as such.

NOTE — An accessory is considered to be permanently useless, when, for re-assembling the accessory, parts or materials other than the original are to be used.

Compliance is checked by inspection and manual test.

14.2 Pins of plugs and portable socket-outlet shall have adequate mechanical strength.

Compliance is checked by the tests of **24** and, for pins which are not solid, by the following test which is made after the test of **21**.

A force of 100 N is exerted on the pin, which is supported as shown in Fig. 31, for 1 min in a direction perpendicular to the axis of the pin, by means of a steel rod having a diameter of 4.8 mm, the axis of which is also perpendicular to the axis of the pin.

During the application of the force, the reduction of the dimension of the pin at the point where the force is applied shall not exceed 0.15 mm.

After removal of the rod, the dimension of the pin shall not have changed by more than 0.06 mm in any direction.

14.3 Pins of plugs shall be:

— locked against rotation,

— not removable without dismantling the plug, and

— adequately fixed in the body of the plug when the plug is wired and assembled as for normal use.

It shall not be possible to replace the earthing or neutral pins or contacts of plugs in an incorrect position.

Compliance is checked by inspection, by manual test and by the tests of **24.2** and **24.10.**

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

Compliance is checked by inspection, by manual test and for single portable socket-outlets by the test of **24.2.**

14.5 Socket-contact assemblies shall have sufficient resiliency to ensure adequate contact pressure.

This requirement may also cover socket-outlets where the contact pressure relies on insulating parts having such characteristics as to ensure a safe and permanent contact in any condition of normal use, with regard in particular to shrinkage, ageing and yielding.

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

14.6 Pin and socket-contacts shall be resistant to corrosion and abrasion.

Compliance is checked by an appropriate test, which is under consideration.

14.7 The enclosure of rewirable accessories shall completely enclose the terminals and the ends of flexible cable and cord.

The construction shall be such that the conductors can be properly connected and that, when the accessory is wired and assembled as for normal use, there is no risk that:

— pressing the cores together cause damage to the conductors insulation likely to result in a breakdown of the insulation;

— a core, the conductor of which is connected to a live terminal, is necessarily pressed against accessible metal parts; and

— a core, the conductor of which is connected to the earthing terminal, is necessarily pressed against live parts.

14.8 Rewirable accessories shall be so designed that terminal screws or nuts cannot become loose and fall out of position in such a way that they establish an electrical connection between live parts and the earthing terminal or metal parts connected to the earthing terminal.

Compliance with the requirements of **14.7** and **14.8** is checked by inspection and by manual test.

14.9 Rewirable accessories with earthing contact shall be designed with ample space for slack of the earthing conductor in such a way that, if the strain relief is rendered inoperative, the connection of the earthing conductor is subjected to strain after the connections of the current-carrying conductors and that, in case of excessive stresses, the earthing conductor will break after the current-carrying conductors.

Compliance is checked by the following test:

The flexible cable or cord is connected to the accessory in such a way that the current-carrying conductors are led from the strain relief to the corresponding terminals along the shortest possible path.

After they are correctly connected, the core of the earthing conductor is led to its terminal and cut off at a distance 8 mm longer than necessary for its correct connection.

The earthing conductor is then connected to the terminal. It must be then possible to house the loop, which is formed by the earthing conductor owing to its surplus length when the accessory is assembled correctly.

In non-rewirable non-moulded on accessories with earthing contact the length of the conductors between the terminations and the cord anchorage shall be so adjusted that the current-carrying conductors will be stressed before the earthing conductors, if the flexible cable slips in its anchorage.

Compliance is checked by inspection.

14.10 Terminals of rewirable accessories shall be so located or shielded that they comply with the following test:

A 6 mm length of insulation is removed from the end of a flexible conductor, having the minimum nominal cross-sectional area specified in Table 3. One wire of the flexible conductor is left free and remaining wires are fully inserted into and clamped in the terminal, as for normal use.

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

The free wire of a conductor connected to a live terminal shall not touch any accessible metal part or be able to emerge from the enclosure when the accessory has been assembled.

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

If necessary, the test is repeated with the free wire in another position.

The prohibition against making sharp bends around barriers does not imply that the free wire shall be kept straight during the test. Sharp bends are made if it is considered likely that such bends can occur during the normal assembly of the plug or portable socket-outlet, for example when a cover is pushed on.

14.11 For rewirable plugs and rewirable portable socket-outlets:

— it shall be clear how the relief from strain and the prevention of twisting is intended to be effected;

— the cord anchorage, or at least part of it, shall be integral with or permanently fixed to one of the component parts of the plug or portable socket-outlet;

— make-shift methods, such as, tying the cable or cord in a knot or tying the ends with string, shall not be used;

— cord anchorages shall be suitable for the different types of flexible cable which may be connected including cables having rubber sheath of maximum diameter as shown in Tables 17 and 18, and their effectiveness shall not depend upon the assembly of the parts of the body;

— cord anchorages shall be of insulating material or be provided with an insulating lining fixed to the metal parts;

— metal parts of the cord anchorage, including clamping screws, shall be insulated from the earthing circuit.

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

14.12 Insulating parts which kept the live parts in position shall be reliably fixed together, and it shall not be possible to dismantle the accessory without the aid of a tool.

Compliance is checked by inspection and by manual test.

14.13 If covers of portable socket-outlets are provided with bushings for the entry holes for the pins, these bushes shall not be allowed to be removed from the outside or to become detached inadvertently from the inside, when the cover is removed.

14.14 Screws intended to allow the access to the interior of the accessory shall be captive.

NOTE — The use of tight fitting washers of cardboard or the like is deemed to be an adequate method for securing screws which must be captive.

Compliance with the requirements of **14.13** and **14.14** is checked by inspection.

14.15 The engagement face of plugs shall have no projections other than the pins, when the plug is wired and assembled as for normal use.

Compliance is checked by inspection, after fitting conductors of the largest cross-sectional area specified in Table 3.

NOTE — The earthing contacts including collars and recesses are not considered as projections from the engagements face.

14.16 Portable socket-outlet shall be so designed that full engagement of associated plugs is not prevented by any projection from their engagement face.

Compliance is checked by the test of **13.5**.

14.17 Accessories other than ordinary shall be provided with a gland or the like for sealing the cable entries.

Plugs other than ordinary shall be adequately enclosed when fitted with a flexible cable as for normal use.

Portable socket-outlets other than ordinary shall remain totally enclosed even without a plug in engagement.

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

Compliance is checked by inspection and by the test of **16.2**.

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

This requirement does not imply that the lid, if any, on the entry openings for the pins need be closed when the plug is not in position, provided that the accessory passes the relevant tests for the verification of the ingress of water.

14.18 Portable socket-outlets having means for suspension from a wall or other mounting surfaces shall be so designed that the suspension means do not allow access to live parts and that any failure during the test does not expose live parts.

There shall be no free openings between the space intended for the suspension means fixed to the wall and the live parts.

Compliance is checked by inspection and by the tests of **24.11, 24.12** and **24.13**.

14.19 Combinations of plugs and socket-outlets with circuit-breakers or other protective devices shall comply with the relevant standards, if any.

Compliance is checked by reference to appropriate standards if any.

14.20 Portable accessories shall not be an integral part of lampholders.

Compliance is checked by inspection.

14.21 Plugs classified exclusively as plugs for equipment of class II shall be rewirable or non-rewirable type.

If they are incorporated in a cord set, this shall be provided with a connector for equipment of class II.

If they are incorporated in a cord extension set, this shall be provided with a portable socket-outlet for equipment of class II.

NOTE — Cord extension sets for equipments of class II are not allowed.

Compliance is checked by inspection.

14.22 Components, such as, switches and fuses, incorporated in accessories shall comply with the

relevant Indian Standard, if any, as far as it reasonably applies.

Compliance is checked by inspection and, if necessary, by testing the component according to the relevant Indian Standard, if any.

14.23 If a plug is an integral part of plug-in equipment, that equipment shall not cause overheating of the pins or impose undue strain on fixed socket-outlets.

NOTE — Examples of equipments with plugs which are an integral part are razors and lamps with rechargeable batteries, plug-in transformers, etc.

For two-pole plugs, with or without earthing contact, compliance is checked by the tests of **14.23.1** and **14.23.2**.

14.23.1 The plug of the equipment is inserted into a fixed socket-outlet complying with this standard, the socket-outlet being connected to a supply voltage equal to 1.1 times the highest rated voltage of the equipment.

After 1 h, the temperature-rise of the pins shall not exceed 45°C.

14.23.2 The equipment is then inserted into a fixed socket-outlet complying with this standard, the socket-outlet being pivoted about a horizontal axis through the axis of the live socket-contacts at a distance of 8 mm behind the engagement face of the socket-outlet and parallel to this engagement face.

The additional torque which has to be applied to the socket-outlet to maintain the engagement face in the vertical plane shall not exceed 0.25 Nm.

14.24 Plugs shall be shaped in such a way and made of such a material that they can easily be withdrawn by hand from the relevant socket-outlet.

In addition the gripping surfaces shall be so designed that the plug can be withdrawn without having to pull on the flexible cable or cord.

Compliance is checked by a test which is under consideration.

14.25 Membranes in inlet opening shall meet the requirements of **13.23** and **13.24** shall apply.

15 INTERLOCKED SOCKET-OUTLETS

Socket-outlet interlocked with a switch shall be so constructed that a plug cannot be inserted into or withdrawn from the socket-outlet while the socket-contacts are live, and the socket-contacts of the socket-outlet cannot be made live until a plug is almost completely in engagement.

Compliance is checked by inspection and by manual test.

NOTE — Other test requirements are under consideration.

16 RESISTANCE TO AGEING, TO HARMFUL INGRESS OF WATER AND TO HUMIDITY

16.1 Resistance to Ageing

Accessories shall be resistant to ageing.

Parts intended for decorative purpose only, such as, certain lids, are to be removed before the test.

Compliance is checked by the following test:

Accessories, mounted as for normal use, are subjected to a test in a heating cabinet with an atmosphere having the composition and pressure of the ambient air and ventilated by natural circulation.

Accessories other than ordinary are tested after having been mounted and assembled as prescribed in **16.2**.

The temperature in the cabinet is 70 ± 2°C.

The samples are kept in the cabinet for 7 days (168 h).

The use of an electrically heated cabinet is recommended.

Natural circulation may be provided by holes in the walls of the cabinet.

After the treatment, the samples are removed from the cabinet and kept at room temperature and relative humidity between 45 percent and 55 percent for at least 4 days (96 h).

The samples shall show no crack visible with normal or corrected vision without additional magnification, nor shall the material have become sticky or greasy, this being judged as follows.

With the forefinger wrapped in a dry piece of rough cloth the sample is pressed with a force of 5 N.

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

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

NOTE — The force of 5 N can be obtained in the following way:

The sample is placed on one of the pans of a balance and the other pan is loaded with a mass equal to the mass of the sample plus 500 g.

Equilibrium is then restored by pressing the sample with the fore-finger wrapped in a dry piece of rough cloth.

16.2 Resistance to Harmful Ingress of Water

The enclosure of accessories other than ordinary shall provide a degree of protection against harmful ingress of water in accordance with the classification of the accessories.

Compliance is checked by the following tests.

NOTE — The tests are based on IS 12063

16.2.1 Fixed socket-outlets are mounted on a vertical surface.

Flush-type and semi-flush type socket-outlets are fixed in a test wall using an appropriate box in accordance with the manufacturer's instructions.

In case, where the manufacturer's instruction does not specify another type of wall, the test wall according to Fig. 41 is used.

In case where the manufacturer's instructions specify another type of wall, this wall as well as the mounting shall be described in sufficient detail to ensure reproducible tests. The test wall as per Fig. 41 is made with bricks having smooth surface so that when the box is mounted in test wall, it shall fit tight against the wall so that water cannot enter between the box and the wall.

NOTES

1 If sealing material is used in order to seal the box into the wall, sealing compound should not influence the sealing properties of the specimen to be used.

2 Figure 41 shows an example where the edge of the box is positioned in the reference plane, other positions are possible according to the instructions of the manufacturer.

The test wall is placed in a vertical position.

Fixed socket-outlet are mounted as in normal use and fitted with such cables having conductors of the largest and smallest cross-sectional area given in Table 3, as appropriate to their rating.

Portable socket-outlets are tested on a plain, horizontal surface in a position as in normal use, such that there is no strain on the flexible cable. They are fitted with such flexible cables (*see* Table 17) having conductors of the largest and smallest cross-sectional area given in Table 3, as appropriate to their rating.

Screws operated when mounting the accessory are tightened with a torque equal to two-third of the applicable torque given in Table 6.

Glands are tightened with a torque equal to two-third of that applied during the test of **24.6.**

NOTE — Glands are not fitted with sealing compound or the like.

Parts which can be removed without the aid of a tool are removed.

During the test the drain hole, if any, of socket-outlets with a degree of protection higher than IPX4, shall not be open.

Fixed socket-outlets are tested without a plug in engagement and with the lid, if any closed.

Portable socket-outlets are tested without a plug in engagement with the lid, if any, closed.

Plugs are tested when in full engagement first with a fixed and then with a portable socket-outlet of the same system and with the same degree of protection against water it both type are defined in the system.

NOTE — In some systems plugs and socket-outlets are not defined in all the same degree of protection.

16.2.2 Splash-proof accessories are subjected to the test specified for the degree of protection IPX4 according to the requirements of IS 12063.

16.2.3 Jet-proof accessories are subjected to the specified for the degree of protection IPX5, according to the requirements IS 12063.

16.2.4 Care shall be taken not to disturb, for example, to knock or shake, the assembly, such that test results will be affected.

If the accessory has drain hole, it shall be proved by inspection that any water which enters does not accumulate and that it drains away without doing any harm to the complete assembly.

NOTES

1 For degree of protection higher than IPX4 it may be necessary to open the drain holes for inspection.

2 If the accessory is not provided with drain holes, consideration shall be given to the disposal of any accumulation of water which may occur.

The specimens shall withstand on electric strength test specified in **17.2** which shall be started within 5 min after the completion of the test according to this sub-clause.

16.3 Resistance to Humidity

Accessories shall be proof against humidity which may occur in normal use.

Compliance is checked by the humidity treatment described in this sub-clause followed immediately by the measurement of the insulation insistence and by the electric strength test specified in **17.**

Inlet openings, if any, are left open; if knock outs are provided, one of them is opened.

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

The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity maintained between 91 percent and 95 percent.

The temperature of the air, where samples are placed, is maintained within ± 1°C of any convenient value t between 15°C and 35°C.

Before being placed in the humidity cabinet, the samples are bought to a temperature between t and t + 4°C.

The samples are kept in the cabinet for:

— 2 days (48 h) for ordinary accessories, and

— 7 days (168 h) for accessories other than ordinary.

NOTES

1 In most cases the samples may be brought to the specified temperature, by keeping them at this temperature for at least 4 h before the humidity treatment.

2 A relative humidity between 91 percent and 95 percent can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2So_4) or potassium nitrate (KNO_3) in water having a sufficiently large contact surface with the air.

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

After this treatment the samples shall show no damage within the meaning of this standard.

17 INSULATION RESISTANCE AND ELECTRIC STRENGTH

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

Compliance is checked by the following tests, which are made immediately after the test of **16.3,** in the humidity cabinet or in the room in which the samples were brought to the prescribed temperature, after reassembly of those parts which can be removed without the aid of a tool and were removed for the test.

17.1 The insulation resistance is measured using a dc voltage of approximately 500 V, the measurement being made 1 min after application of the voltage.

The insulation resistance shall be not less than 5 M W.

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

a) between all poles connected together and the body, the measurement being made with a plug complying with this standard in engagement;

b) between each pole in turn and all others, these being connected to the body with a plug complying with this standard in engagement;

c) between any metal enclosure and metal foil in contact with the inner surface of its insulating lining, if any;

NOTE — This test is only made if any insulating lining is necessary to provide insulation.

d) between any metal part of the cord anchorage, including clamping screws, and earthing terminal or earthing contact, if any, of portable socket-outlet;

e) between any metal part of the cord anchorage of portable socket-outlets and a metal rod of the maximum diameter of the flexible cable or cord inserted in its place (*see* Table 17).

The term "body" used in Items (a) and (b) includes accessible metal parts, metal frames supporting the base of flush-type socket-outlets, metal foil in contact with the outer surface of accessible external parts of insulating material, fixing screws of bases or covers and cover-plates, external assembly screws, and earthing terminals or earthing contacts.

NOTES

1 Measurements (c), (d) and (e) are not made on non-rewirable portable socket-outlets.

2 While the metal foil is wrapped round the outer surface or placed in contact with the inner surface of parts of insulating material, it is pressed against holes or groove without any appreciable force by means of a straight unjointed test finger having the same dimensions as the standard test finger shown in Fig. 2.

17.1.2 For plugs, the insulation resistance is measured consecutively:

a) between all poles connected together and the body;

b) between each pole in turn and all others, these being connected to the body;

c) between any metal part of the cord anchorage, including clamping screws, and the earthing terminal or earthing contact, if any;

d) between any metal part of the cord anchorage and a metal rod of the maximum diameter of the flexible cable or cord inserted in its place (*see* Table 17).

The term "body" used in (a) and (b) includes all accessible metal parts, external assembly screws, earthing terminals, earthing contacts and metal foil in contact with the outer surface of accessible external parts of insulating material, other than the engagement face.

NOTES

1 Measurements (c) and (d) are not made on non-rewirable plugs.

2 While the metal foil is wrapped round the outer surface or placed in contact with the inner surface of parts of insulating material, it is pressed against holes or grooves without any appreciable force by means of a straight unjointed test finger having the same dimensions as the standard test finger shown in Fig. 2.

17.2 A voltage of substantially sine-wave form, having a frequency of 50 Hz, is applied for 1 min between the parts indicated in **17.1.**

The test voltage shall be as follow:

— 1 250 V for accessories having a rated voltage up to and including 110 V;

— 2 000 V for accessories having a rated voltage exceeding 110 V.

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

NOTES

1 The high voltage transformer used for the test must be so designed that, when the output terminals are short-circuited after the output voltage has been adjusted to the appropriate test voltage, the output current is at least 200 (m A).

2 The over current relay must not trip when the output current is less than 100 m A.

3 Care is taken that the rms value of the test voltage applied is measured within ± 3 percent.

4 Glow discharges without drop in voltage are neglected.

17.3 When applied as a routine test, the high voltage test may also be carried out as a flash test. The specimen may not be connected to the supply and an ac voltage one and a half times the values given in **17.2** shall be applied for a period of 5 s.

18 OPERATION OF EARTHING CONTACTS

Earthing contacts shall provide adequate contact pressure and shall not deteriorate in normal use.

Compliance is checked by the tests of **19** and **21**.

19 TEMPERATURE RISE

19.1 Accessories shall be so constructed that they comply with the following temperature-rise test:

— non-rewirable accessories are tested as delivered.

— rewirable accessories are fitted with polyvinyl chloride insulated conductors having a normal cross-sectional area as shown in Table 15.

The terminals screws or nuts are tightened with a torque equal to two-third of that specified in **12.2.8**.

NOTE — To ensure normal cooling of the terminals, the conductors connected to them must have a length of at least 1 m.

Flush-mounted accessories are mounted in flush-mounted boxes. The box is placed in a block of pinewood filled around the box with plaster, so that the front edge of the box does not protrude and is not more than 5 mm below the front surface of the pinewood block.

NOTE — The test assembly should be allowed to dry for at least seven days when first made.

The size of the pinewood block, which may be fabricated from more than one piece, shall be such that there is at least 25 mm of wood surrounding the plaster, the plaster having a thickness between 10 mm and 15 mm around the maximum dimensions of the sides and rear of the box.

NOTE — The sides of cavity in the pinewood block may have cylindrical shape.

The cables connected to the socket-outlet shall enter through the top of the box, the point(s) of entry being sealed to prevent the circulation of air. The length of each conductor within the box shall be ± 10 mm.

Surface-type socket-outlets shall be mounted centrally on the surface of a wooden block, which shall be at least 20 mm thick, 500 mm wide and 500 mm high.

Other types of socket-outlets shall be mounted according to the manufacturer's instruction or, in the absence of such an instruction, in the position of normal use considered to give the most onerous conditions.

The test assembly shall be placed in a draught-free environment for the test.

Socket-outlets are tested using a test plug with brass pins having the minimum specified dimensions.

Plugs are tested using a fixed socket-outlet complying with the standard and having as near to average characteristics as can be selected, but with minimum size of the earthing pin, if any.

The plug is inserted into the socket-outlet and an alternating current as specified in Table 20, is passed for 1 h.

For accessories having three poles or more, the current during the test shall be passed through the phase contacts, where applicable. In addition, separate tests shall be made passing the current through the neutral contact, if any, and the adjacent phase contact and

Table 15 Nominal Cross-Sectional Areas of Copper Conductors for Temperature-Rise Test

(*Clause* 19.1)

Rated Current of Accessory A	Nominal Cross-Sectional Area mm²	
	Flexible Conductors for Portable Accessories	Rigid Conductors (Solid or Stranded for Fixed Accessories)
(1)	(2)	(3)
Up to and including 10	1	1.5
Over 10 up to and including 16	1.5	2.5

through the earthing contact, if any, and the nearest phase contact. For the purpose of this test, earthing contacts, irrespective of their number, are considered as one pole.

In case of multiple and combined socket-outlets the test is carried out on one socket-outlets of each type and current rating.

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

The temperature-rise at the terminals shall not exceed 45°C.

NOTES

1 For the purpose of the test of **25.3**, the temperature-rise of external parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact with them, is also determined.

2 In case of accessories incorporating dimmers, fuses, switches, energy regulators, etc, these other elements are short-circuited for the purpose of this test.

20 MAKING AND BREAKING CAPACITY

Accessories shall have adequate breaking capacity.

Compliance is checked by testing socket-outlets, and plugs with pins which are not solid, by means of an apparatus as shown in Fig. 12.

Rewirable accessories are fitted with conductors as specified for the test of **19**.

NOTE — In case of failure of the shutters, the tests on shuttered socket-outlets may be repeated with operations made by hand.

Socket-outlets are tested using a test plug with brass pins provided, if applicable, insulating sleeves, and having the maximum specified (dimension, with a tolerance of 0 mm/0.06 mm, and spaced at the nominal distance, with a tolerance of +0.05 mm; however, as far as the extremities of the sleeves are concerned, it is sufficient that their dimensions are within the tolerances given in the relevant data sheets, if any.

NOTES

1 Dimensions of insulating sleeves are under consideration.

2 The shapes of the extremities of the insulating sleeves are not considered of importance for the purpose of the test provided that they are according to the relevant data sheets if any.

3 The material of the brass pins shall be as specified in IS 292 type Cu Zn 39 Pb2-M.

4 The micro-composition shall be homogeneous.

The ends of round pins are rounded.

Plugs are tested using a fixed socket-outlet complying with this standard and having as near to average characteristics as can be selected.

NOTE — Care is taken that the pins of the test plugs are in good condition before the test is started.

The length of the stroke of the test apparatus shall be between 50 mm and 60 mm.

The plug is inserted into and withdrawn from the socket-outlet 50 times (100 strokes) at a rate of:

— 30 strokes per minute

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

The test voltage is 1.1 times the rated voltage and the test currents are 1.25 times the rated current.

The periods during which the test current is passed from engagement of the plug until the subsequent disengagement shall be: $1.5 \begin{smallmatrix}+0.5\\0\end{smallmatrix}$ s.

Accessories are tested using an alternating current ($\cos \phi = 0.6 \pm 0.05$).

No current is passed through the earthing circuit, if any.

The test is made with the connections shown in Fig. 40.

Resistors and inductors are not connected in parallel, except that, if an aircore inductor is used, a resistor, taking approximately 1 percent of the current through the inductor is connected in parallel with it.

Iron-core inductors may be used, provided the current has substantially sine-wave form.

Accessible metal parts, metal supports and any metal frame supporting the base of flush-type socket-outlets are connected through the selector switch C; for two-pole accessories, to one of the poles of supply for half the number of stroke, and to the other pole for the remainder.

In the case of multiple and combined socket-outlets, the test is carried out on one socket-outlet of each type and current rating.

After the test, the samples shall show no damage impairing their further use and the entry holes for the pins shall not show any damage which may impair the safety within the meaning of this standard.

21 NORMAL OPERATION

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

Compliance is checked by testing socket-outlets, and plugs with resilient earthing socket-contacts or with pins which are not solid, by means of an appropriate test apparatus, an example of which is shown in Fig. 12.

The test pins (during socket-outlet test) and the fixed/ socket-outlets (during the plug test for plugs with resilient earthing socket-outlets or with pins which are

not solid) shall be replaced during the test after 4 500 and 9 000 strokes.

NOTE — In case of failure of the shutters, tests on shuttered socket-outlet may be repeated performing the required number of strokes (that is, 10 000 strokes) with current flowing on samples prepared by the manufactures without shutters, and by performing the same number of strokes without current flowing on samples provided with shutters or, as a third choice, with operations made by hand as in normal use.

Socket-outlets are tested using a test plug with brass pins provided, if applicable, with insulating sleeves, and having the maximum specified dimensions, with a tolerance of –0.06 mm, and spaced at the nominal distance with a tolerance of +0.05 mm, however, as far as the extremities of the sleeves are concerned, it is sufficient that their dimensions are within the tolerances given in the relevant data sheet if any.

NOTES

1 Dimensions of insulating sleeves are under consideration.

2 The shapes of the extremities of the insulating sleeves are not considered of importance for the purpose of the test.

3 The material of the brass pins shall be as specified in IS 292 type CuZn 39 Pb2-M.

4 The micro-compositions shall be homogeneous.

The end of round pins is rounded.

NOTES

1 Plugs are tested using a fixed socket-outlet complying with this standard and having as near to average characteristics as can be selected.

2 Care is taken that the pins of the test plugs are in good condition before the test is started.

The plug is inserted into and withdrawn from the socket-outlet 5 000 times (10 000 strokes) at rate of:

— 30 strokes per minute.

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

The specimens are tested with an alternating current as specified in Table 20, at rated voltage, in a circuit with $\cos \phi = 0.8 \pm 0.05$.

The test current is passed during each insertion and engagement of the plug.

The periods during which the test current is passed from engagement of the plug until subsequent shall be: $1.5 + \begin{matrix}0.5\\0\end{matrix}$ s.

No current is passed through the earthing circuit, if any.

The test is made with the connection indicated in **20**, the selector switch C being operated as prescribed in **20**.

In the case of multiple and combined socket-outlet the test is carried out on one socket-outlet of each type and current rating.

During the test no sustained arcing shall occur.

After the test, the samples shall not-show:

— wear impairing their further use;

— deterioration of enclosures, insulating linings or barriers;

— damage to the entry holes for the pins that might impair proper working;

— loosening of electrical or mechanical connections; and

— seepage of sealing compound.

For shuttered socket-outlets a gauge according to Fig. 3 is applied to the entry holes corresponding to the live contacts with a force up to 20 N and it is applied successively in three directions without withdrawing or rotating the gauge after each movement, and then a steel gauge according to Fig. 4 is applied with a force up to 1 N and in three directions, with independent movements (that is, withdrawing the gauge after each movement).

The gauges of Fig. 3 and Fig. 4 shall not touch live parts when they remain under the relevant forces.

An electrical indicator, with a voltage not less than 40 V and more than 50 V, is used to show contact with the relevant part.

The specimens shall then comply with the requirements of **19**, the test current being, however, equal to the test current required for the normal operation test of the **21** and the temperature-rise, at any point, not exceeding 45°C, and they shall withstand an electric strength test made according to **17.2**, the test voltage, however, being reduced to 1 500 V in the case of accessories having a rated voltage of 250 V and to 1 000 V in case of accessories having a rated voltage of 110 V.

NOTE — The humidity treatment as per **16.3**, is not repeated before the electric strength test of this clause. The test of **13.2** and **14.2** are made after the tests of this clause.

22 FORCE NECESSARY TO WITHDRAW THE PLUG

The construction of accessories shall allow the easy insertion and withdrawal of the plug, and prevent the plug from work out of the socket-outlet in normal use.

For the purpose of this test, earthing contacts, irrespective of their number are considered as one pole.

Interlocked accessories are tested in the unlocked position.

Compliance is checked, for socket-outlets only by:

— a test to ascertain that the maximum force necessary to withdraw the test plug from the socket-outlet is no higher than the force specified in Table 16.

— a test to ascertain that the minimum force necessary to withdraw a single pin gauge from the individual

contact assembly is not lower than the force specified in Table 16.

22.1 Verification of the Maximum Withdrawal Force

The socket-outlet is fixed to the mounting plate *A* of an apparatus as shown in Fig. 13, so that the axis of the socket-contacts are vertical and the entry holes for the pins of the plug face downwards.

The test plugs have finely ground pins of hardened steel, having a surface roughness not exceeding 0.8 µm over their active length and spaced at the nominal distance, with a tolerance of ± 0.05 mm.

The diameter, for round pins, and the distance between contact surfaces, for other types of pins, shall have the maximum specified dimensions, with a tolerance of 0 mm/–0.01 mm.

NOTE — The maximum specified dimension is the nominal plus the maximum tolerance.

The pins are wiped free from grease, before each test, using a cold chemical degreaser such as trichloroethane or petroleum spirit.

NOTE — When using the liquid specified for the test, adequate precautions shall be taken to prevent fire, or inhalation of vapour.

The test plug with the maximum size pins is inserted into and withdrawn from the socket-outlet ten times. It is then again inserted, a carrier *E*, for a principal mass *F* and a supplementary mass *G*, being attached to it by means of a suitable clamp *D*. The supplementary mass is such that it exerts a force equal to one-tenth of the maximum withdrawal force shown in Table 16.

The principal mass, together with the supplementary mass, the clamp, the carrier and the plug exert a force equal to the maximum withdrawal force shown.

The principal mass is hung on the plug without jolting and the supplementary mass is allowed to fall from a height of 50 mm into the principal mass.

The plug shall not remain in the socket-outlet.

22.2 Verification of Minimum Withdrawal Force

The test pin gauge, is illustrated in Fig. 42 is applied to each individual socket contact with the socket-outlet held horizontally and the gauge having vertically down wards.

Shutters, if any, are rendered inoperative so as not to affect the test.

The test pin gauge is made of hardened steel, having a surface roughness not exceeding 0.8 µm over its active length.

The plug pin portion of the gauge shall have cross-sectional dimensions equal to the minimum shown in Fig. A-1, a tolerance of 0 mm/0.01 mm and a length sufficient to make adequate contact with the socket-outlet. The total mass of the gauge shall be equal to that specified in Table 16.

NOTE — If the socket-outlet accepts plugs having pins with different dimensions the smallest appropriate one shall be used.

The pin is wiped free from grease, before each test, using a cold chemical degreaser such as trichloroethane or petroleum ether.

NOTE — When using the liquid specified for the test, adequate precautions should be taken to prevent inhalation of vapour.

The test pin gauge is then inserted into the contact-assembly.

The test pin gauge is applied gently, and care is taken not to knock the assembly when checking the minimum withdrawal force.

The gauge shall not fall from the contact-assembly within 30 s.

23 FLEXIBLE CABLES AND THEIR CONNECTION

23.1 Plugs and portable socket-outlets shall be provided with a cord anchorage such that the conductors are relieved from strain, including twisting,

Table 16 Maximum and Minimum Withdrawal Force

(*Clauses* 22, 22.1, 22.2, 24.10, 24.11 *and* 24.13)

Rating	Number of Poles	Withdrawal Forces, N	
		Multi-Pin Gauge *Max*	Single-Pin Gauge *Min*
(1)	(2)	(3)	(4)
Up to and including 10 A	2	40	1.5
	3	50	
Above 10 A up to and including 16 A	2	50	2
	3	54	

where they are connected to the terminals or terminations, and that their covering is protected from abrasion.

The sheath if any, of the cord shall be clamped within the cord anchorage.

Compliance is checked by inspection.

23.2 The effectiveness of the retention is checked by the following test by means of an apparatus as shown in Fig. 14.

Non-rewirable accessories are tested as delivered; the test is made on new samples.

Rewirable accessories are first tested with a cable having the smallest nominal cross-sectional area, and then with a cable having the largest nominal cross-sectional area, so shown in Table 17.

Accessories designed exclusively for use with flat flexible cables are tested only with the types of flat flexible cables specified.

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

The cord anchorage is used in the normal way, clamping screws, if any, being tightened with a torque equal to two-thirds of specified in **12.2.8.**

After reassembly of the sample, the component parts shall fit snugly and it shall not be possible to push the cable into the sample to any appreciable extent.

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

The flexible cable is then subjected 100 times to a pull of:

50 N if the rated current is 2.5 A.

60 N if the rated current is above 2.5 A.

The pulls are applied practically without jerks each time for 1 s.

Care shall be taken to exert the same pull on all parts

Table 17 External Dimensions of Flexible Cables to be Accommodated by Cord Anchorage

(*Clauses* 17.1.1, 17.1.2 *and* 23.2)

Rating of Accessory	Number of Poles[1]	Type of Cable	Number of Conductors and Nominal Cross-Sectional Area mm²	Limits for External Dimensions for Flexible Cables mm	
				Min	*Max*
(1)	(2)	(3)	(4)	(5)	(6)
6 A up to and including 10 A Up to and including 250 V[2]	2	Flat non-sheathed cord	2 × 0.75	2.7 × 5.4	3.2 × 6.4
		Ordinary polyvinyl chloride sheathed cord	2 × 0.75	3.8 × 6.0	5.2 × 7.6
6 A up to and including 10 A Up to and including 250 V	2	Flat non-sheathed cord	2 × 0.75	2.7 × 5.4	3.2 × 6.4
		Ordinary polyvinyl chloride sheathed cord	2 × 1	6.4	8.0
	3	Ordinary polyvinyl chloride sheathed cord	3 × 0.75	–	–
		Ordinary polyvinyl chloride sheathed cord	3 × 1	6.4	8.4
Above 10 A up to and including 16 A Up to and including 250 V	2	Flat non-sheathed cord	2 × 0.75	2.7 × 5.4	3.2 × 6.4
		Ordinary polyvinyl chloride sheathed cord	2 × 1.5	7.4	9.0
	3	Ordinary polyvinyl chloride sheathed cord	3 × 0.75	–	–
		Ordinary polyvinyl chloride sheathed cord	3 × 1.5	6.4	9.8

[1] Earthing contacts, irrespective of their number, are considered as one pole.

[2] Exclusively designed for two conductor flexible cables.

(core, insulation and sheath) of the flexible cable simultaneously.

Immediately afterwards, the flexible cable is subjected for 1 min to a torque, as specified to Table 18.

Plugs provided with flat tinsel cords are not subjected to the torque test.

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

For measurement of the longitudinal displacement, a mark is made on flexible cable, at a distance of approximately 20 mm from the end of the specimen or the flexible cable guard, before it is subjected to the pull.

If, for non-rewirable accessories, there is no definite end to the specimen or flexible cable guard, an additional mark is made on the body of the specimen.

The displacement of the mark on the flexible cable in relation to the specimen or flexible cable guard is measured while the flexible cable is subjected to the pull.

In addition, for rewirable accessories it shall be checked by a manual test that they are suitable for fitting with the appropriate cable as shown in Table 19.

23.3 Non-rewirable plugs and non-rewirable portable socket-outlets shall be provided with a flexible cable complying with IS 694 or IS 9968 (Part 1). The cross-sectional areas of the conductors in relation to the rating of accessories are given in the relevant columns of Table 20.

NOTE — Table 20 also specifies the test currents for the test of temperature-rise and normal operation.

Table 18 Torque Test Values for Cord Anchorage

(*Clause* 23.2)

Rating of Plug or Portable Socket-Outlet	Flexible Cable (Number of Cores × Cross-Section in mm²)				
	2 × 0.5	2 × 0.75	3 × 0.5	3 × 0.75	2 or more × 1
(1)	(2)	(3)	(4)	(5)	(6)
Up to and including 16 A and 250 V	0.1 Nm	0.15 Nm	0.15 Nm	0.25 Nm	0.25 Nm

Table 19 Maximum Dimensions of Flexible Cables to be Accommodated by Rewirable Accessories

(*Clause* 23.2)

Rating of Accessory	Number of Poles[1)]	Type of Flexible Cable	Number of Conductors and Nominal Cross-Sectional Area mm²	Maximum Dimensions for Flexible Cables mm
(1)	(2)	(3)	(4)	(5)
6 A up to and including 10 A Up to and including 250 V[2)]	2	Ordinary tough rubber sheathed cord	2 × 0.75	8.0
6 A up to and including 10 A Up to and including 250 V	2	Ordinary tough rubber sheathed cord	2 × 1	8.8
	3	Ordinary tough rubber sheathed cord	3 × 1	9.2
Above 10 A up to and including 16 A Up to and including 250 V	2	Ordinary tough rubber sheathed cord	2 × 1.5	10.5
	3	Ordinary polyvinyl chloride sheathed cord	3 × 1.5	11.0

[1)] Earthing contacts, irrespective of their number, are considered as one pole.

[2)] Exclusively designed for two conductor flexible cables.

Table 20 Relationship Between Ratings of Accessories, Nominal Cross-Sectional Areas of Test Conductors and Test Currents for the Tests of Temperature-Rise and Normal Operation

(*Clauses* 19.1 *and* 23.3)

Rating of Accessory	Rewirable Fixed Accessories Test Current A		Rewirable Portable Socket-Outlets Test Current A		Non-rewirable Portable Test Current Cross-Section A			Non-rewirable Plugs Test Current Cross-Section A		
	Clause	Clause	Clause	Clause		Clause	Clause		Clause	Clause
	19	21	19	21	mm²	19	21	mm²	19	21
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
								Tinsel	1	1
2.5 A	–	–	–	–	–	–	–	0.5	2.5	2.5
110 V/250 V								0.75	4	2.5
								1	4	2.5
								Tinsel	1	1
6 A	9	6	8.4	6	–	–	–	0.5	2.5	2.5
110 V/250 V								0.75	9	6
								1	9	6
10 A					0.75	10	10	0.5	2.5	2.5
110 V/250 V	16	10	14	10	1	12	10	0.75	10	10
					1.5	16	10	1	12	10
								Tinsel	1	1
16 A					1	12	12	0.5	2.5	2.5
110 V/250 V	22	16	20	16	1.5	16	16	0.75	10	10
								1	12	12
								1.5	16	16

NOTES

1 Tinsel cords and flexible cables having a cross-sectional area of 0.5 mm² are allowed in lengths up to 2 m only.

2 Plugs incorporated in cord sets are tested as specified in this standard.

3 The test currents for accessories having other rated currents are determined by interpolation between the next lower and the next higher standard ratings except that for **19** test currents for rewirable portable accessories, which are obtained as follows:

for $I_n \leq 10$ A test current = $1.4\ I_n$

for $I_n > 10$ A test current = $1.25\ I_n$

Flexible cables shall have the same number of conductors as there are poles in the plug or socket-outlet, earthing contacts, if any, being considered as one pole, irrespective of their number. The conductor connected to the earthing contact shall be identified by the colour combination green/yellow.

Compliance is checked by inspection, by measurement and by checking that the flexible cables are in accordance with IS 694 or IS 9968 (Part 1), as applicable.

23.4 Non-rewirable plugs and non-rewirable socket-outlets shall be so designed that the flexible cable is protected against excessive bending where it enters the accessory. Guards provided for this purpose shall be of insulating material and shall be fixed in a reliable manner.

NOTE — Helical metal springs, whether bare or covered with insulating material, shall not be used as cord guards.

Compliance is checked by inspection and by a flexing test made by means of an apparatus as shown in Fig. 15.

The test is made on new specimens.

The specimen is fixed to the oscillating member of the apparatus so that, when this is at the middle of its travel, the axis of the flexible cable, where it enters

the specimen, is vertical and passes through the axis of oscillation.

Specimens with flat cords are mounted so that the major axis of the section is parallel to the axis of oscillation.

The accessory shall be fixed in the test apparatus in the following way:

— Plugs: by the pins

— Portable socket-outlet: at a distance of 4 mm to 5 mm (provisional values) in the direction of the flexible cable, from the engagement face; a test plug having the maximum dimensions shall be inserted in the portable socket-outlets during the test.

The accessory is, by variation of the distance between the fixing part of the oscillating member and the axis of oscillation, so positioned that the flexible cables makes the minimum lateral movement when the oscillating member of the test apparatus is moved over its full travel.

NOTES

1 In order to have the possibility of finding easily by experiment the mounting position with the minimum lateral movement of the flexible cable during the test, the flexing apparatus shall be built in such a way that the different supports for the accessories mounted on the oscillating member can be readily adjusted.

2 It is recommended to have a device (for example, a slot or a pin) to see whether the flexible cable makes the minimum lateral movement,

The flexible cable is loaded with a mass such that the force applied is:

— 20 N for accessories with flexible cables having a nominal cross-sectional area exceeding 0.75 mm^2.

— 10 N for other accessories.

A current equal to the rated current of the accessory or the following current, whichever is the lower, is passed through the conductors:

— 16 A for accessories with flexible cables having a nominal cross-sectional area exceeding 0.75 mm^2.

— 10 A for accessories with flexible cables having a nominal cross-sectional area of 0.75 mm^2.

— 2.5 A for accessories with flexible cables having a nominal cross-sectional area less than 0.75 mm^2.

The voltage between the conductors is equal to the rated voltage of the sample.

The oscillating member is moved through an angle of 90° (45° on either side of the vertical), the number of flexing being 10 000 and the rate of flexing 60 per minute.

NOTE — A flexing is one movement, either backwards or forwards.

Specimens with circular section flexible cables are turned through 90° in the oscillating member after 5 000 flexing, specimens with flat flexible cables are only bent in a direction perpendicular to the plane containing the axes of the conductors.

During the flexing test, there shall be:

a) no interruption of the current, and

b) no short-circuit between conductors.

NOTE — A short-circuit between the conductors of the flexible cable is considered to occur if the current attains a value equal to twice the test current of the accessory.

The voltage drop between each contact and the corresponding conductor, with a test current flowing having a value as prescribed for **21**, shall not exceed 10 mV.

After the test the guard, if any, shall not have separated from the body and the insulation of the flexible cable shall show no sign of abrasion or wear; broken strands of the conductors shall not have pierced the insulation so as to become accessible.

24 MECHANICAL STRENGTH

Accessories, surface mounting boxes and screwed glands shall have adequate mechanical strength to withstand the stresses imposed during installation and use.

Compliance is checked by the appropriate tests of **24.1** to **24.13** as follows:

— for fixed socket-outlets	**24.1** and **24.3**
— for portable single socket-outlets:	
• with enclosures, covers or bodies other than thermoplastic or elastomeric material	**24.2**
• with enclosures, covers or bodies of elastomeric or thermoplastic material	**24.2, 24.4** and **24.5**
— for portable multiple and combined socket-outlets:	
• with enclosures, covers or bodies other than elastomeric or thermosplastic material	**24.9**
• with enclosures, covers or bodies of elastomeric or thermoplastic material	**24.4** and **24.9**
— for plugs:	
• with enclosures, covers or bodies other than elastomeric or thermoplastic material	**24.2** and **24.10**
• with enclosures, covers or bodies of elastometric or thermoplastic material	**24.2, 24.4, 24.5** and **24.10**

— for screwed glands of accessories other than ordinary — **24.6**

— for plug pins provided with insulating sleeves — **24.7**

— for shuttered socket-outlets — **24.8**

— for surface mounting boxes — **24.1**

— for portable socket-outlets having means for suspension on a wall — **24.11**, **24.12** and **24.13**

24.1 The specimens are subjected to blows by means of an impact-test apparatus as shown in Fig. 16, 17, 18 and 19.

The striking element has a hemispherical face of 10 mm radius of polyamide having a Rockwell hardness of HR 100, and has a mass of 150 ± 1 g.

It is rigidly fixed to the lower end of a steel tube with an external diameter of 9 mm and a wall thickness of 0.5 mm, which is pivoted at its upper end in such a way that it swings only in a vertical plane.

The axis of the pivot is 1000 ± 1 mm above the axis of the striking element.

The Rockwell hardness of the polyamide striking element is determined by using a ball having a diameter of 12.700 ± 0.002 5 mm. The initial load being 100 ± 2 N and the extra load 500 ± 2.5 N.

The design of the apparatus is such that a force between 1.9 N and 2.0 N has to be applied to the face of the striking element to maintain the tube in a horizontal position.

The specimens are mounted on a sheet of plywood, 8 mm thick and 175 mm square, secured at its top and bottom edges to a rigid bracket which is part of the mounting support.

Portable multiple socket-outlets are tested as fixed socket-outlets but they are fixed to the plywood sheet by auxiliary means.

The mounting support shall have a mass of 10 ± 1 kg and shall be mounted on a rigid frame by means of pivots. The frame is fixed to a solid wall.

The design of the mounting is such that:

— the specimen can be so placed that the point of impact lies in the vertical plane through the axis of the pivot;

— the specimen can be removed horizontally and turned about an axis perpendicular to the surface of the plywood;

— the plywood can be turned 60°, in both directions about a vertical axis.

— surface-type socket-outlets and surface mounting boxes are mounted on the plywood as in normal use.

Inlet openings which are not provided, with knock-outs, are left open; if they are provided with knock-outs, one of them is opened.

Flush-type socket-outlets are mounted in a recess provided in a block of hornbeam or material having similar mechanical characteristics, which is fixed to a sheet of plywood and not in its relevant mounting box.

If wood is used for the block, the direction of the wood fibres must be perpendicular to the direction of the impact.

Flush-type screw fixing socket-outlets shall be fixed by means of screws to lugs recessed in the hornbeam block. Flush-type claw fixing socket-outlets shall be fixed to the block by means of the claws.

Before applying the blows, fixing screws of bases and covers are tightened with a torque equal to two-third of that specified in Table 6.

The specimens are mounted so that the point of impact lies in the vertical plane through the axis of the pivot.

The striking element is allowed to fall from a height which is specified in Table 21.

The impact energy determined by the part of the specimen which projects most from the mounting surface is applied on all parts of the specimen, with the exception of parts A.

The height of fall is the vertical distance between the position of a checking point when the pendulum is released, and the position of that point at the moment of impact. The checking point is marked on the surface of the striking element where the line through the point of intersection of the axes of the steel tube of the pendulum and the striking element and perpendicular to the plane through both axes, meets the surface.

The specimens are subjected to blows, which are evenly distributed. The blows are not applied to "knock-outs".

The following blows are applied:

— for parts A, five blows :

- One blow in the centre, after the specimen has been moved horizontally; one each on the unfavourable points between the centre and the edges and then, after the specimen has been turned 90° about its axis perpendicular to the plywood, one each on similar points;

— for parts B (as far as applicable), C and D four blows:

- Two blows on each of the other two sides of the specimen on which blows can be applied after the specimen has been turned 90° about its axis perpendicular to the plywood sheet has been turned 60° in each of the opposite directions;

- Two blows on each of the two sides of the specimen on which blows can be applied after the plywood sheet has been turned 60° in each of the opposite directions.

If inlet openings are provided, the specimen is so mounted that the two lines of blows are as nearly as possible equidistant from these openings.

Cover plates and other covers of multiple socket-outlets are treated as though they were the corresponding number of separate covers, but only one blow is applied to any one point.

For socket-outlets other than ordinary, the test is made with lids, if any, closed and in addition, the appropriate number of blows is applied to these parts which are exposed when the lids are open.

After the test, the samples shall show no damage within the meaning of this standard. In particular, live parts shall not become accessible.

After the test on lens (windows for pilot lights) the lens may be cracked and/or dislodged, but it shall not be possible to touch live parts with:

— the standard jointed test finger under the conditions stated in **10.1**;

— the standard unjointed test finger under the conditions stated in **10.1**, but with a force of 10 N;

— the steel wire of Fig. 4, applied with a force of 1 N, for accessories with increased protection.

In case of doubt, it is verified that it is possible to remove and to replace external parts, such as, boxes, enclosures, covers and cover-plates, without these parts or their insulating lining being broken. If a cover-plate backed by an inner cover, is broken, the test is repeated on the inner cover, which shall remain unbroken.

NOTE — Damage to the finish, small dents which do not reduce creepage distances or clearances below the values specified in **27.1** and small chips which do not adversely affect the protection against electric shock or harmful ingress of water are neglected.

Cracks not visible with the normal or corrected vision, without additional magnification, and surface cracks in fibre reinforced moldings and the like, are ignored.

Cracks or holes in the outer surface of any part of the accessory are ignored if the accessory complies with this standard even if this part is omitted. If a decorative cover is backed by an inner cover, fracture of the decorative cover is neglected if the inner cover withstands the test after removal of the decorative cover.

24.2 The specimens are tested in a tumbling barrel as shown in Fig. 20.

Rewirable accessories are fitted with the flexible cables specified in **23.2** having the smallest cross-sectional area specified in Table 3 and a free length of approximately 100 mm.

Terminal screws and assembly screws are tightened with a torque equal to two-thirds of the specified in **12.2.8**.

Non-rewirable accessories are tested as delivered, the flexible cable being cut so that a free length of about 100 mm projects from the accessory.

Table 21 Height of Fall for Impact Tests

(*Clause* 24.1)

Height of Fall mm	Parts of Enclosure to be Subjected to the Impact	
	Ordinary Accessories	Other Accessories
(1)	(2)	(3)
100	*A* and *B*	–
150	*C*	*A* and *B*
200	*D*	*C*
250	–	*D*

where

A = parts on the front surface, including the parts which are recessed;

B = parts which do not project more than 15 mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exception of the above parts *A*;

C = parts which project more than 15 mm and not more than 25 mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exception of the above parts *A*; and

D = parts which project more than 25 mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exception of the above parts *A*.

The specimens fall from a height of 500 mm onto a steel plate, 3 mm thick, the number of falls being:

— 1 000 if the mass of the specimen without flexible cable does not exceed 100 g.

— 500 if the mass of the specimen without flexible cable exceed 100 g.

The barrel is turned at a rate of five revolutions per minute, ten falls per minute thus taking place.

Only one specimen is tested in the barrel at a time.

After the test, the specimen shall show no damage within the meaning of this standard. In particular:

— no part shall have become detached or loosened,

— the pins shall not have become so deformed that the plug cannot be introduced into a socket-outlet complying with the dimension given in Annex A and also fails to comply with the requirements of **9.1** and **10.3**.

— the pins shall not turn when a torque of 0.4 Nm is applied, first in one direction for 1 min and then in the opposite direction for 1 min.

NOTES

1 During the examination after the test, special attention is paid to the connection of the flexible cable.

2 Small pieces may be broken off without causing rejection provided that the protection against electric shock is not affected.

3 Damage to the finish and small dents which do not reduce the creepage distances or clearances below the values specified in **27.1** are neglected.

24.3 Ordinary surface-type socket-outlets are first fixed to a cylinder of rigid steel sheet, having a radius equal to 4.5 times the distance between fixing holes, but in any case not less than 200 mm. The axes of the holes are in a plane perpendicular to the axis of the cylinder and parallel to the radius through the centre of the distance between the holes.

The fixing screws are gradually tightened, the maximum torque applied being 0.5 Nm for screws having a thread diameter up to and including 3 mm and 1.2 Nm for screws having a larger thread diameter.

The socket-outlets are then fixed in a similar manner to a flat steel sheet.

During and after the tests, the socket-outlets shall show no damage impairing their further use.

24.4 The specimens are subject to an impact test by means of an apparatus as shown in Fig. 21.

The apparatus on a pad of sponge rubber, 40 mm thick is placed together with the specimen in a refrigerator at a temperature of $-15 \pm 2°C$, for at least 16 h.

At the end of this period, each specimen, in turn, is placed in the normal position of use as shown in Fig. 21, and the falling weight is allowed to fall from a height of 100 mm. The mass of the falling weight is $1\,000 \pm 2$ g.

After the test the specimen shall show no damage within the meaning of this standard.

24.5 The specimens are subjected to a compression test in the manner as shown in Fig. 21, the temperature of the pressure plate, of the base and of the samples being $27 \pm 2°C$ and the force applied being 300 N.

The specimens are first placed in the position (a) shown in Fig. 22, and the force is applied for 1 min. They are then placed in the position (b) shown in Fig. 22 and again subjected to the force for 1 min.

Fifteen minutes after removal from the test apparatus, the specimens shall show no damage within the meaning of this standard.

24.6 Screwed glands are fitted with a cylindrical metal rod having a diameter, equal to the nearest whole number, below the internal diameter, in millimetres, of the packing.

The glands are then tightened by means of a suitable spanner, the torque shown in Table 22 being applied to the spanner for 1 min.

After the test, the glands and the enclosures of the

Table 22 Torque Test Values for Glands

(*Clause* 24.6)

Diameter of Test Rod mm	Torque Nm	
	Metal Glands	Glands of Moulded Material
(1)	(2)	(3)
Up to and including 14	6.25	3.75
Above 14 and including 20	7.5	5.0
Above 20	10.0	7.5

specimens shall show no damage within the meaning of this standard.

24.7 Plug pins provided with insulating sleeves are subjected to the following test by means of an apparatus as shown in Fig. 23.

The test apparatus comprises a horizontally disposed beam, which is pivoted about its centre point. A short length of steel wire, 1 mm in diameter and bent into a U shape, the base of the U being straight, is rigidly attached, at both ends, to one end of the beam, so that the straight part projects below the beam and is parallel to the axis of the beam pivot.

The plug is held in a suitable clamp in such a position that the straight part of the steel wire rests on the plug pin, at right angles to it. The pin slopes downwards at an angle of 10° to the horizontal.

The beam is loaded so that the wire exerts a force of 4 N on the pin.

The plug is caused to move backwards and forwards in a horizontal direction in the plane of the axis of the beam, so that the wire rubs along the pin. The length of pin thus abraded is approximately 9 mm, of which approximately 7 mm is over the insulating sleeve. The number of movements is 20 000 (10 000 in each direction) and the rate of operation is 30 movements per min.

The test is made on one pin of each specimen.

After the test, the pins shall show no damage which may affect safety or impair the further use of the plug, in particular, the insulating sleeve shall not have punctured or rucked up.

24.8 Shuttered socket-outlets shall have the shutter so designed that it withstands the mechanical force which may be expected in normal use, for example, when a pin of a plug is inadvertently forced against the shutter of a socket-outlet entry hole.

Compliance is checked by the following test, which is carried out both on specimens which have been submitted to the test according to **21**, without and with previous treatment as in **16.1**.

One pin from a plug of the same system is applied for 1 min with a force of 40 N against the shutter of an entry hole in a direction perpendicular to the front surface of the socket-outlet.

For shutters provided as the only means to prevent single pole insertion, the force shall be 75 N instead of 40 N.

Where the socket-outlet is designed to accept plugs of different types, the test is made with a pin from a plug with the largest size pin.

The pin shall not come in contact with live parts.

An electrical indicator with a voltage not less than 40 V and not more than 50 V is used to show contact with the relevant part.

After the test, the specimens shall show no damage within the meaning of this standard.

NOTE — Small dents on the surface, which does not adversely affect further use of the socket-outlet, are neglected.

24.9 Rewirable multiple portable socket-outlets are fitted with the lightest type of flexible cable of the smallest cross-sectional area specified in Table 3.

The free end of the cable is fixed to a wall at a height of 750 mm above the floor, as shown in Fig. 24.

The specimen is held so that the flexible cable is horizontal and then it is allowed to fall on to a concrete floor, eight times, the cable being rotated through 45° at its fixing between each time.

After the test, the specimens shall show no damage within the meaning of this standard; in particular, no part shall have become detached or loosened.

Accessories other than ordinary ones shall be submitted again to the relevant test as specified in **16.2**.

Small chips and dents which do not adversely affect the protection against electric shock or harmful ingress of water are neglected.

24.10 The plug is placed on a rigid steel plate provided with holes suitable for the pins of the plug as shown as an example in Fig. 25.

The distances between the centres of the holes (for example, d_1 and d_2) shall be the same as the distances between the centres of the circle circumscribed around the cross-sectional area of each pin as given in Annex A for plugs.

Each hole shall have a diameter equal to that of the circle circumscribed around the cross-sectional area of the pin plus 6 mm ± 0.5 mm.

The plug is to be so positioned on the steel plate that the centres of the circles circumscribing the pins coincide with the centres of the holes.

A pull on equal to the maximum withdrawal force as given in Table 16 is applied, without jerks, for 1 min or each pin in turn, in the direction of the longitudinal axis of the pin.

A pull is applied within a heating cabinet at a temperature of 70 ± 2°C. One hour after the plug has been placed in the heating cabinet.

After the test, the plug is allowed to cool down to ambient temperature and then no pin shall have been displaced in the body of the plug more than 1 mm.

The test is made on new specimens.

24.11 Barriers, between the space intended for the suspension means fixed to the wall and the live parts, likely to be subjected to mechanical strain when the portable socket-outlet is suspended on a wall, are tested as follows:

A cylindrical steel rod, having a diameter of 3 mm and a hemispherical end with radius of 1.5 mm, is pushed perpendicular to the supporting wall surface, in the most unfavourable position, for 10 s against the barrier, the force being equal to 1.5 times the maximum plug withdrawal force (as specified in Table 16).

The rod shall not pierce the barrier.

24.12 The portable socket-outlet mounted with supply flexible cable is suspended on the wall as in normal use, by means of a cylindrical steel rod having the same dimensions as the rod described in **24.11** and a length sufficient to touch the rear of the barrier.

A pull equal to the force prescribed in **23.2** for checking the cord anchorage is applied, in the most unfavourable position, to the supply flexible cable for 10 s. During the test, the portable socket-outlet means for suspension on a wall shall not break or, if they break, live parts shall not become accessible to the standard test finger.

24.13 The portable socket-outlets is suspended on the wall as in normal use, using a round head screw with shank diameter of 3 mm, and is subjected to a pull test with the maximum withdrawal force specified, for the corresponding plug, as specified in Table 16 applied without jerks.

The pull force is applied for 10 s perpendicular to the engagement face of the socket-outlet giving the greatest strain on the suspension means.

During the test, the portable socket-outlets means for suspension on a wall shall not break in a way which allows live parts to become assessable to the standard test finger.

NOTE — The test of **24.11, 24.12** and **24.13** are carried out on each means for suspension, in the case of more than one means.

24.14 When testing the forces necessary for covers or, cover-plates to come off or not to come off, the socket-outlets are mounted as for normal use, flush-type socket-outlets are fixed in appropriate mounting boxes, which are installed as for normal use so that the rims of the boxes are flush with the walls, and the covers or cover-plates are fitted. If the cover or cover-plates are provided with locking means which can be operated without the aid of a tool, these means are unlocked.

Compliance is then checked according to **24.14.1** and **24.14.2** (*see* **13.7.2**).

24.14.1 *Verification of the Non-removal of Covers or Cover-Plates*

Forces are gradually applied in directions perpendicular to the mounting surfaces, in such a way that the resulting force acting on the centre of the covers, cover-plates, or parts of them is respectively:

— 40 N, for covers, cover-plates or parts of them complying with the tests of **24.17** and **24.18**, or

— 80 N, for other covers, cover-plates or parts of them.

The force is applied for 1 min. The covers or cover-plates shall not come off.

The test is then repeated on new specimens, the cover or cover-plate is fitted on the wall after a sheet of hard material, 1 mm ± 0.1 mm thick, has been fitted around the supporting frame as shown in Fig. 8.

NOTE —The sheet of hard material is used to simulate wall paper and may consist of a number of pieces.

After the test the specimens shall show no damage within the meaning of this standard.

24.14.2 *Verification of the Removal of Covers or Cover-Plates*

A force not exceeding 120 N is gradually applied, in directions perpendicular to the mounting supporting surfaces, to covers, cover-plates, or parts of them by means of a hook placed in turn in each of the grooves, holes, spaces or the like, provided for removing them.

The cover or cover-plates shall come off.

The test is made 10 times to each separable part, the fixing of which is not dependant on screws (equally distributing as far as practicable the application points) the removal force is applied each time to the different grooves, holes or the like provided for removing the separable part.

The test is then repeated on new specimens, the cover or cover-plate is fitted on the wall after a sheet of hard material, 1 mm ± 0.1 mm thick, has been fitted around the supporting frame, as shown in Fig. 8.

After the test, the samples shall show no damage within the meaning of this standard.

24.15 The test is made as described in **24.14**, but applying, for **24.14.1**, the following forces:

— 10 N, for covers or cover-plates complying with the test of **24.17** and **24.18**.

— 20 N, for other covers or cover-plates.

26.16 The test is made as described in **24.14**, but applying, for **24.14.1**, the force of 10 N for all covers or cover-plates.

24.17 The gauge shown in Fig. 7 is pushed towards

each side of each cover or cover-plates which is fixed without screws on a mounting or supporting surfaces, as shown in Fig. 9. The face B resting on the mounting/ supporting surface, with the face A perpendicular to it, the gauge is applied at right angle to each side under test.

In the case of a cover or cover-plate fixed without screws to another cover, or cover-plate or to a mounting box, having the same outline dimensions, the face B of the gauge shall be placed at the same level as the junction; the outline of the cover or cover-plate shall not exceed the outline of the supporting surface.

The distances between the face C of the gauge and the outline of the side under test, measured parallel to face B, shall not decrease (with the exception for grooves, holes, reverse tapers or the like, placed at a distance less than 7 mm from a plane including face B and complying with the test of **24.18**) when measurements are repeated starting from point *x* in the direction of the arrow *y* (*see* Fig. 10).

24.18 A gauge according to Fig. 5, applied with a force of 1 N shall not enter more than 1.0 mm from the upper part of any groove, whole or reverse taper or the like when the gauge is applied parallel to the mounting/ supporting surface and at right angle to the part under test, as shown in Fig. 11.

NOTE — Verification as to whether the gauge according to Fig. 5 has entered more than 1.0 mm is made with reference to a surface perpendicular to face B and including the upper part of the outline of the grooves, holes, reverse tapers or the like.

25 RESISTANCE TO HEAT

Accessories and surface mounting boxes shall be resistant to heat.

Compliance is checked by:

a) for surface mounting boxes, separable covers, separable cover-plates and separable frames, by the test of **25.3**;

b) for portable accessories, with the exception of the parts, if any, covered by (a), by the tests of **25.1**, **25.4** and with the exception of accessories made from natural or synthetic rubber or a mixture of both, **25.3**;

c) for fixed socket-outlets, with the exception of the parts, if any covered by (a), by the tests of **25.1**, **25.2** and with the exception of fixed socket-outlets made from natural or synthetic rubber or a mixture of both, **25.3**.

Parts intended only for decorative purposes, such as, certain lids, are not submitted to this test.

25.1 The specimen is kept for 1 h in a heating cabinet at a temperature of 100 ± 2°C.

During the test, they shall not undergo any change impairing their further use, and sealing compound, if any, shall not flow to such an extent that live parts are exposed.

After the test, the samples are then allowed to cool down to approximately room temperature. There shall be no access to live parts which are normally not accessible when the specimens are mounted as in normal use, even if the standard test finger is applied with a force not exceeding 5 N are mounted as for normal use.

After the test, marking shall still be legible.

Discoloration, blisters or slight displacement of the sealing compound is disregarded, provided that safety is not impaired within the meaning of this standard.

25.2 Parts of insulating material necessary to retain current-carrying parts of the earthing circuit in position, and parts of the front surface zone of thermoplastic material of 2 mm width surrounding the phase and neutral pin entry holes of socket-outlets, shall be subjected to a ball-pressure test by means of the apparatus as shown in Fig. 27, except that insulating parts necessary to retain the earthing terminal in position in a box, shall be tested as specified in **25.3**.

NOTE — When it is not possible to carry out the test on the sample under test, the test shall be carried out on a piece cut out of the sample and at least 2 mm thick. If this is not possible, up to and including four layers, each cut out of the same specimen sample, may be used, in which case the total thickness of the layers shall be not less than 2.5 mm.

The part under test shall be placed on a steel plate at least 3 mm thick and in direct contact with it.

The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against this surface with a force of 20 N.

The test load and the supporting means shall be placed within the heating cabinet for sufficient time to ensure that they have attained the stabilized testing temperature before the test commences.

The test is made in a heating cabinet at a temperature of 125 ± 2°C.

After 1 h, the ball shall be removed from the specimen, which is then immersed, in cold water for cooling down within 10 s, to approximately room temperature.

The diameter of the impression caused by the ball is measured and shall not exceed 2 mm.

25.3 Parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact with them, are subjected to a ball-pressure test in accordance with **25.2**, but the test is made at a temperature of 70 ± 2°C or 40 ± 2°C plus the highest of temperature-rise determined for the relevant part during the test of **19**, whichever is the higher.

25.4 The specimens are subjected to a compression test by means of an apparatus as shown in Fig. 28, the test being made in a heating cabinet at a temperature of 80 ± 2°C.

The apparatus comprises two steel jaws, having a cylindrical face of 25 mm radius, a width of 15 mm and a length of 50 mm. The length of 50 mm can be increased, depending on the size of the accessory to be tested.

The corners are rounded with a radius of 2.5 mm.

The specimen is clamped between the jaws in such a way that these press against it in the area where it is gripped in normal use, the centre line of the jaws coinciding as nearly as possible with the centre of this area. The force applied through the jaws is 20 N.

After 1 h, the jaws are removed and the samples shall show no damage within the meaning of this standard.

26 SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS

26.1 Connections, electrical or mechanical, shall withstand the mechanical stresses occurring in normal use.

Mechanical connection to be used during installation of accessories may be made using thread-forming tapping screws or thread-cutting tapping screws only when the screws are supplied together with the piece in which they are intended to be inserted. In addition, thread-cutting screws intended to be used during installation shall be captive with the relevant part of the accessory.

Screws or nuts which transmit contact pressure shall be in engagement with a metal thread.

Compliance is checked by inspection and, for screws and nuts transmitting contact pressure or which are operated when connecting up the accessory, by the following test.

NOTE — The requirements for the verification of terminals are given in **12**.

The screw or nuts are tightened and loosened:

— 10 times for screws in engagement with a thread of insulating material and for screws of insulating material.

— 5 times in all other cases.

Screws or nuts in engagements with a thread of insulating material and screws of insulating material are completely removed and reinserted each time.

The test is made by means of a suitable screwdriver or a suitable tool, applying a torque as specified in **12.2.8**.

During the test, no damage impairing the further use of the screwed connections shall occur, such as, breakage of screws or damage to the head slots (rendering the use of the appropriate screwdriver impossible), threads, washers or stirrups.

NOTES

1 Screws or nuts which are operated when connecting up accessories include screws for fixing covers or cover plates, etc., but not connecting means for screwed conduits and screws for fixing the base of a fixed socket-outlet.

2 The shape of the blade of the test screwdriver must match the head of the screw to be tested. The screws and nuts must not be tightened in jerks. Damage to covers is ignored.

3 Screwed connections are considered as partially checked by the test of **21** and **24**.

26.2 For screws in engagement with a thread of insulating material and which are operated when mounting the accessory during the installation, their correct introduction into the screw hole or nut shall be ensured.

Compliance is checked by inspection and by manual test.

NOTE — The requirement with regard to correct introduction is met if introduction of the screw in a slanting manner is prevented, for example, by guiding the screw by the part to be fixed, by a recess in the female thread or by the use of a screw with the leading thread removed.

26.3 Electrical connecting shall be so designed that contact pressure is not transmitted through insulating material other than ceramic, pure mica or other material with characteristics no less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulating material.

This requirement does not preclude designs with flat tinsel cord where the contact pressure is obtained from insulating parts having such properties as to ensure reliable and permanent contact under all conditions of normal use, especially in view of shrinking, ageing or cold flow of the insulating part.

Connections made by insulation piercing of tinsel cord shall be reliable.

Compliance is checked by inspection and, for the last requirement, by a test, which is under consideration.

NOTE — The suitability of the material is considered in respect of the stability of the dimensions.

26.4 Screws and rivets, which serve as electrical as well as mechanical connections, shall be locked against loosening and/or turning.

Compliance is checked by inspection and manual test.

NOTES

1 Spring washers may provide satisfactory locking.

2 For rivets, a non-circular shank or an appropriate notch may be sufficient.

3 Sealing compound which softens on heating provides satisfactory locking only for screw connections not subjected to torsion in normal use.

26.5 Current-carrying parts, including those of terminals (also earthing terminals), shall be of a metal having, under the conditions occurring in the accessory, mechanical strength, electrical conductivity and resistance to corrosion adequate for their intended use.

Compliance is checked by inspection and, if necessary, by chemical analysis.

Examples of suitable metals, when used within the permissible temperature range and under normal conditions of chemical pollution, are:

— copper

NOTE — The requirement of copper used for current carrying parts are given in IS 14340.

— an alloy containing at least 58 percent copper for parts made from rolled sheet (in cold condition) or at least 50 percent copper for other parts.

— stainless steel containing at least 13 percent chromium and not more than 0.09 percent carbon.

— steel provided with an electroplated coating of zinc according to IS 1573, the coating having a thickness of at least.

5 µm, for ordinary equipment;

12 µm, for splash-proof equipment; and

25 µm, for jet-proof equipment.

— steel provided with an electroplated coating of nickel and chromium according to IS 1068, the coating having a thickness of at least:

20 µm, for ordinary equipment;

30 µm, for splash-proof equipment; and

40 µm, for jet-proof equipment.

— steel provided with an electroplated coating of tin, according to IS 1359, the coating having a thickness of at least:

12 µm, for ordinary equipment;

20 µm, for splash-proof equipment; and

30 µm, for jet-proof equipment.

Current-carrying parts, which may be subjected to mechanical wear, shall not be made of steel provided with an electroplated coating.

Under moist conditions metals showing a great difference of electro-chemical potential with respect to each other shall not be used in contact with each other.

Compliance is checked by a test which is under consideration.

NOTE — The requirement of this sub-clause does not apply to screw, nuts, washers, clamping plates and similar parts of terminals.

26.6 Contacts which are subjected to a sliding action in normal use shall be of a metal resistant to corrosion.

Compliance with the requirements of **26.5** and **26.6** is checked by inspection and in case of doubt, by chemical analysis.

26.7 Thread-forming screws and thread cutting screws shall not be used for the connection of current carrying parts.

Thread-forming screws and thread cutting screws may be used to provide earthing continuity, provided that it is not necessary to disturb the connection in normal use and at least two screws are used for each connection.

Compliance is checked by inspection.

27 CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH SEALING COMPOUND

27.1 Creepage distances, clearances, and distances through sealing compound shall be not less than the values shown in Table 23.

Compliance is checked by measurement.

For rewirable accessories, the measurements are made on the specimen fitted with conductors of the largest cross-sectional area specified in Table 3, and also without conductors.

The conductor shall be inserted into the terminal and so connected that the core insulation touches the metal part of the clamping unit or, in case the core insulation is prevented by construction from touching the metal part, the outside of the obstruction.

For non-rewirable accessories, the measurements are made on the specimen as delivered.

Socket-outlets are checked when in engagement with a plug and also without a plug.

Distances through slots or openings in external parts of insulating material are measured to metal foil in contact with the accessible surface other than the engagement face of plugs. The foil is pushed into corners and the like by means of the straight unjointed test finger having the same dimensions as the standard test finger of Fig. 2, but is not pressed into openings.

For ordinary surface-type socket-outlets, the most unfavourable conduit or cable is introduced for a distance of 1 mm into the socket-outlets, in accordance with **13.22**. If the metal frame supporting the base of a flush-type socket-outlet is movable, this frame is placed in the most unfavourable position.

NOTES

1 The contribution to the creepage distance of any groove less than 1 mm wide is limited to its width.

2 Any air gap less than 1 mm wide is ignored in computing the total clearance.

3 The surface on which the base of a socket-outlet for surface mounting is mounted includes any surface in contact with the base when the socket-outlet is installed. If the base is provided with a metal plate at the back, this plate is not regarded as the mounting surface.

Table 23 Creepage Distance, Clearances and Distances Through Insulating Sealing Compound

(*Clauses* 12.3.8, 13.7.2 *and* 27.1)

	Description	mm
	Creepage Distance:	
1.	between live part of different polarity	3
2.	between live parts and: – accessible insulating and earthed metal parts – parts of earthing circuit – metal frames supporting the base of flush-type socket-outlets – screws or devices for fixing bases, covers or cover-plates of fixed socket-outlets – external assembly screws, other than screws which are on the engagement face of plugs and are isolated from the earthing circuit	3
3.	between pins of plugs and metal parts connected to them, when fully engaged, and a socket-outlet of the same system having accessible unearthed metal parts[1], made according to the most unfavourable construction[2]	3.5
4.	between the accessible unearthed metal parts[1] : of a socket-outlet and a fully engaged plug of the same system having pins and metal parts connected to them made according to the most unfavourable construction[2]	3.5
5.	between live parts of a socket-outlet (without a plug and its accessible unearthed[1] metal parts	3.5
	Clearance:	
6.	between live parts of different polarity	3
7.	between live parts and: – accessible insulating and earthed metal parts not mentioned under Items 8 and 9, – parts of the earthing circuit – metal frames supporting the base of flush-type socket-outlets – screws or devices for fixing bases, covers or cover-plates of fixed socket-outlets – external assembly screws, other than screws which are on the engagement face of plugs and are insulated from the earthing circuit	3
8.	between live parts and: – exclusively earthed metal boxes[3] with the socket-outlet mounted in the most unfavourable position	3
	– unearthed metal boxes, without insulating lining with the socket-outlet in the most unfavourable position	4.5
9.	between live parts and the surface on which the base of a socket-outlet for surface mounting is mounted	6
10.	between live parts and the bottom of any conductor recess, if any, in the base of a socket-outlet for surface mounting	3
	Distance Through Insulating Sealing Compound:	
11.	between live parts covered with at least 2 mm of sealing compound and the surface on which the base of a socket-outlet for surface mounting is mounted	3
12.	between live part covered with at least 2 mm of sealing compound and the bottom of any conductor recess, if any in the base of socket-outlet for surface mounting	2.5

[1] With the exception of screws and the like.

[2] The most unfavourable construction may be checked by means of a gauge which is as per Annex A to the system concerned.

[3] Exclusively earthed metal boxes are those suitable only for use in installations where earthing of metal boxes is required.

27.2 Insulating sealing compound shall not protrude above the edge of the cavity in which it is contained.

27.3 Ordinary surface-type socket-outlets shall not have bare current-carrying strips at the back.

Compliance with the requirements of **27.2** and **27.3** is checked by inspection.

28 RESISTANCE OF INSULATING MATERIAL TO ABNORMAL HEAT, TO FIRE AND TO TRACKING

28.1 Resistance to Abnormal Heat and to Fire

Parts of insulating material which might be exposed to thermal stresses due to electric effects, and the deterioration of which might impair the safety of the accessory, shall not be unduly affected by abnormal heat and by fire.

Compliance is checked by means of the tests as per **28.1.1** and, in addition, for plugs with pins provided with insulating sleeves by the test of **28.1.2**.

28.1.1 Glow-Wire Test

The test is performed according to IS 11000 (Part 2/ Sec 1) under the following conditions:

— for parts of insulating material necessary to retain current-carrying parts and parts of the earthing circuit of fixed accessories in position, by the test made at a temperature of 850°C.

— for parts of insulating material, necessary to retain current carrying parts and parts of the earthing circuit of portable accessory in position, by the test made at a temperature of 750°C.

— for parts of insulating material necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact with them, by the test made at a temperature of 650°C.

If the tests specified have to be made at more than one place on the same specimen, care must be taken to ensure that any deterioration caused by previous tests does not affect the result of the test to be made.

Small parts, such as washers, are not subjected to test of this sub-clause.

The tests are not made on parts of ceramic material.

NOTE — The glow-wire test is applied to ensure that an electrically heated test wire under defined test conditions does not cause ignition of insulating parts or to ensure that a part of insulating material, which might be ignited by the heated test wire under defined conditions, has a limited time to burn without spreading fire by flame or burning parts or droplets falling down from the tested part onto pinewood board covered with a tissue paper.

If possible, the specimen should be a complete accessory.

NOTE — If the test cannot be made on a complete accessory, a suitable part may be cut from it for the purpose of the test.

The test is made on one specimen.

The test is made applying the glow-wire once.

In case of doubt, the test shall be repeated on two further specimens.

The specimen shall be positioned during the test in the most unfavourable position of its intended use (with the surface tested in a vertical position).

The tip of the glow-wire shall be applied to the specified surface of the specimen taking into account the conditions of the intended use under which a heated or glowing element may come into contact with the specimen.

The specimen is regarded as having passed the glow-wire test if:

— there is no visible flame and no sustained glowing, or if

— flames and glowing on the specimen extinguish within 30 s after the removal of the glow-wire.

There shall be no ignition of the tissue paper or scorching of the board.

28.1.2 The specimen of a plug with pins provided with insulating sleeves is tested by means of the test apparatus as shown in Fig. 26.

This test apparatus consists of an insulating plate *A* and of a metal part *B*: between these two parts an air space of 3 mm shall be provided and this distance shall be obtained through means which do not impair the air circulation around the pins.

The front surface of the insulating plate *A* shall be round and flat and have a diameter equal to twice the maximum permissible dimension of the engagement face of the plug.

The thickness of this insulating plate shall be 5 mm.

The metal part *B* shall be of brass and have, for the length of at least 20 mm, the same shape as the maximum outline of the plug.

The rest of this metal part shall be so shaped that the accessory under test is heated through it by conduction, and that the heat transmission to the accessory under test by convection or radiation is reduced to a minimum.

A thermocouple shall be inserted at a distance of 7 mm from the front surface of the metal part in a symmetrical position, as shown in Fig. 26.

The dimensions of the holes for the pins in the metal part *B* shall be 0.1 mm larger than the maximum dimensions of the pins and the distances between pins shall be the same as those given in Annex A; the depth of the holes shall be sufficient.

NOTE — The metal part *B* can be made of two or more component pieces, for hole cleaning purposes.

The specimens are inserted in the test apparatus, placed in the most unfavourable horizontal position, when the test apparatus has reached a steady temperature, measured by means of the thermocouple, of 120 ± 5°C for accessories having a rated current of 2.5 A or 180 ± 5°C for accessories having a rated current of 6 A or 200 ± 5°C for accessories having a higher current ratings.

NOTE — The value of 200 ± 5°C is provisional.

The temperature is maintained at those values for 3 h.

The specimens are then taken out from the test apparatus and are allowed to cool down to room temperature, at which they are maintained for at least 4 h.

The insulating sleeves of the pins of the samples are then submitted to an impact test in accordance with **30** but made at ambient temperature, and to a visual inspection.

NOTE — During vision the visual inspection, no cracks on the insulating sleeves shall be visible with the normal or corrected vision without additional magnification, and the dimensions of the insulating sleeves shall not be changed so as to impair the protection against accidental contact.

28.2 Resistance to Tracking

For accessories other than ordinary, parts of insulating material retaining live parts in position shall be of material resistant to tracking.

Compliance is checked according to IS 2824.

Ceramics parts are not tested.

The material under test shall pass a tracking index of 175 V using test solution A with the interval between drops 30s ± 5s. No flash over or breakdown between electrodes shall occur before a total of 50 drops has fallen.

29 RESISTANCE TO RUSTING

Ferrous parts, including covers and surface mounting boxes shall be adequately protected against rusting.

Compliance is checked by the following test.

All grease is removed from the parts to be tested, by immersion in carbon tetrachloride, trichloroethane or an equivalent degreasing agent, for 10 min.

The parts are then immersed for 10 min in a 10 percent solution of ammonium chloride in water at a temperature of 27 ± 5°C.

Without drying, but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of 27 ± 5°C.

After the parts have been dried for 10 min in a heating cabinet at a temperature of 100 ± 5°C, their surfaces shall show no signs of rust.

NOTES

1 Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

2 For small springs and the like, and for inaccessible parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are only subjected to the test if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease.

30 ADDITIONAL TESTS ON PINS PROVIDED WITH INSULATING SLEEVES

The material of the pin-insulting sleeves shall be resistant to the stresses to which it may be subjected at the high temperature likely to occur in conditions approaching the bad connection conditions and at low temperatures in particular conditions of service.

Compliance is checked by means of the following tests.

30.1 Pressure Test at High Temperature

The specimens are tested by means of the apparatus as shown in Fig. 29. This apparatus has a rectangular blade (*see* Fig. 29) with an edge 0.7 mm wide, to be used in the case of round pins, or a blade having a round shape (*see* Fig. 29), with a diameter of 6 mm and an edge of 0.7 mm, in other cases.

The specimens are placed in position as shown in Fig. 29.

The force applied through the blade is 2.5 N.

The apparatus, with the specimen in position, is maintained for 2 h in a heating cabinet at a temperature of 200 ± 5°C.

The specimen is then removed from the apparatus and, within 10 s, cooled by immersion in cold water.

The thickness of the insulation is measured immediately at the point of impression.

The thickness, within the area of the impression shall be not less than 50 percent of the thickness measured before the test.

NOTE — The values 2.5 N and 200 ± 5°C are provisional.

30.2 Static Damp Heat Test

A set of three specimen is submitted to two damp heat cycles in accordance with IS 9000 (Part 5/ Sec 1 and 2).

After this treatment and after recovery to ambient

temperature, the specimens are submitted to the following tests:

— insulation resistance and electric strength test in accordance with **17**; and

— abrasion test, in accordance with **24.7**.

30.3 Impact Test at Low Temperature

The specimens are subjected to an impact test by means of the apparatus as shown in Fig. 30. The mass of the falling weight is 100 ± 1 g.

The apparatus, on a sponge rubber pad, 40 mm thick, is placed, together with the specimens, in a refrigerator at a temperature of − 15 ± 2°C for at least 24 h.

At the end of this period, each specimen, in turn, is placed in position, as shown in Fig. 30, and the falling weight is allowed to fall from a height of 100 mm. Four impacts are applied successively to the same specimen, rotating it through 90° between impacts.

NOTES

1 After the test, the specimens are allowed to attain approximately room temperature and are then examined.

2 No cracks of the insulating sleeves shall be visible with the normal or corrected vision without additional magnification.

3 The cooling period of 24 h mentioned in the tests of **30.3** and **30.4** includes the time necessary for cooling down the apparatus.

30.4 Tests at Low Temperature

A set of three specimens is maintained at −15° ± 2°C for 24 h. After recovering to ambient temperature, the specimens are submitted to the following tests:

— insulation resistance and electric strength test, in accordance with **17**.

— abrasion test, in accordance with **24.7**.

31 TESTS

31.1 Type Test

The following shall be carried out as type tests on selected samples (*see* **5**) of accessories drawn preferably at random from a regular lot of production for criteria of acceptance (*see* **5**).

1) Rating (*see* **6**);
2) Classification (*see* **7**);
3) Marking (*see* **8**);
4) Checking of dimensions (*see* **9**);
5) Protection against electric shock (*see* **10**);
6) Provision for earthing (*see* **11**);
7) Terminals (*see* **12**);
8) Constructional requirements of fixed socket outlets (*see* **13**);
9) Construction of plugs and portable socket outlets (*see* **14**);
10) Interlocked socket-outlet (*see* **15**);
11) Resistance to ageing, to harmful ingress of water and to humidity (*see* **16**);
12) Insulation resistance and electric strength (*see* **17**);
13) Operation of earthing contacts (*see* **18**);
14) Temperature-rise (*see* **19**);
15) Making and breaking capacity (*see* **20**);
16) Normal operation (*see* **21**);
17) Force necessary to withdraw the plug (*see* **22**);
18) Flexible cables and their connection (*see* **23**);
19) Mechanical strength (*see* **24**);
20) Resistance to heat (*see* **25**);
21) Screws, current carrying parts and connections (*see* **26**);
22) Creepage distances, clearances and distance through sealing compound (*see* **27**);
23) Resistance of insulation material to abnormal heat, to fire and to tracking (*see* **28**);
24) Resistance to rusting (*see* **29**); and
25) Additional tests on pins provided with insulating sleeves (*see* **30**).

31.1.1 The specimen subjected to type tests shall pass the tests for providing conformity with the requirements of this standard.

31.2 Acceptance Tests

The following shall constitute acceptance test:

a) Marking (*see* **8**);
b) Resistance to ageing, to harmful ingress of water and to humidity (*see* **16**);
c) Insulation resistance and electric strength (*see* **17**);
d) Temperature-rise (*see* **19**);
e) Making and breaking capacity (*see* **20**); and
f) Mechanical strength (*see* **24**);

31.2.1 A recommended sampling procedure for acceptance test is specified in Annex C.

31.3 Routine Tests

The following shall constitute routine tests:

a) Marking (*see* **8**); and
b) Electric strength (Flash test) (*see* **17.3**).

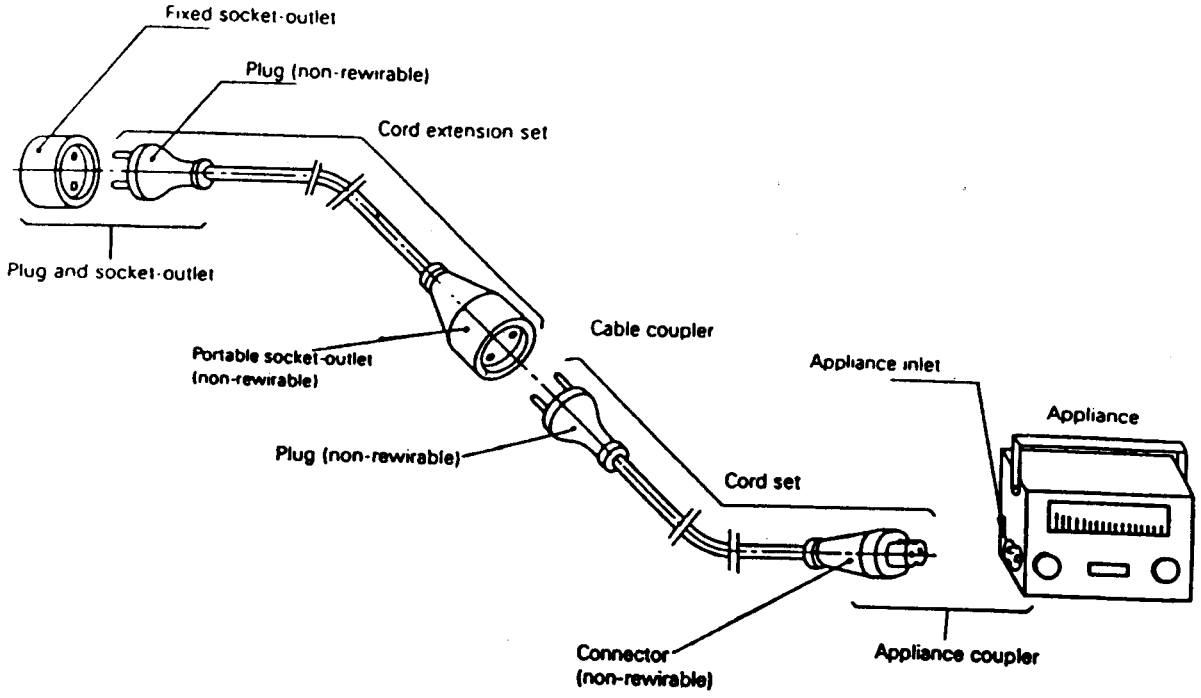


FIG. 1A DIAGRAM SHOWING VARIOUS ACCESSORIES AND THEIR USE

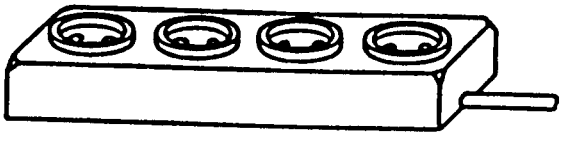


FIG. 1B MULTIPLE SOCKET OUTLETS (TABLE TYPE)

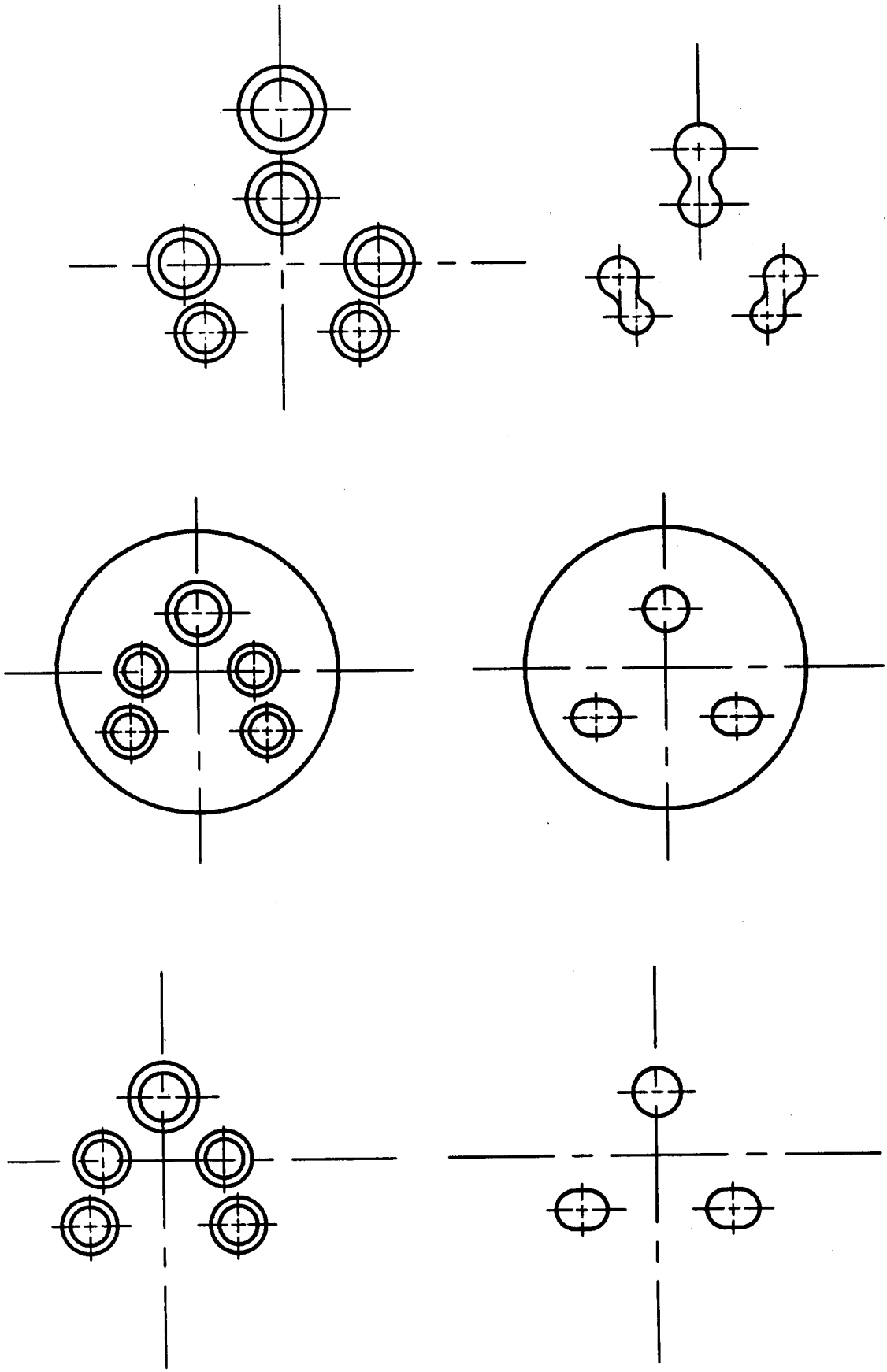
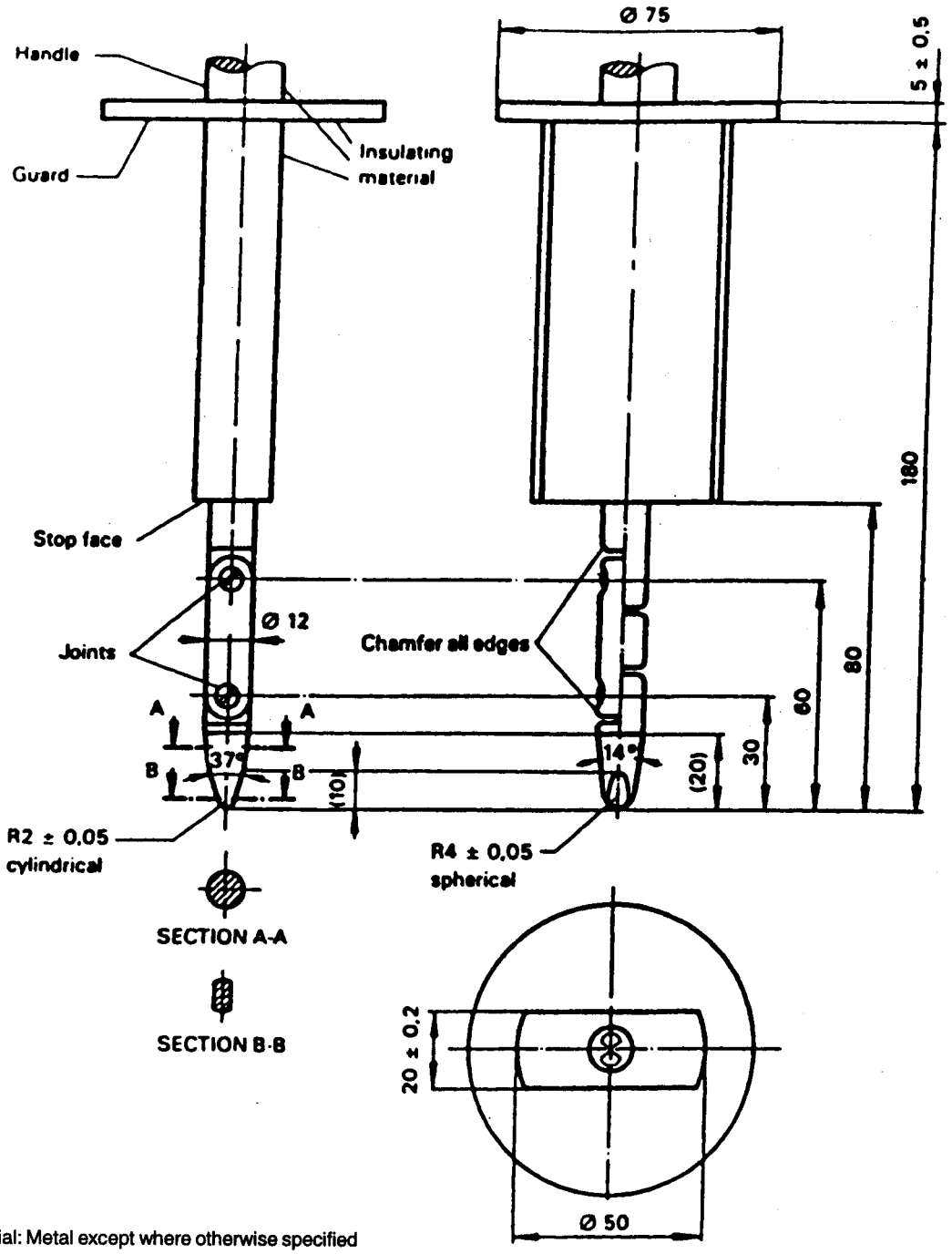


FIG. 1C COMBINED SOCKET-OUTLETS



Material: Metal except where otherwise specified

Linear dimensions in millimetres

Tolerances on dimensions without specific tolerance:

on angles: 0/–10′

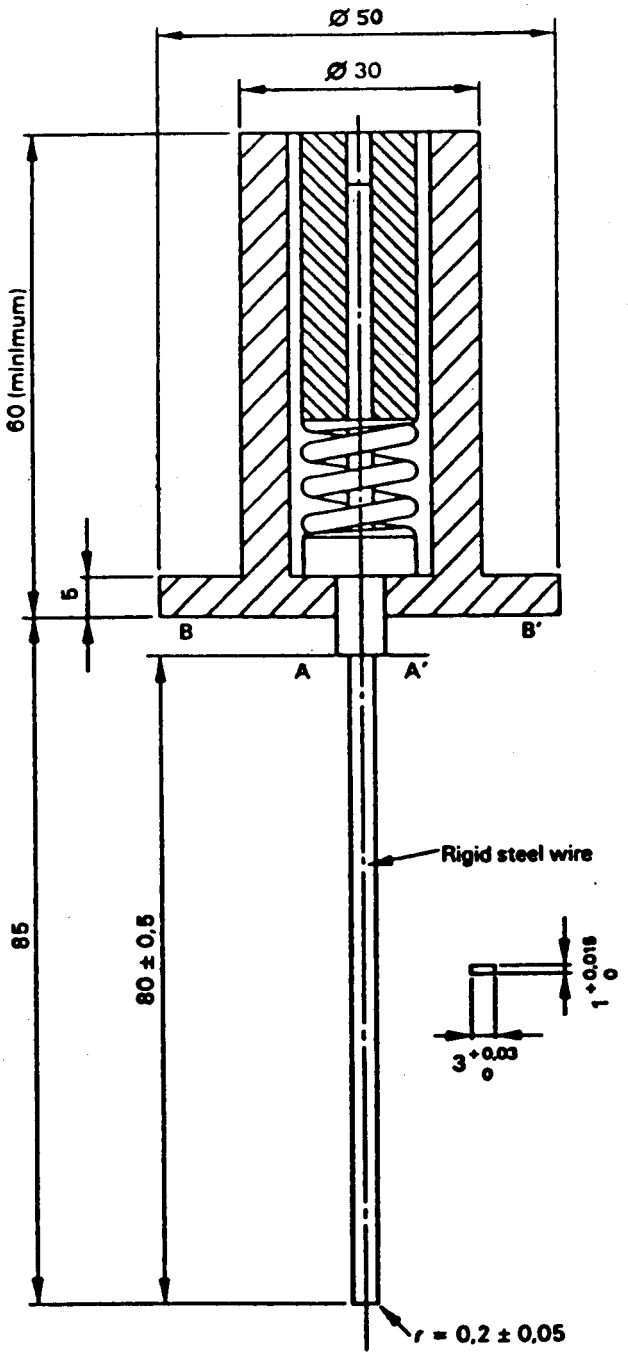
on linear dimensions:

up to 25 mm: 0/–0.05

over 25 mm: ± 0.2

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0 to + 10° tolerance.

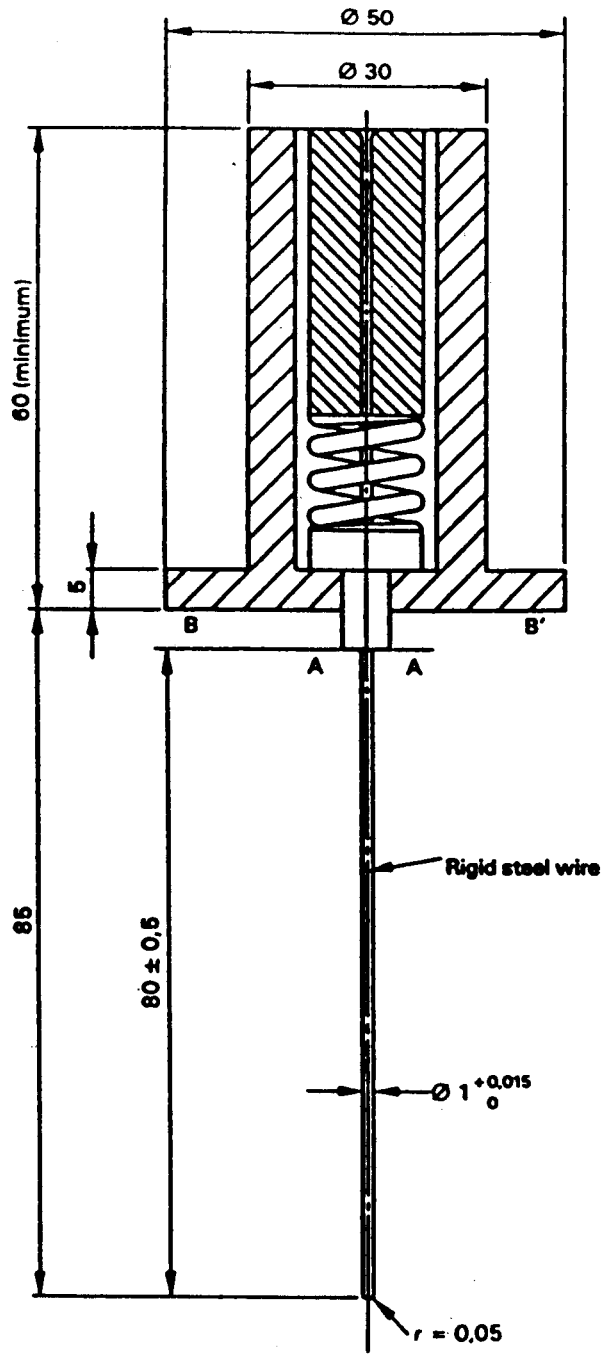
FIG. 2 JOINTED TEST FINGER



Dimensions in millimetres.

To calibrate the gauge, a push force of 20 N is applied on the steel rigid wire in the direction of its axis; the characteristics of the gauge internal spring shall be such that the surface A — A' is brought practically to the same level as the surface B — B' when this force is applied.

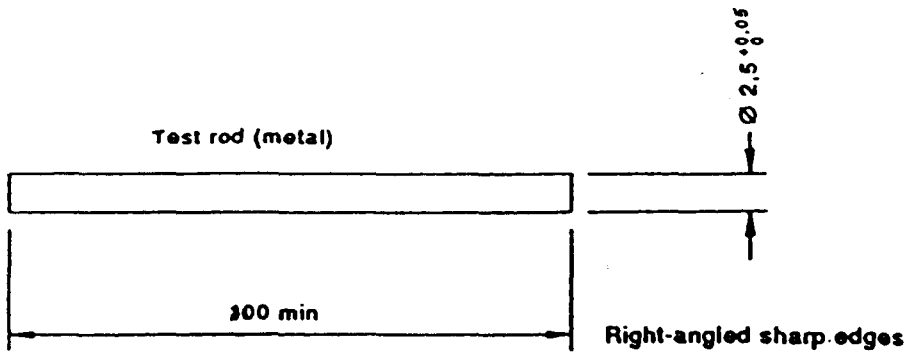
FIG. 3 GAUGE FOR CHECKING NON-ACCESSIBILITY OF LIVE PARTS, THROUGH SHUTTERS AFTER NORMAL OPERATION TEST



Dimensions in millimetres.

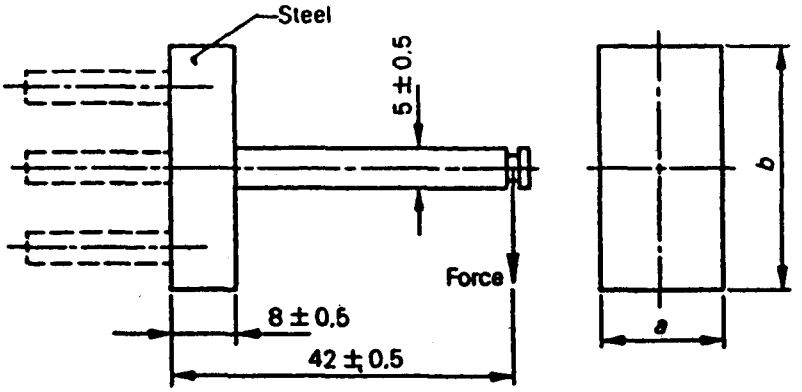
To calibrate the gauge, a push force of 1 N is applied on the steel rigid wire in the direction of its axis; the characteristics of the gauge internal spring shall be such that the surface *A* — *A'* is brought practically to the same level as the surface *B* — *B'* when this force is applied.

FIG. 4 GAUGE FOR CHECKING NON-ACCESSIBILITY OF LIVE PARTS, THROUGH SHUTTERS, AND OF LIVE PARTS OF SOCKET-OUTLETS WITH INCREASED PROTECTION



Dimensions in millimetres.

FIG. 5 GAUGE FOR VERIFICATION OF GROOVES, HOLES AND REVERSE TAPERS



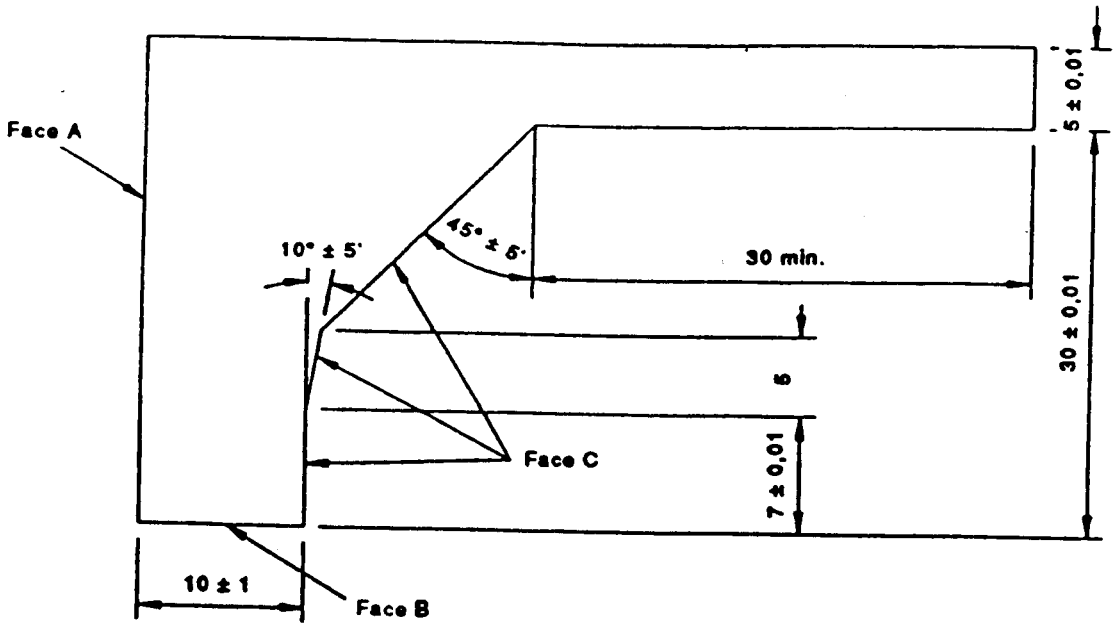
Dimensions in millimetres.

NOTES

1 The dimensions *a* and *b* are to be chosen according to the appropriate dimension given in Annex A.

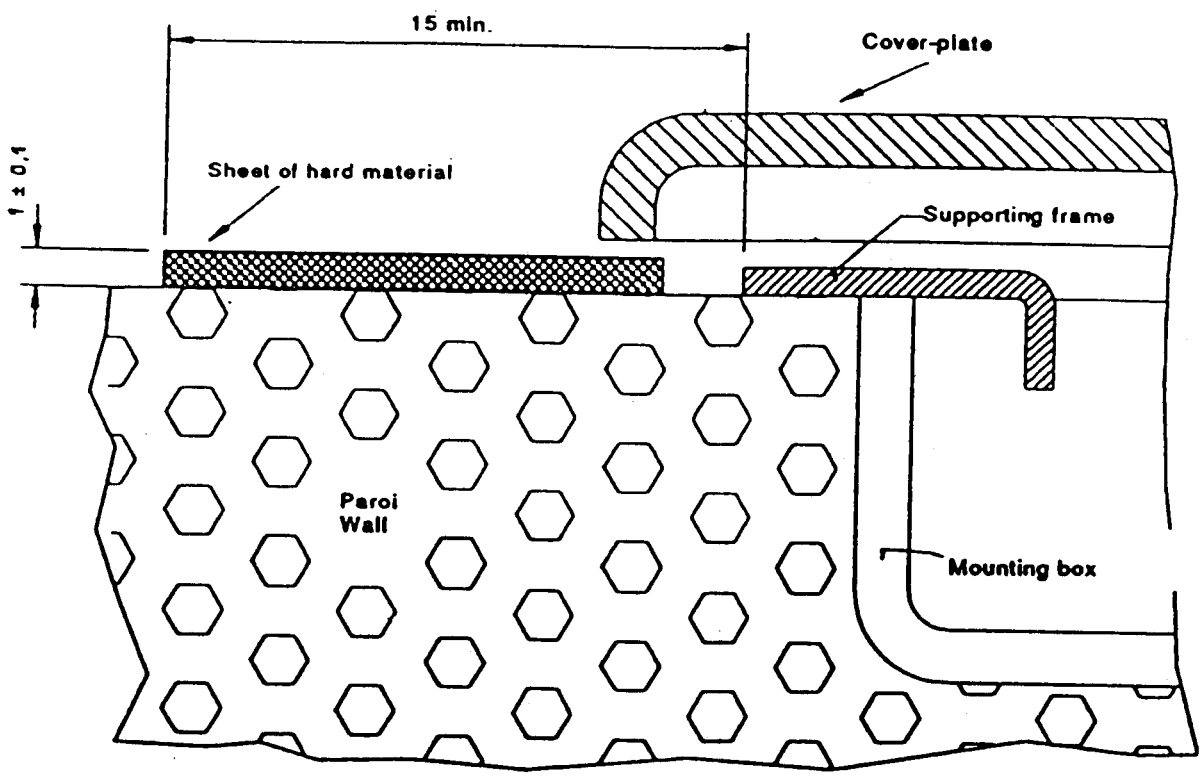
2 Dimensions and arrangement of pins complying with Annex A.

FIG. 6 DEVICE FOR CHECKING THE RESISTANCE TO LATERAL STRAIN



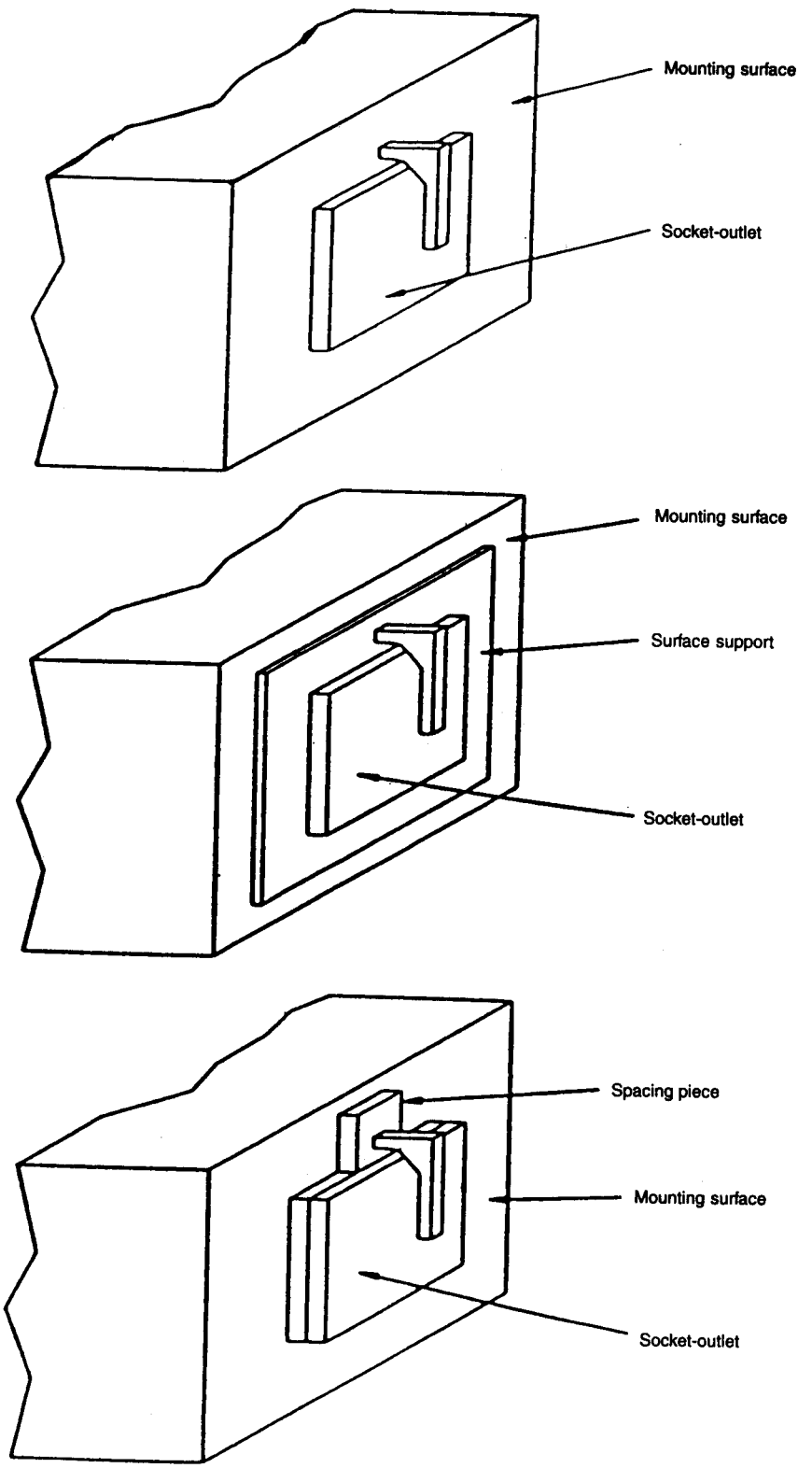
Dimensions in millimetres.

FIG. 7 GAUGE (THICKNESS: ABOUT 2 mm) FOR THE VERIFICATION OF THE OUTLINE OF COVERS OR COVER-PLATES



Dimensions in millimetres.

FIG. 8 ARRANGEMENT FOR TEST ON COVERS OR COVER-PLATES



Spacing piece having the same thickness as that of the supporting part.

FIG. 9 EXAMPLES OF APPLICATION OF THE GAUGE OF FIG. 7 ON COVERS FIXED WITHOUT SCREWS ON A MOUNTING SURFACE OR SUPPORTING SURFACE

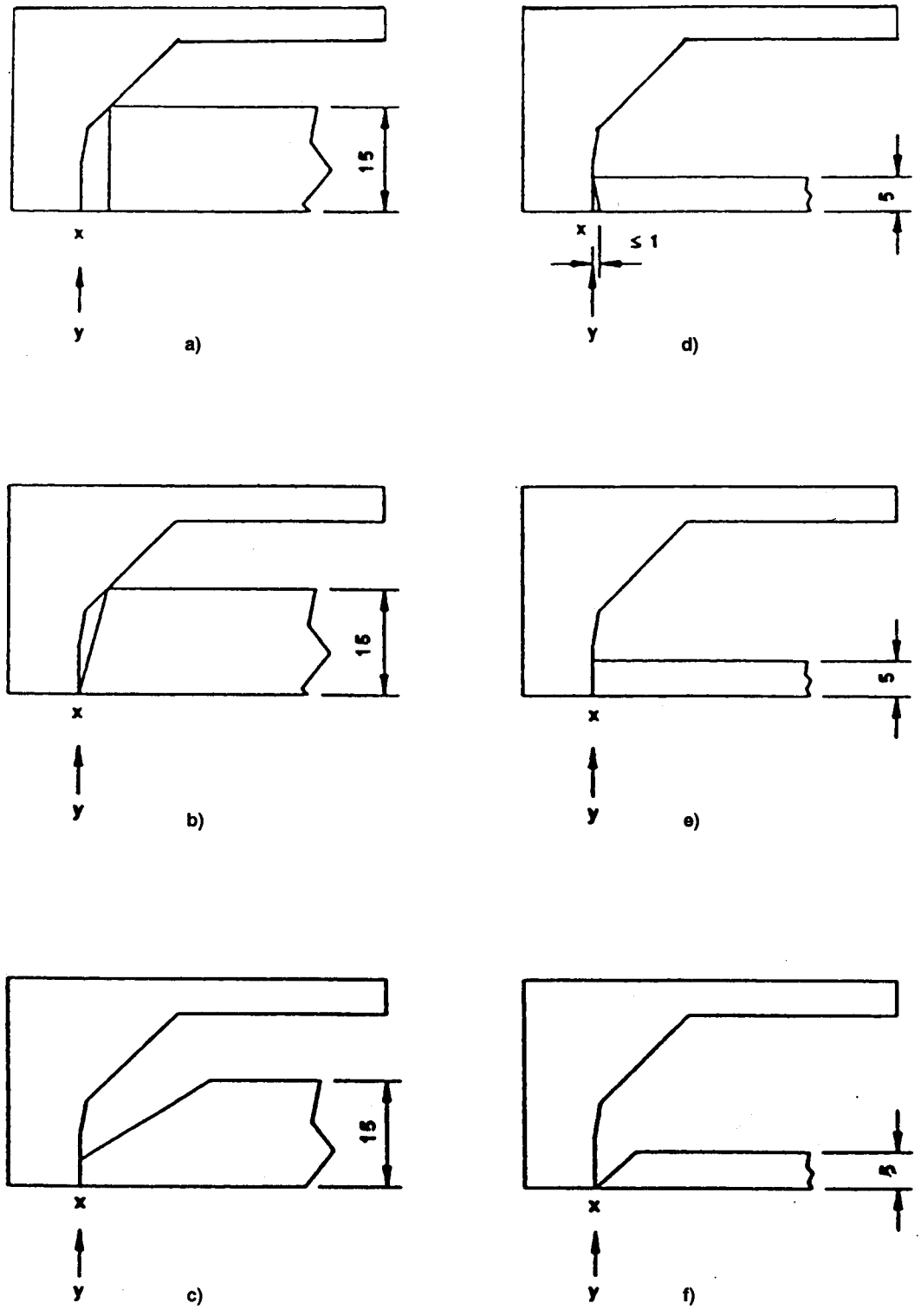


FIG. 10 EXAMPLES OF APPLICATION OF THE GAUGE OF FIG. 7 IN ACCORDANCE WITH THE REQUIREMENT OF **24.17**

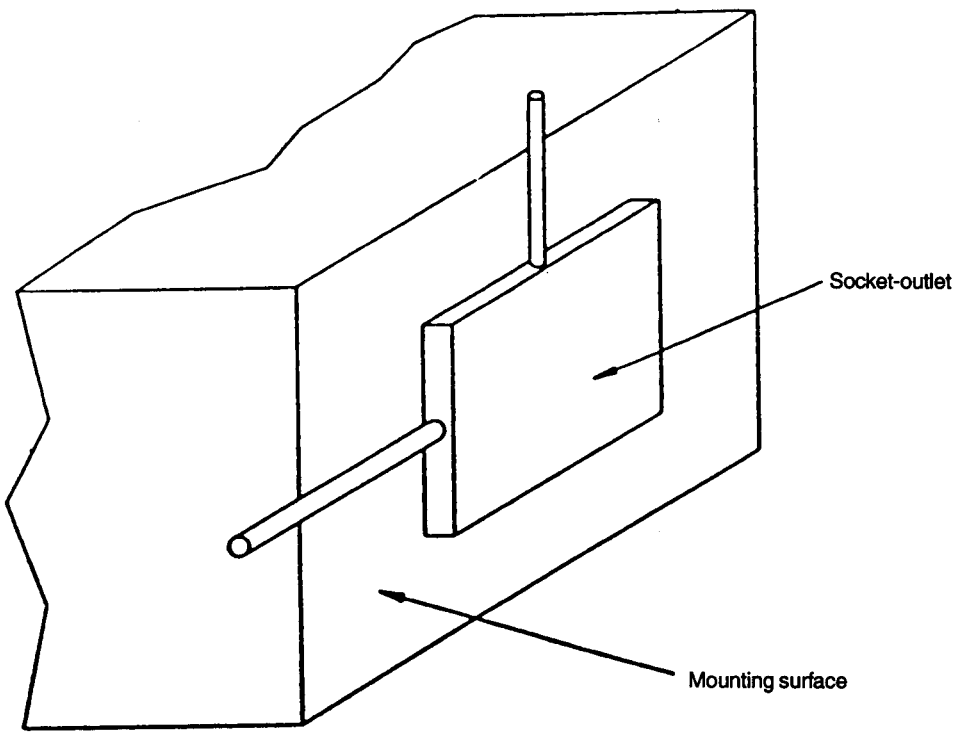
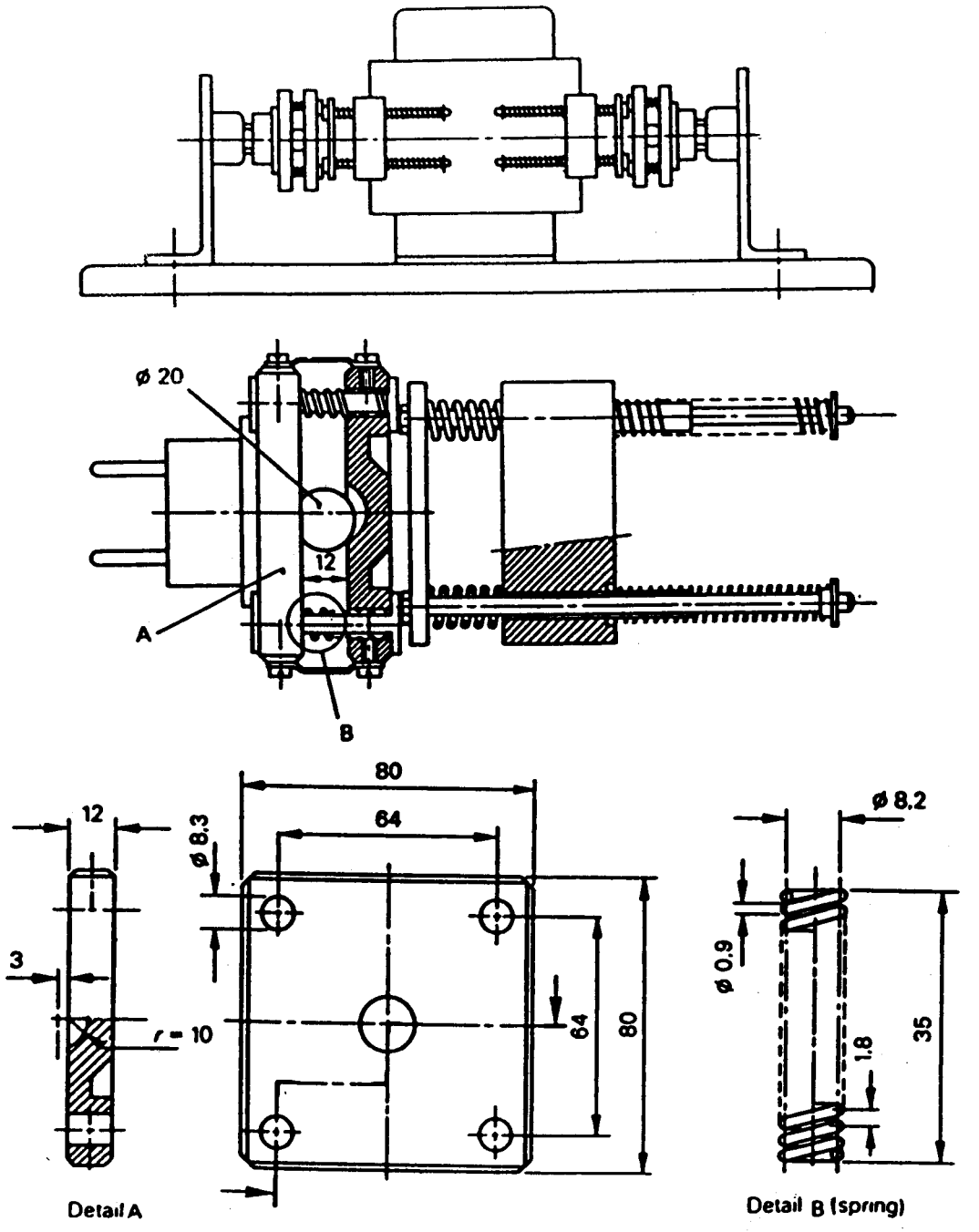


FIG. 11 SKETCH SHOWING THE DIRECTION OF APPLICATION OF THE GUAGE OF FIG. 5



Dimensions in millimetres.

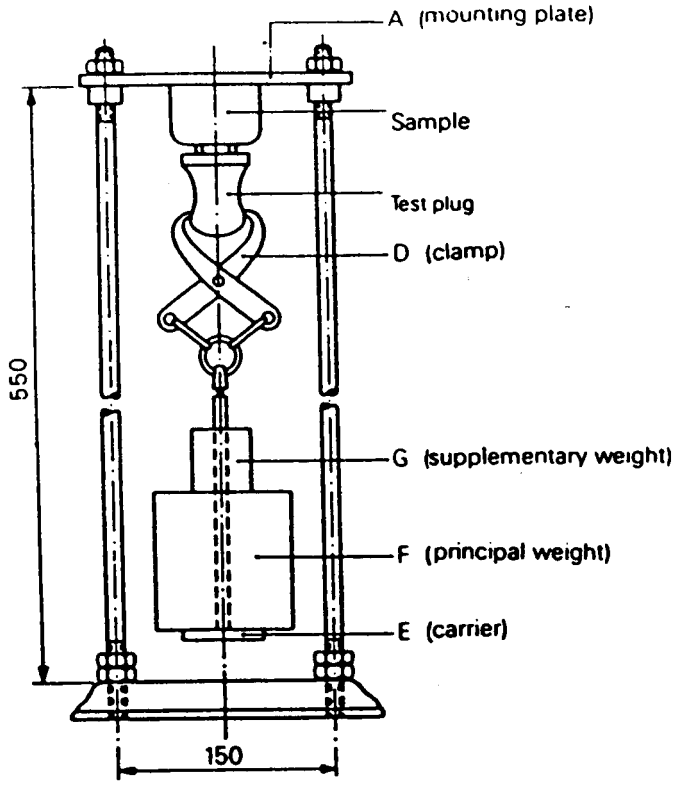
The spring other than spring *B*, are so chosen and adjusted that:

In the disengaged position they exert a force on the plug carrier or specified in the following table.

When compressed by one-third of the difference between the length in the disengaged position and the fully compressed length, they exert a force equal to 1.2 times the appropriate maximum withdrawl force specified in **22**.

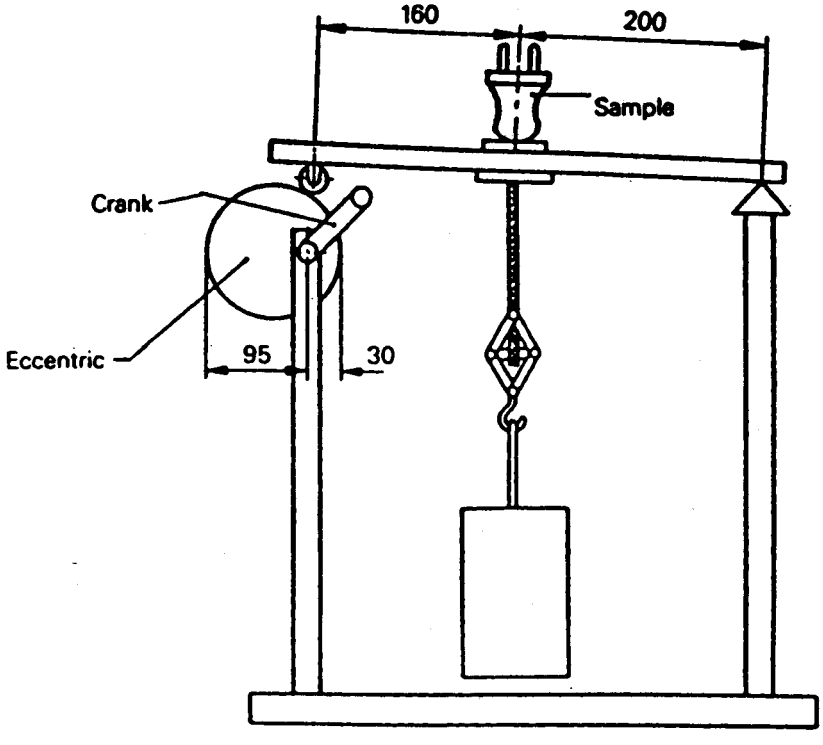
Rating	Number of Poles	Force on the Plug Carrier
Up to and including 10 A	2	3.5
Above 10 A up to and including 16 A	2	7.2

FIG. 12 APPARATUS FOR BREAKING CAPACITY AND NORMAL OPERATION FORCE



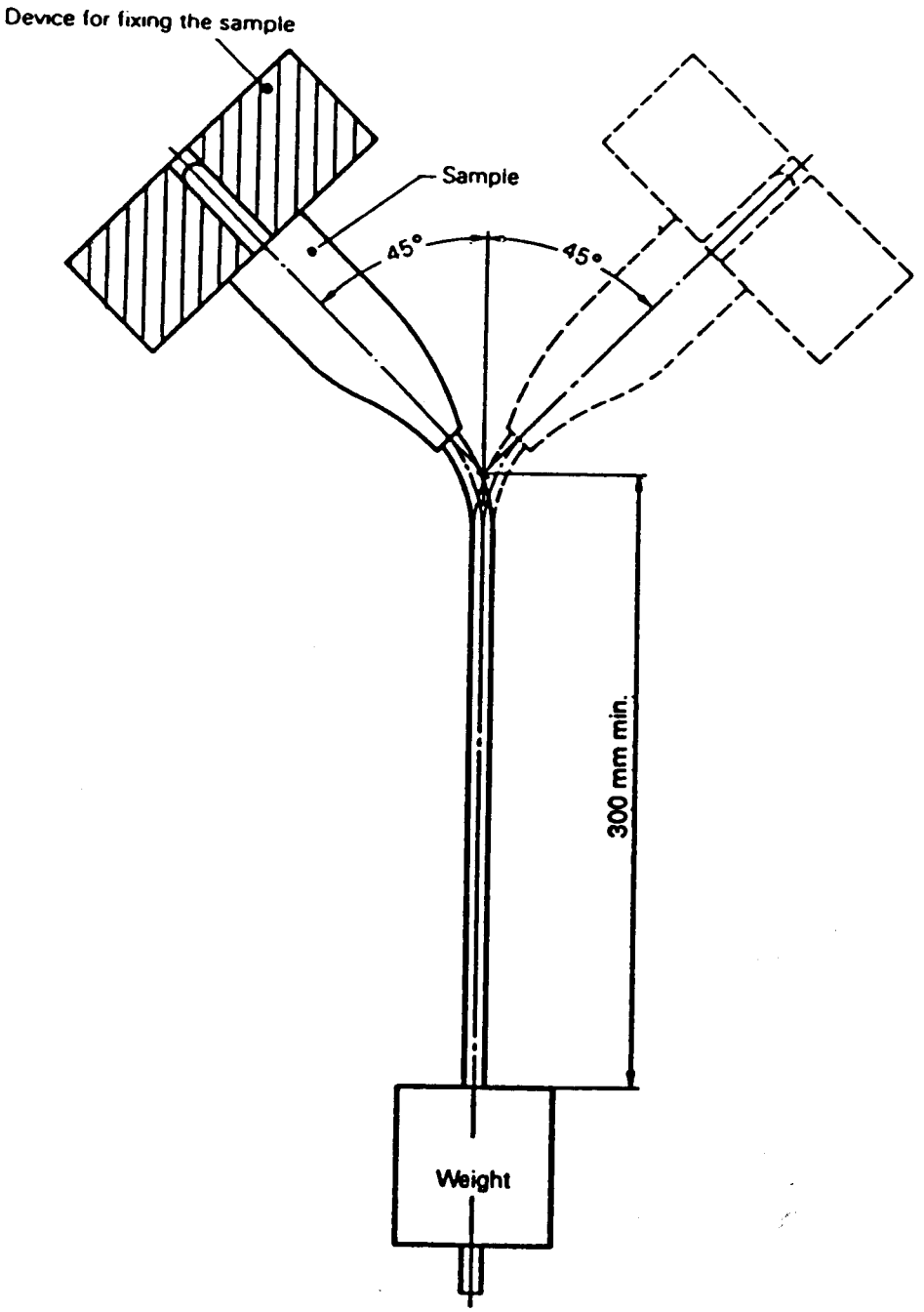
Dimensions in millimetres.

FIG. 13 APPARATUS FOR CHECKING THE WITHDRAWAL FORCE



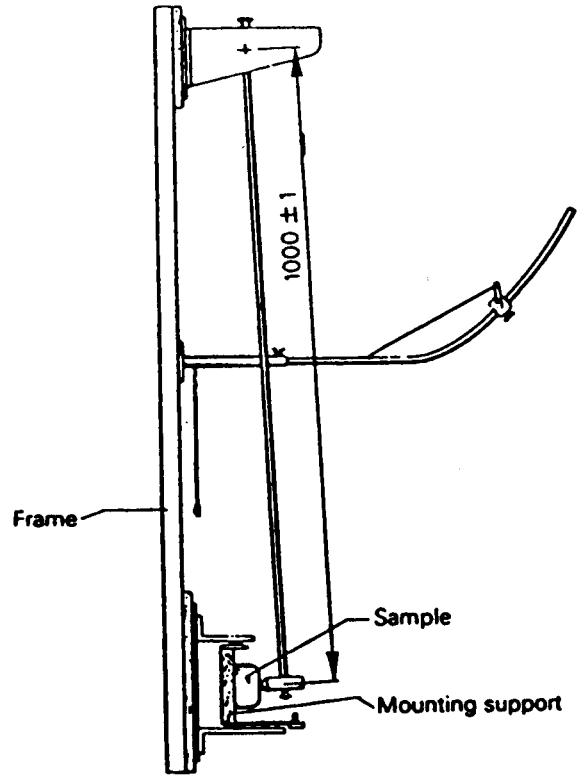
Dimensions in millimetres.

FIG. 14 APPARATUS FOR TESTING THE CORD RETENTION



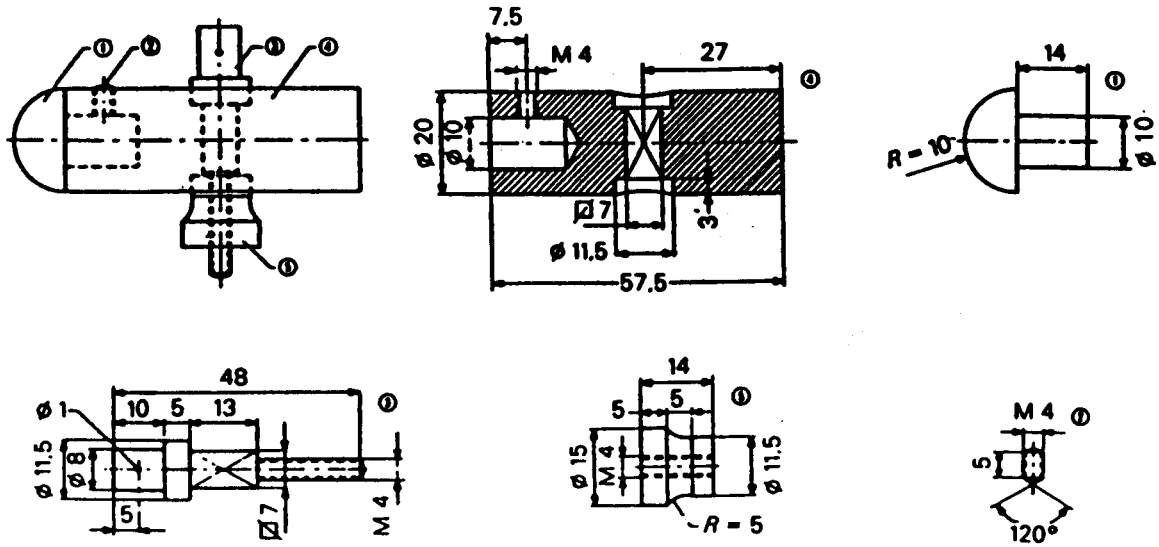
An adjustment of the different supports for the accessories by means of a threaded spindle shall be provided as per **23.4**.

FIG. 15 APPARATUS FOR FLEXING TEST



Dimensions in millimetres.

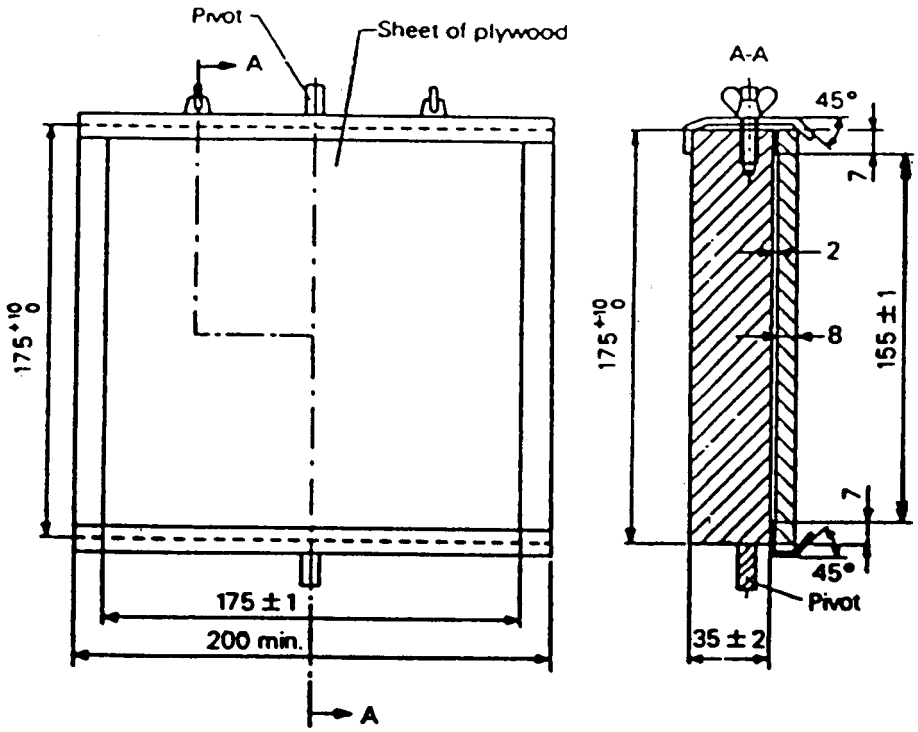
FIG. 16 IMPACT TEST APPARATUS



Dimensions in millimetres.

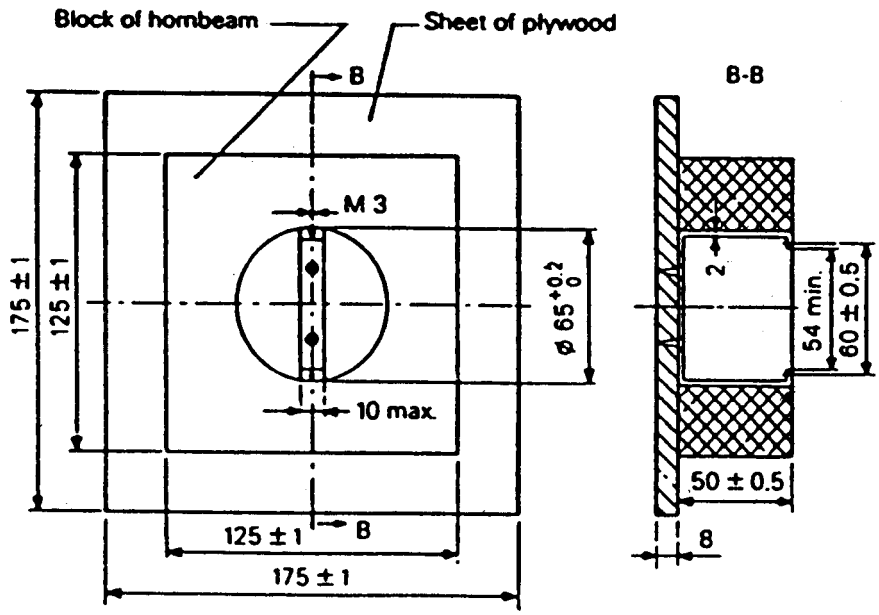
Material of the parts:
1: Polyamide
2, 3, 4, 5: Steel Fe 360

FIG. 17 DETAILS OF THE HAMMER



Dimensions in millimetres.

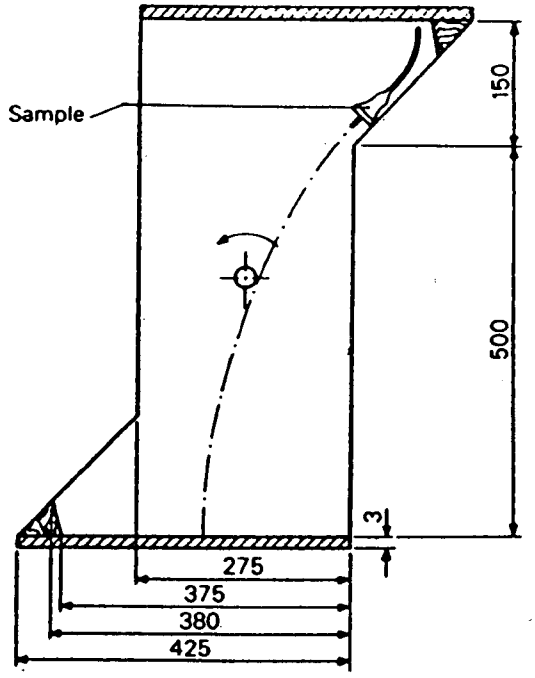
FIG. 18 MOUNTING SUPPORT FOR SAMPLE



Dimensions in millimetres.

The dimensions of the recess in the hornbeam block are given as an example. More general dimensions are under consideration.

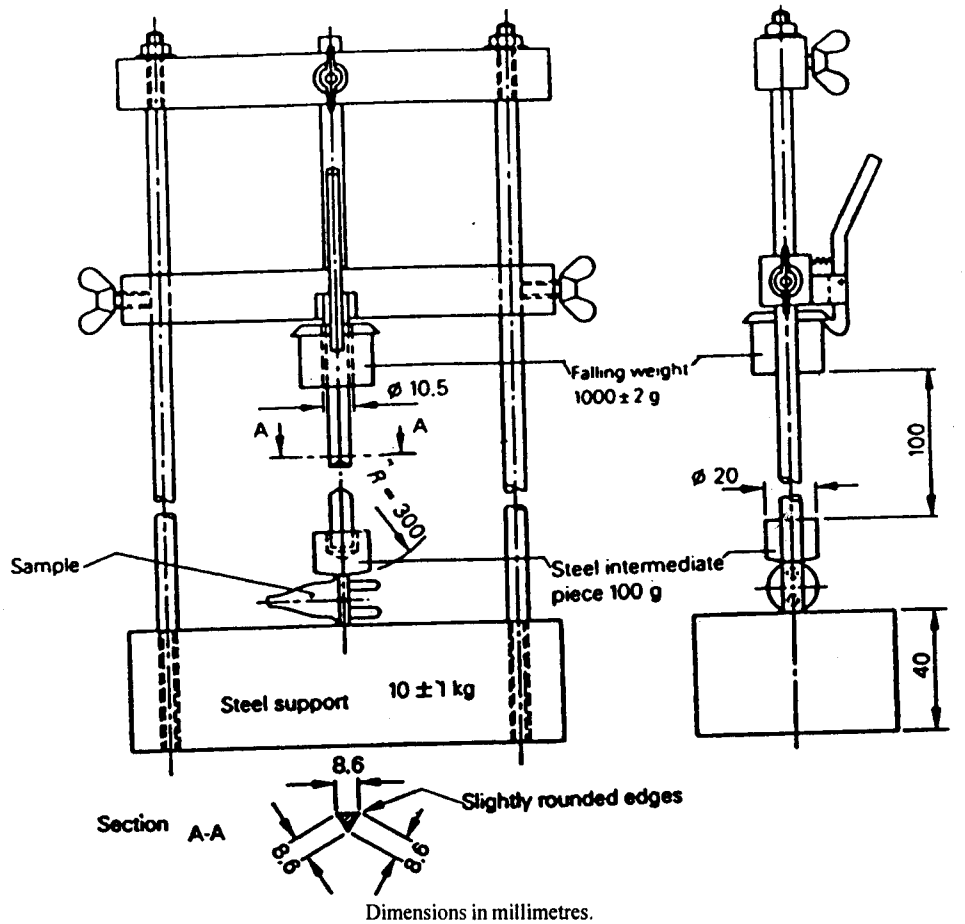
FIG. 19 MOUNTING BLOCK FOR FLUSH TYPE EQUIPMENT



Dimensions in millimetres.

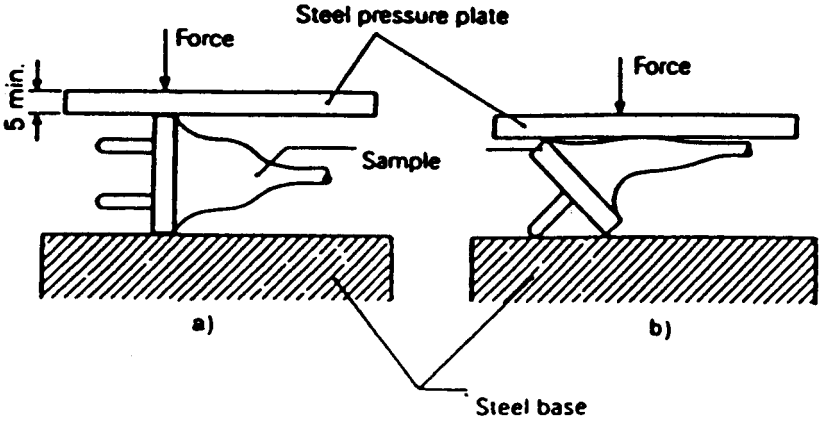
The axial length of the tumbling barrel, on the inside is 275 mm.

FIG. 20 TUMBLING BARREL



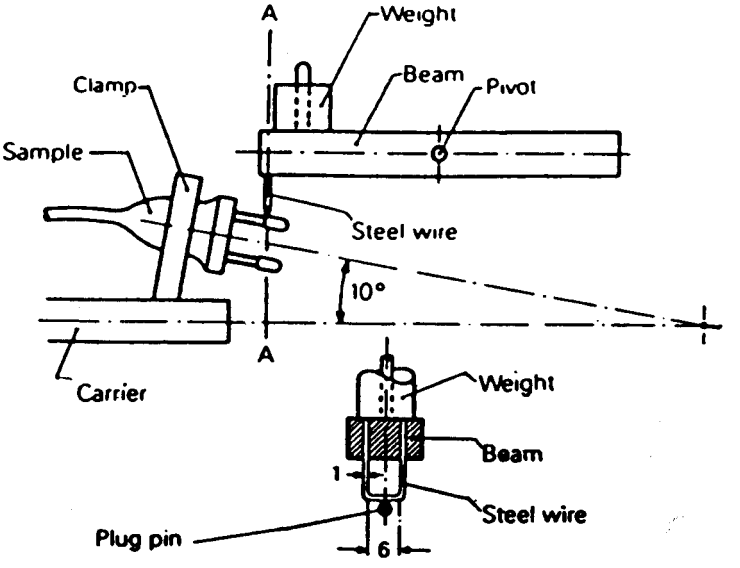
Dimensions in millimetres.

FIG. 21 APPARATUS FOR IMPACT TEST AT LOW TEMPERATURE OF 24.5



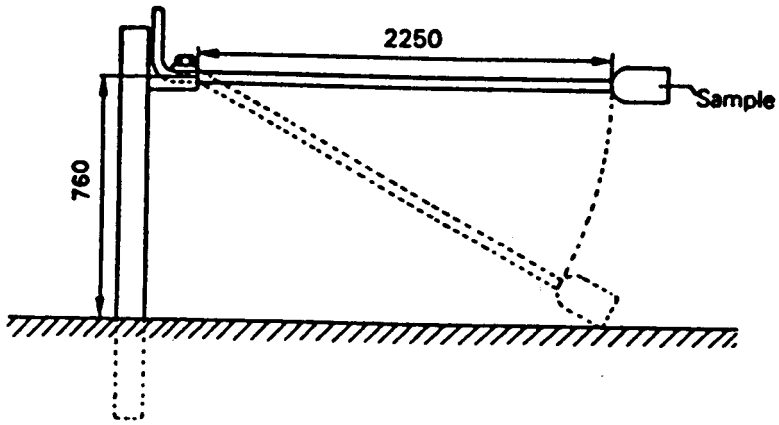
Dimensions in millimetres.

FIG. 22 ARRANGEMENT FOR COMPRESSION TEST OF **24.5**



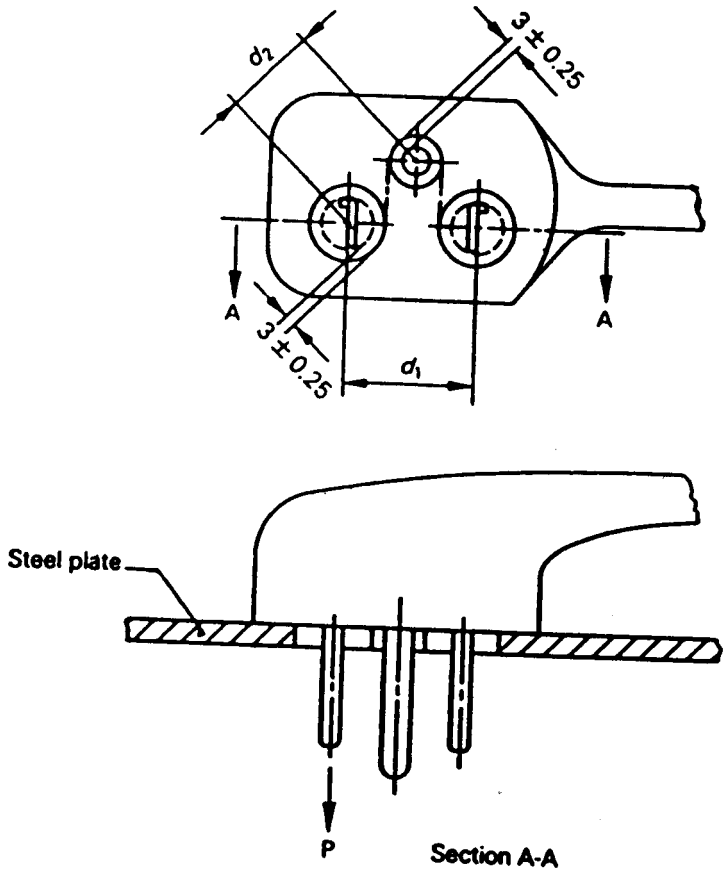
Dimensions in millimetres.

FIG. 23 APPARATUS FOR ABRASION TEST ON INSULATING SLEEVES OF PLUG PINS



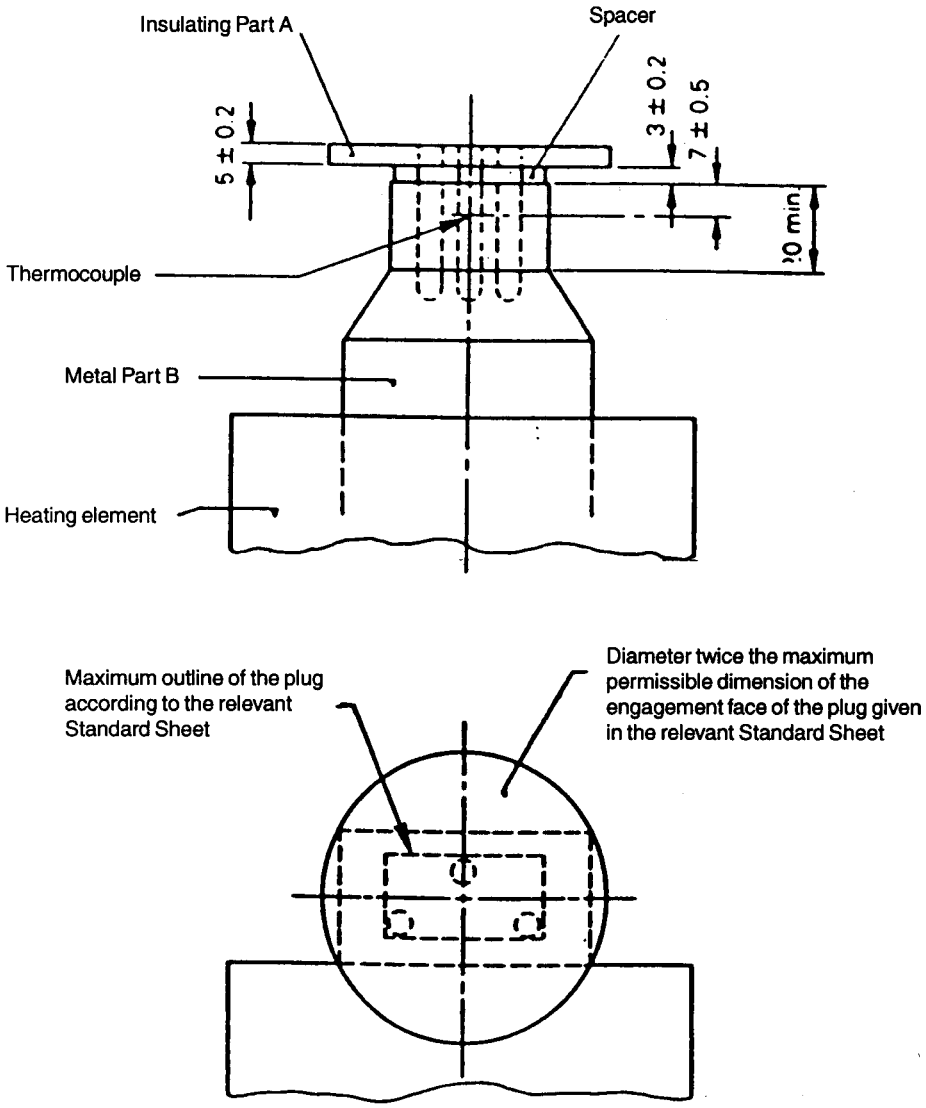
Dimensions in millimetres.

FIG. 24 ARRANGEMENT FOR MECHANICAL STRENGTH TEST ON MULTIPLE PORTABLE SOCKET-OUTLETS



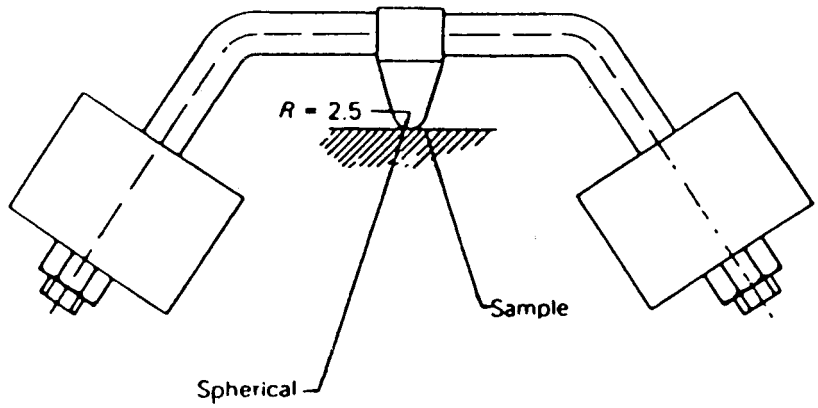
Dimensions in millimetres.

FIG. 25 EXAMPLE OF TEST ARRANGEMENT TO VERIFY THE FIXATION OF PINS IN THE BODY OF THE PLUG



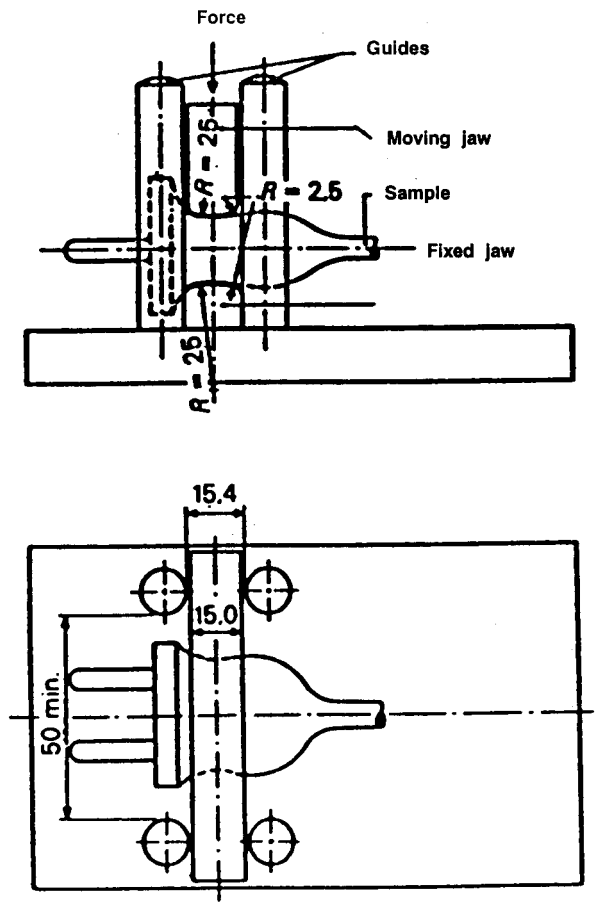
Dimensions in millimetres.

FIG. 26 APPARATUS FOR TESTING RESISTANCE TO ABNORMAL HEAT OF INSULATING SLEEVES OF PLUG PIN



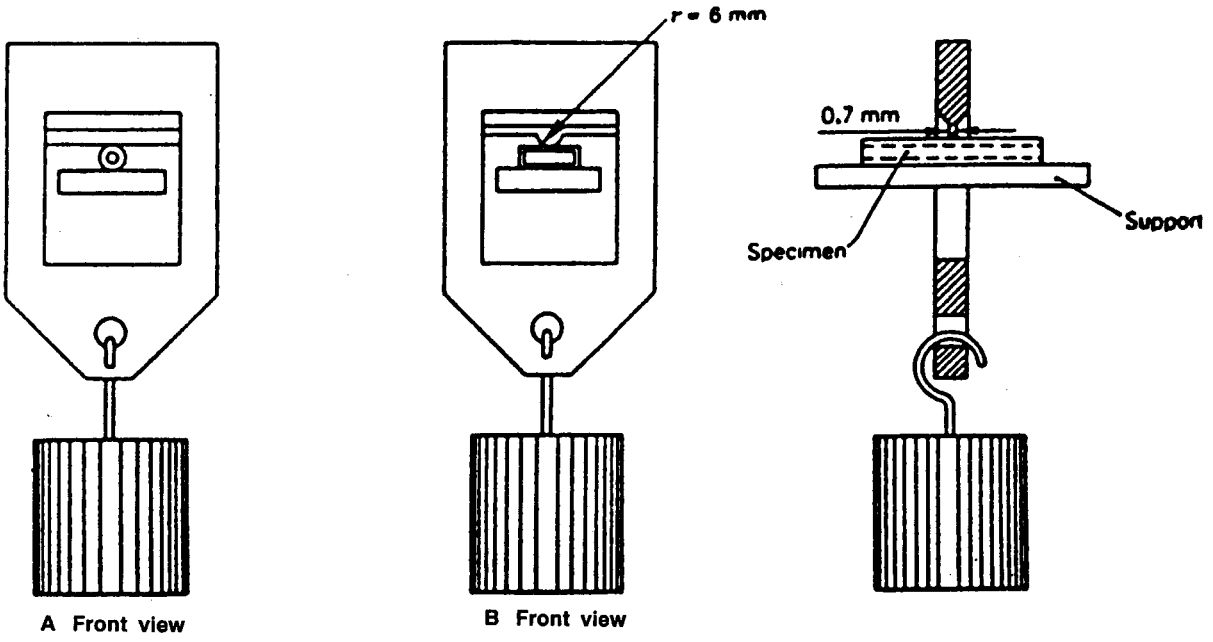
Dimensions in millimetres.

FIG. 27 BALL PRESSURE TEST APPARATUS



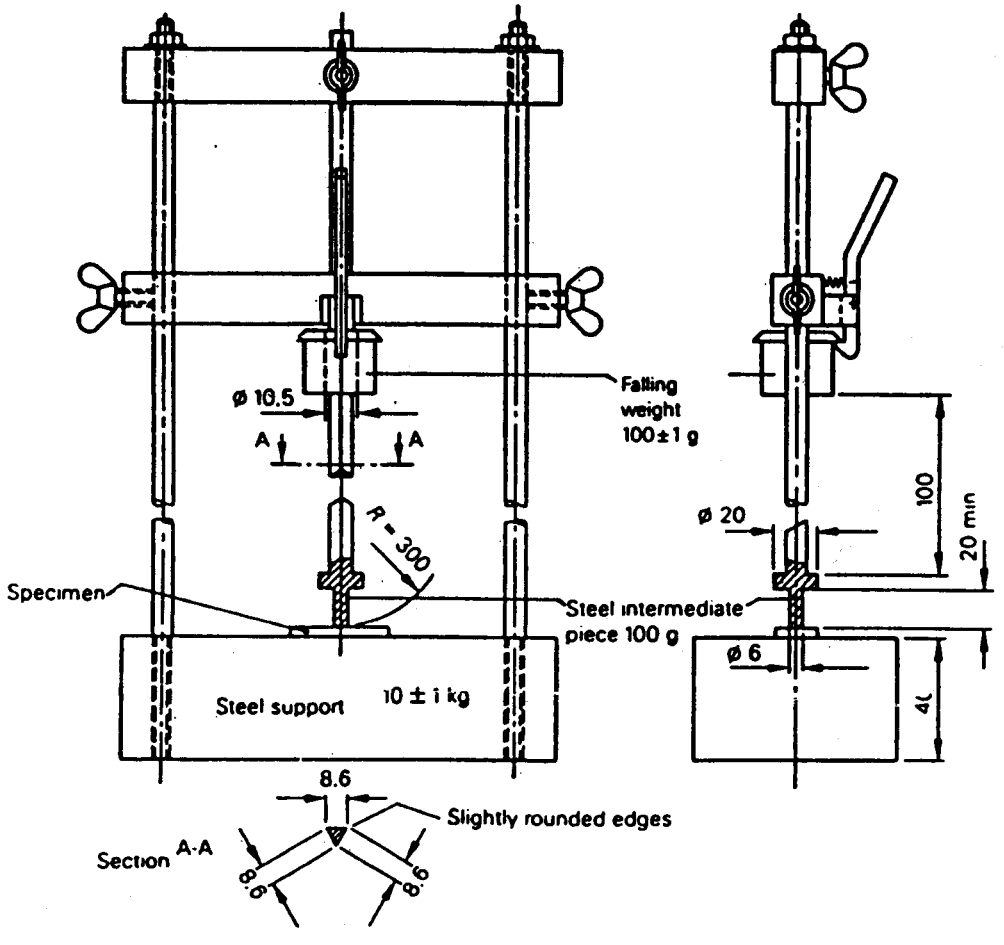
Dimensions in millimetres.

FIG. 28 APPARATUS FOR COMPRESSION TEST FOR THE VERIFICATION OF RESISTANCE TO HEAT OF **25.4**



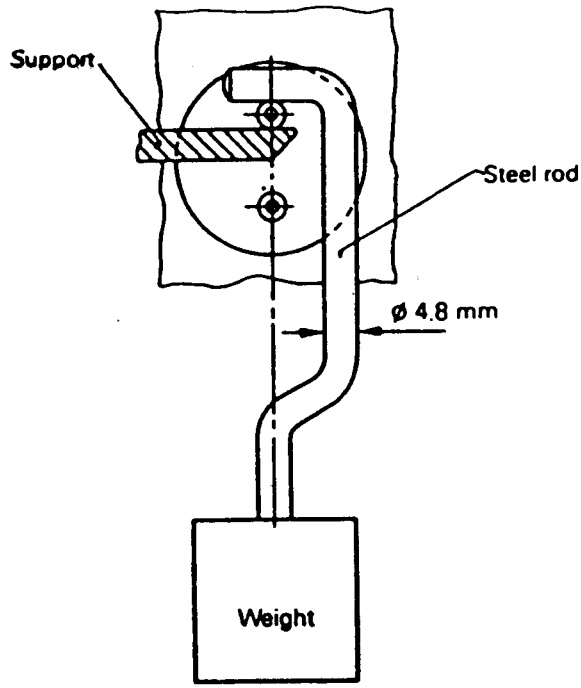
Dimensions in millimetres.

FIG. 29 APPARATUS FOR PRESSURE TEST AT HIGH TEMPERATURE



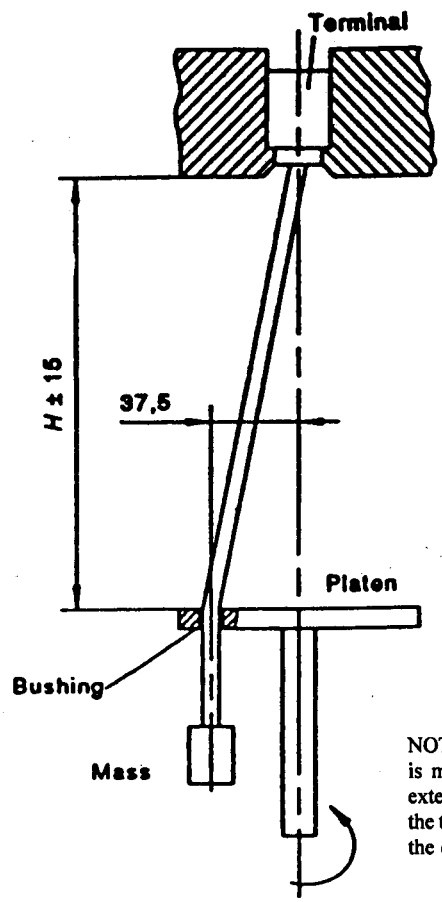
Dimensions in millimetres.

FIG. 30 IMPACT TEST APPARATUS ON PINS PROVIDED WITH INSULATING SLEEVES



Dimensions in millimetres.

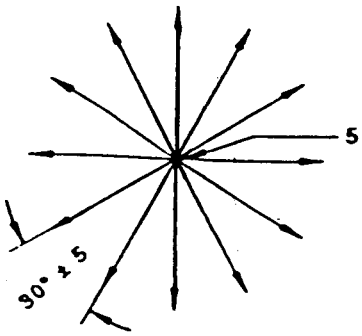
FIG. 31 DEVICE FOR TESTING NON-SOLID PINS



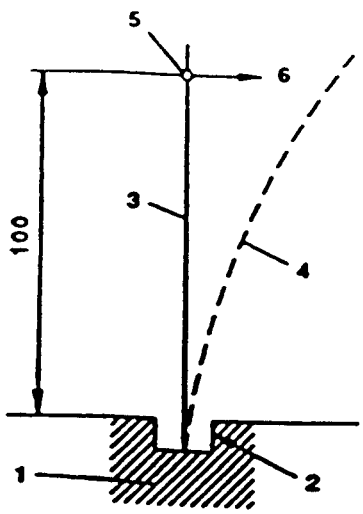
NOTE — Care shall be taken that the bushing hole is made in a way which ensures that the force extended to the cable is pure pulling force and that the transmission of any torque to the connection in the clamping means is avoided.

Dimensions in millimetres.

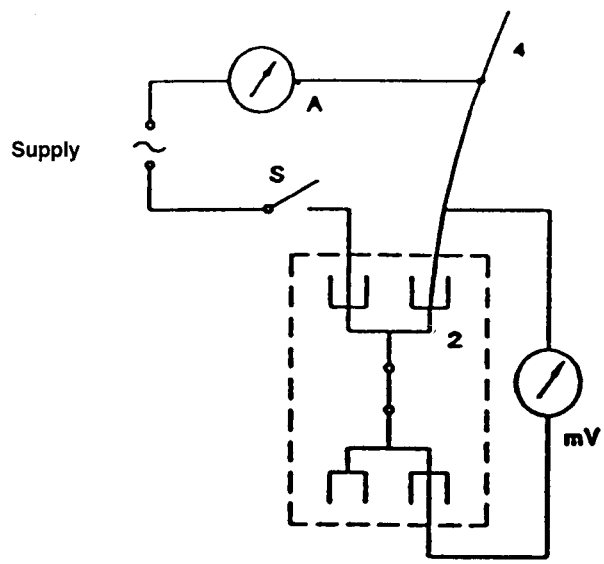
FIG. 32 ARRANGEMENT FOR CHECKING DAMAGE TO CONDUCTORS



Directions of application of the forces



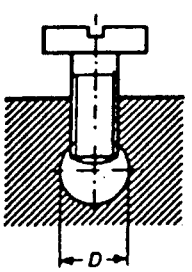
33 A Principle of the test apparatus for deflection tests on screwless terminals



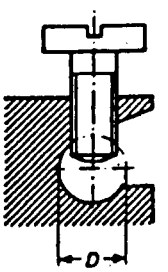
33 B Example of test arrangement to measure the voltage drop during deflection test on screwless terminals

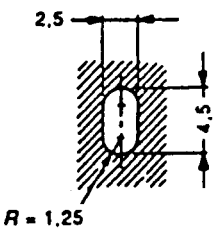
A	Ammeter
mV	Millivoltmeter
S	Switch
1	Sample
2	Clamping unit under test
3	Test conductor
4	Test conductor, deflected
5	Point of application of the force for deflecting the conductor
6	Deflection force (perpendicular to the straight conductor)

FIG. 33 INFORMATION FOR DEFLECTION TEST

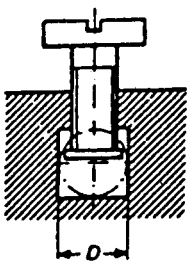


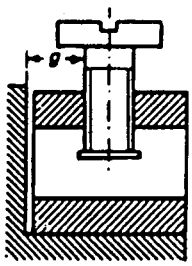
Terminals without pressure plate





Elongated hole terminal





Terminals with pressure plate

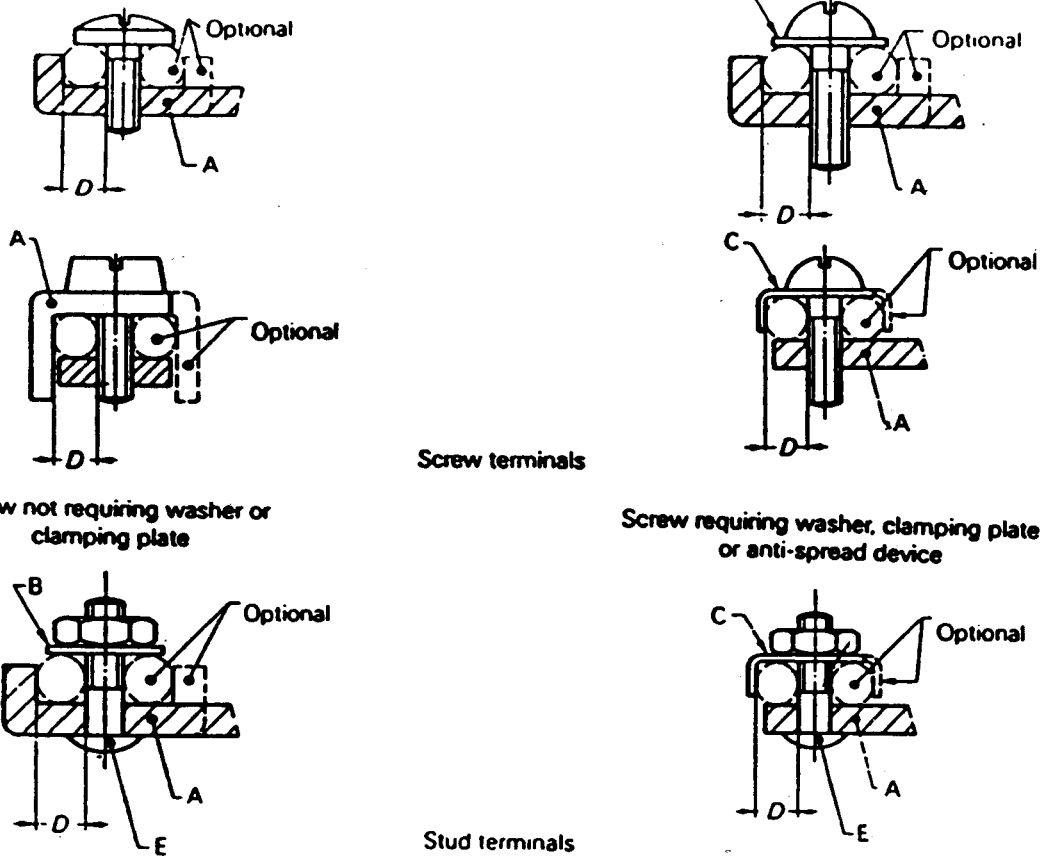
Cross-Section of Conductor Accepted by the Terminal mm²	Minimum Diameter *D* (or Minimum Dimension) of Conductor Space mm	Minimum Distance Between Clamping Screw and End of Conductor When Fully Inserted mm		Torque Nm					
				1[1]		3[1]		4[1]	
		One screw	Two screw	One screw	Two screw	One screw	Two screw	One screw	Two screw
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.5	2.5	1.5	1.5	0.2	0.2	0.4	0.4	0.4	0.4
2.5 (circular hole)	2.0	1.5	1.5	0.25	0.2	0.5	0.4	0.5	0.4
2.5 (elongated hole)	2.5 × 4.5	1.5	1.5	0.25	0.2	0.5	0.4	0.5	0.4
4	3.6	1.8	1.5	0.4	0.2	0.8	0.4	0.8	0.4
6	4.0	1.8	1.5	0.4	0.25	0.8	0.5	0.8	0.5
10	4.5	2.0	1.5	0.7	0.25	1.2	0.5	1.2	0.5

[1] The values specified apply to the screws covered by the corresponding columns in Table 6.

The part of the terminal containing the threaded hole and the part of the terminal against which the conductor is clamped by the screw may be two separate parts, as in the case of terminals provided with a stirrup.

The shape of the conductor space may differ from those shown provided that a circle with a diameter equal to the minimum specified for *D* of the minimum outlines specified for the elongated hole accepting cross sections of conductors up to 2.5 mm² can be inscribed.

FIG. 34 PILLAR TERMINALS



Screw Terminals

Screws requiring washer, clamping plate or anti-spread devices

Stud Terminals

A = fixed part
B = washer or clamping plate
C = anti-spread device
D = conductor space
E = studs

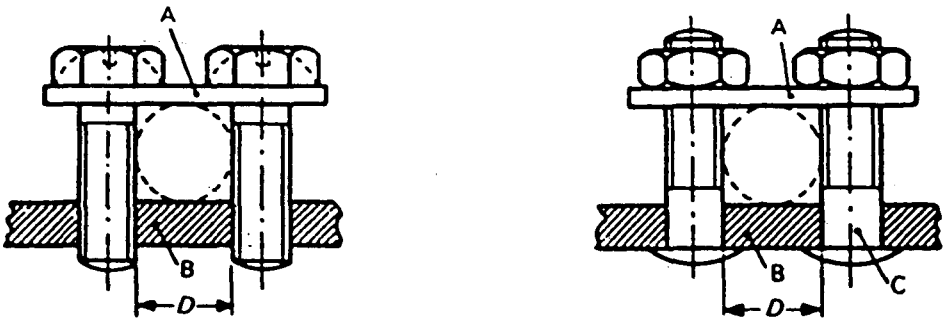
Cross-Section of Conductor Accepted by the Terminal mm²	Minimum Diameter *D* of Conductor Shape mm	Torque Nm			
		3[1]		3[1]	
		One screw	Two screw	One screw	Two screw
(1)	(2)	(3)	(4)	(5)	(6)
Up to 1.5	1.7	0.5	–	0.5	–
Up to 2.5	2.0	0.8	–	0.8	–
Up to 4	2.7	1.2	0.5	1.2	0.5
Up to 6	3.6	2.0	1.2	2.0	1.2
Up to 10	4.3	2.0	1.2	2.0	1.2

[1] The values specified apply to the screws covered by the corresponding columns in Table 6.

The part which retains the conductor in position may be of insulating material provided the pressure necessary to clamp the conductor is not transmitted through the insulating material.

The second optional space for the terminal accepting cross-section of conductors up to 2.5 mm² may be used for the connection of the second conductor when it is required to connect two 2.5 mm² conductors.

FIG. 35 SCREW TERMINALS AND STUD TERMINALS



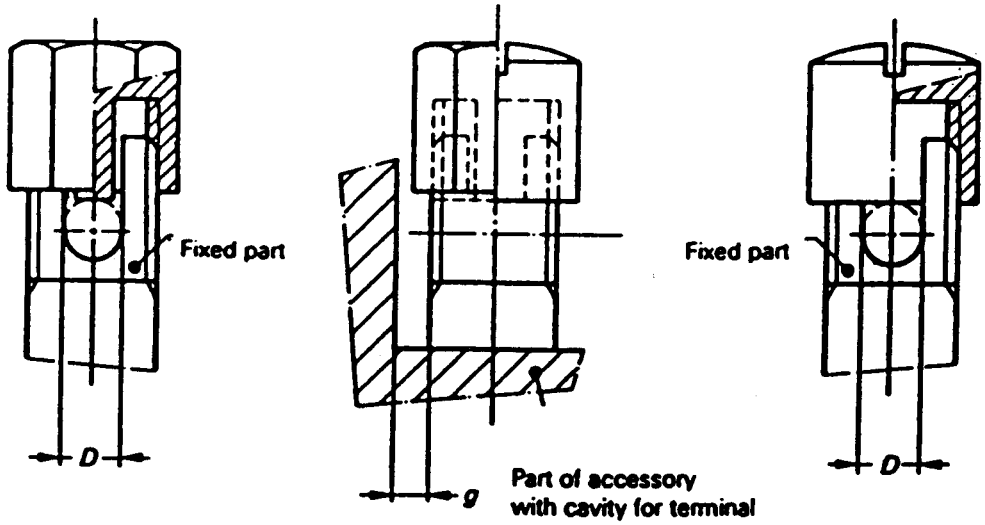
A = Saddle
B = Fixed part
C = Stud
D = Conductor space

Cross-Section of Conductor Accepted by the Terminal mm²	Minimum Diameter *D* of Conductor Space mm	Torque Nm
(1)	(2)	(3)
Up to 4	3.0	0.5
Up to 6	4.0	0.8
Up to 10	4.5	1.2

The shape of the conductor space may differ from that shown in the figure, provided that a circle with a diameter equal to the minimum value specified for *D* can be inscribed.

The shape of the upper and lower faces of the saddle made different to accommodate conductors of either small or large cross-sectional areas by inverting the saddle.

FIG. 36 SADDLE TERMINALS



Cross-Section of Conductor Accepted by the Terminal mm²	Minimum Diameter $D^{1)}$ of Conductor Space mm	Torque Nm
(1)	(2)	(3)
Up to 1.5	1.7	1.5
Up to 2.5	2.0	1.5
Up to 4	2.7	1.8
Up to 6	3.6	1.8
Up to 10	4.3	2.0

[1] The value of the torque to be applied is that col 2 or 3 of Table 6 as appropriate.

NOTE — The bottom of the conductor space must be slightly rounded in order to obtain a reliable connection.

FIG. 37 MANTLE TERMINALS

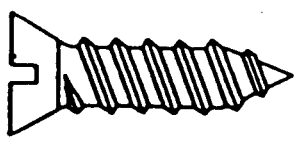


FIG. 38 THREAD FORMING SCREW

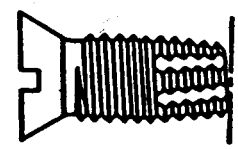


FIG. 39 THREAD CUTTING SCREW

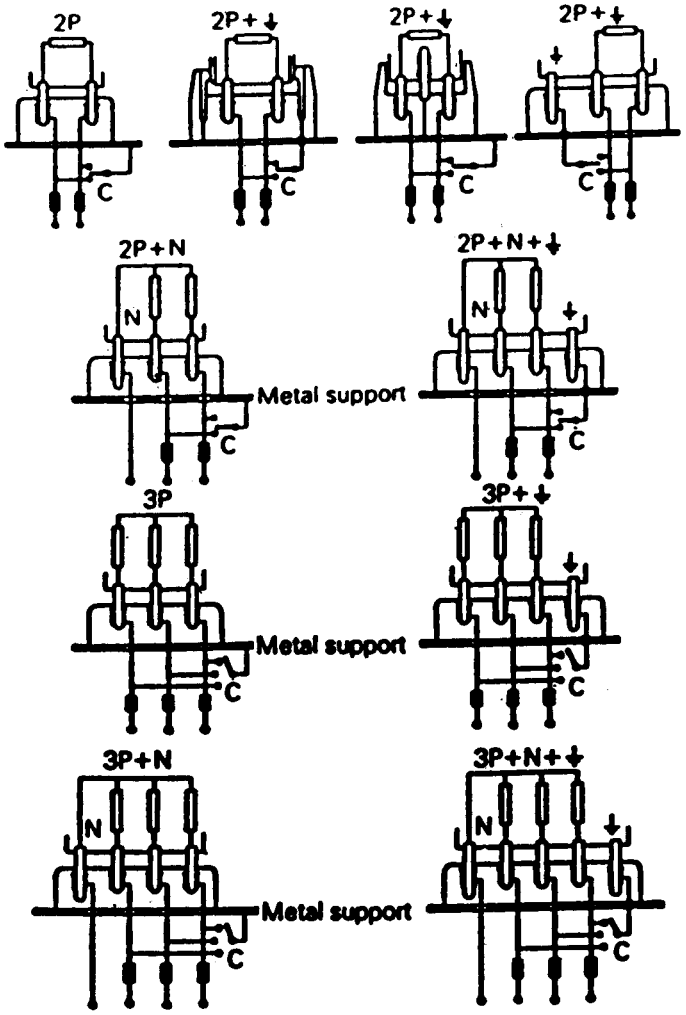
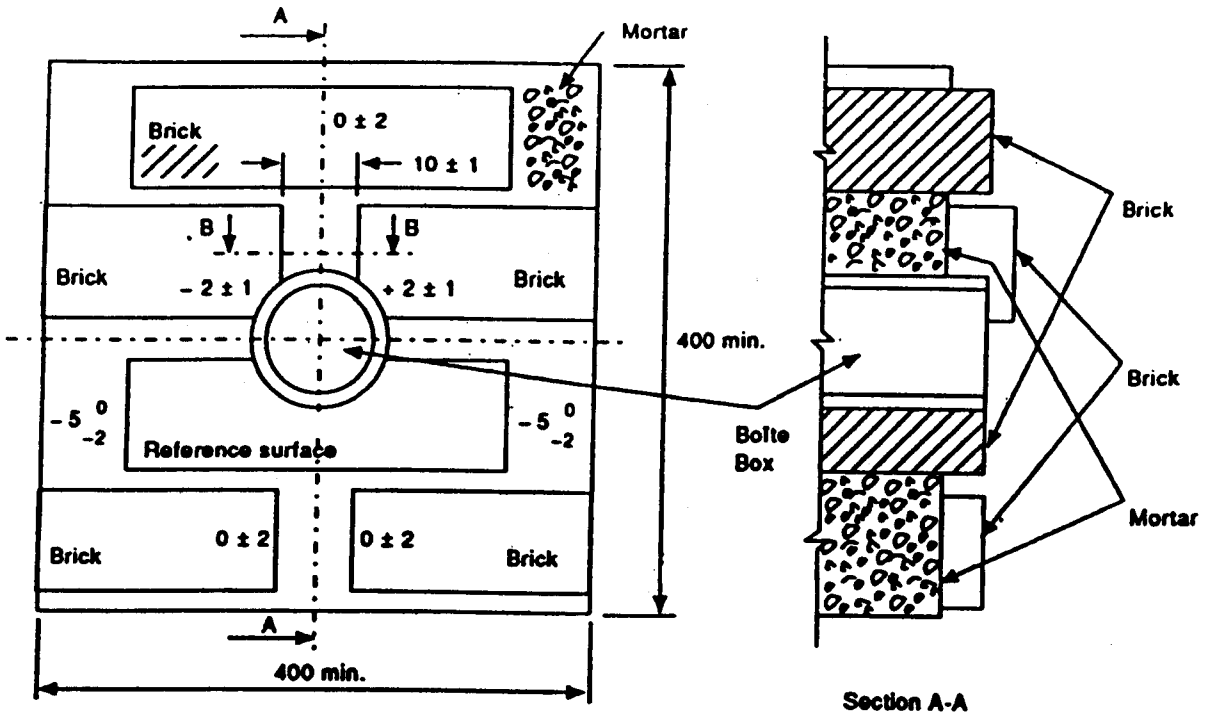
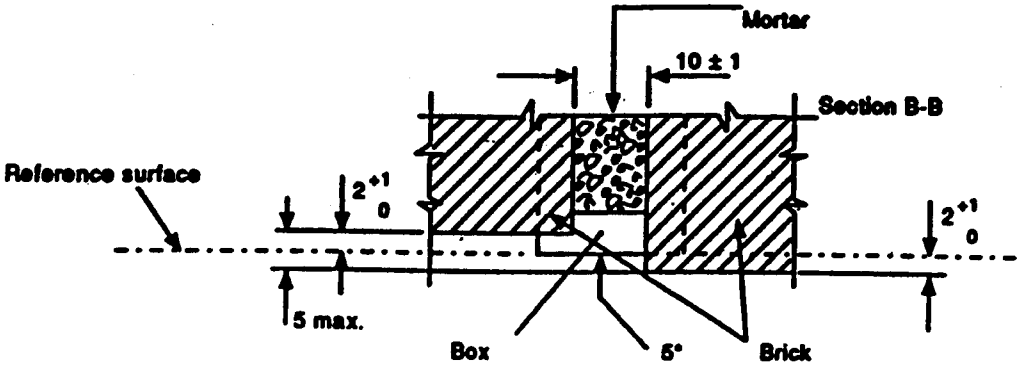


FIG. 40 CIRCUIT DIAGRAMS FOR BREAKING CAPACITY AND NORMAL OPERATION TESTS



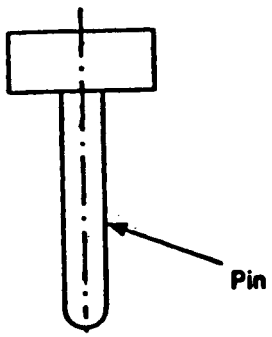
All mortar joints 10 ± 5 mm thick unless otherwise specified



Dimensions in millimetres.

All mortar joints 10 ± 5 mm thick unless otherwise specified, or in accordance with the manufacturer's instructions.

FIG. 41 TEST WALL IN ACCORDANCE WITH THE REQUIREMENTS OF **16.2.1**



(Dimensions according to Annex A)

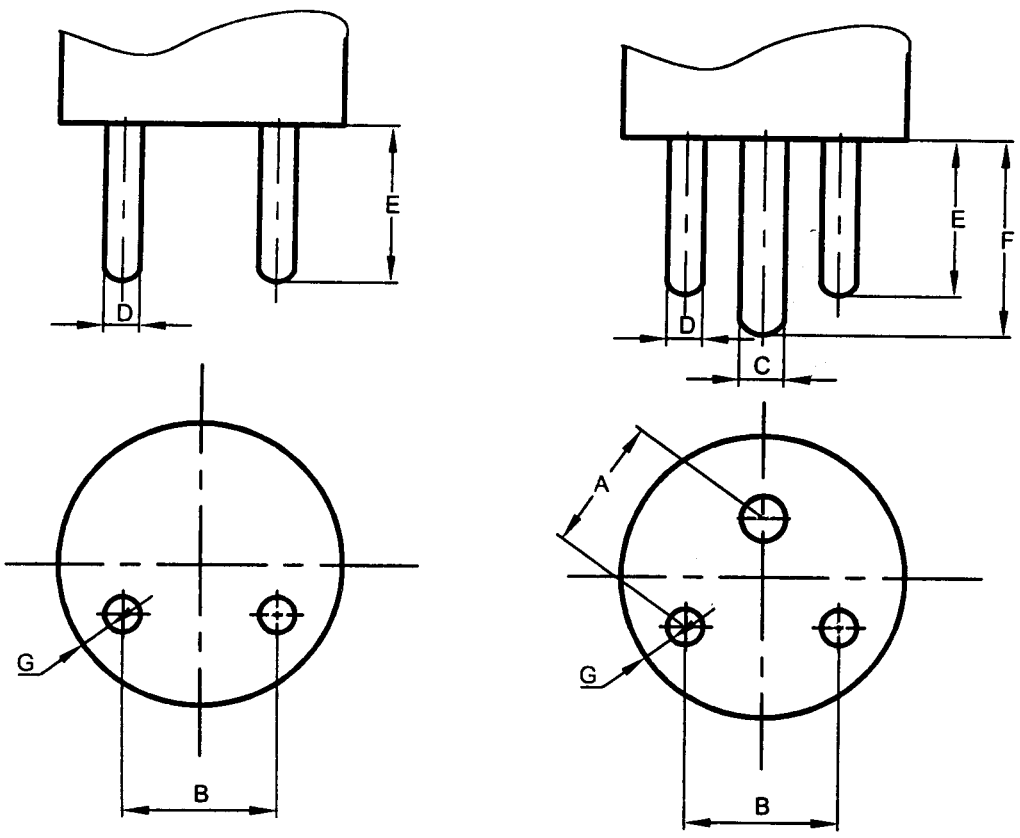
NOTE — The mass to be equally positioned around the centre line(s) of the pin.

FIG. 42 GAUGE FOR THE VERIFICATION OF THE MINIMUM WITHDRAWAL FORCE

ANNEX A

(*Clauses* 9.1 *and* 9.3)

DIMENSIONS OF PLUGS AND SOCKET-OUTLETS



(1)	Rating		
	2.5 A mm (2)	6A/10A mm (3)	16A mm (4)
A	–	– 22.2 ± 0.15	28.6 ± 0.15
B	19.10 ± 0.15 16.50[1] ± 0.10	19.1± 0.15	25.4 ± 0.15
C	–	$7.06^{+0.025}_{-0.050}$	$8.71^{+0.025}_{-0.050}$
D	$5.08^{+0.025}_{-0.050}$	$5.08^{+0.025}_{-0.050}$	$7.06^{+0.025}_{-0.050}$
E	$15.9^{+1.04}_{-0.13}$	$15.9^{+1.04}_{-0.13}$	$20.6^{+1.04}_{-0.13}$
F	–	$20.6^{+1.04}_{-0.13}$	$28.6^{+1.04}_{-0.13}$
G[2], *Min*	7.94	7.94	9.52
H	5.16 to 7.54	5.16 to 7.54	6.76 to 9.12
K	–	6.0	8.0
Nominal width of slot:			
Current-carrying pin	0.6	0.6	0.8
Earthing-pin	0.8	0.8	0.8
Minimum length of slot :			
Current-carrying pin		7.5	10.5
Earthing-pin		10.5	17.0

NOTES

1 The measurement of width of slot of current carrying pins and earthing pin shall be carried out at the bottom of the slot.

2 Dimension '*K*' is applicable for non-shutter type socket-outlets only.

H = distance between the base of plug and socket-outlets at position of first contact of live pins.

[1] Shall be phased out after 30 June 2005.

[2] Dimension '*G*' is the minimum distance between the pins (live and neutral) and the periphery of the plug. If is not applicable for the earth pin.

K = diameter of holes in the socket-outlet plate or cover from the reception of current-carrying plug pins.

ANNEX B

(Clauses 9.1 and 9.2)

GAUGES FOR PLUGS AND SOCKET-OUTLETS

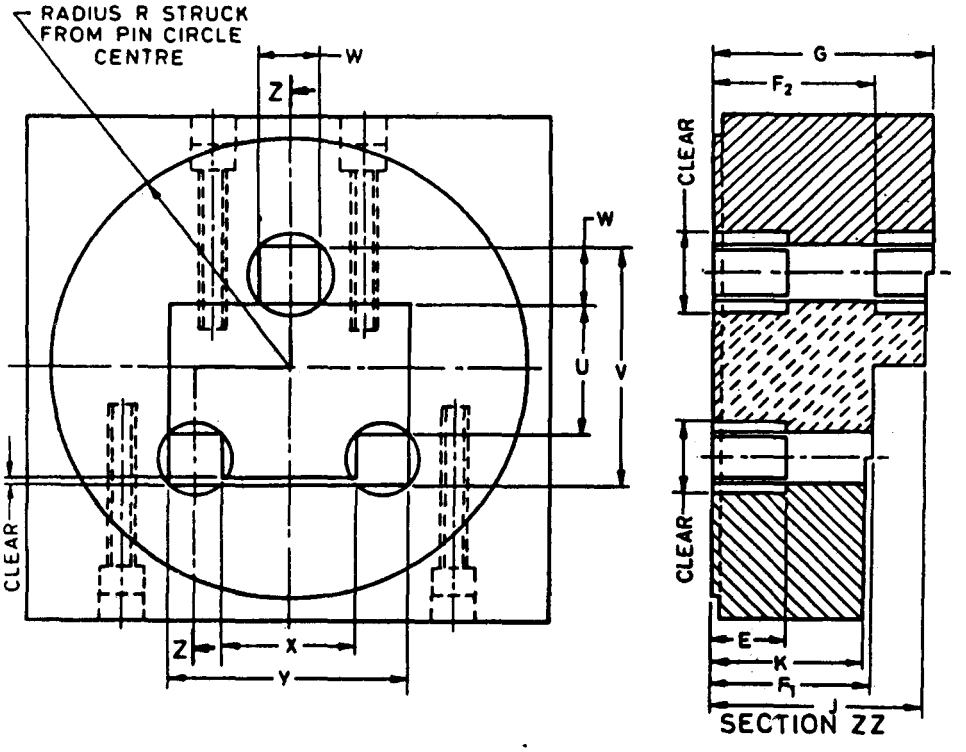
B-1 'GO' GAUGES FOR PLUGS

B-1.1 The gauge (*see* Fig B-1) is to prove correct spacing of plug pins. It accepts the plugs with plug pins at any centres that can be accepted without interference in socket outlets gauged by the maximum and minimum socket gauges.

B-1.2 In addition, it proves the absence of axial projections on the face of the plug base when a plug is fully inserted into the gauge, and it also indicates accuracy of projection of the plug pins from the face of the plug if the end of each plug pin lies within the appropriate step on the back of the gauge when the plug is fully inserted.

B-2 'GO' GAUGES FOR SOCKET-OUTLETS

B-2.1 Two gauges (*see* Fig B-2 and B-3) are required, each having pins of the maximum diameter specified in Annex A, but one gauge having its pins so set that its complete insertion into socket-outlet proves that the socket-outlet will accept without interference, a plug having plug pins at the maximum centre distance and the other gauge having its pins so set that its complete insertion into a socket-outlet proves that the socket-outlet will accept without interference a plug having plug pins at the minimum centre distance. The socket-outlet gauges also prove the absence of axial projection on the face of the socket-outlets.

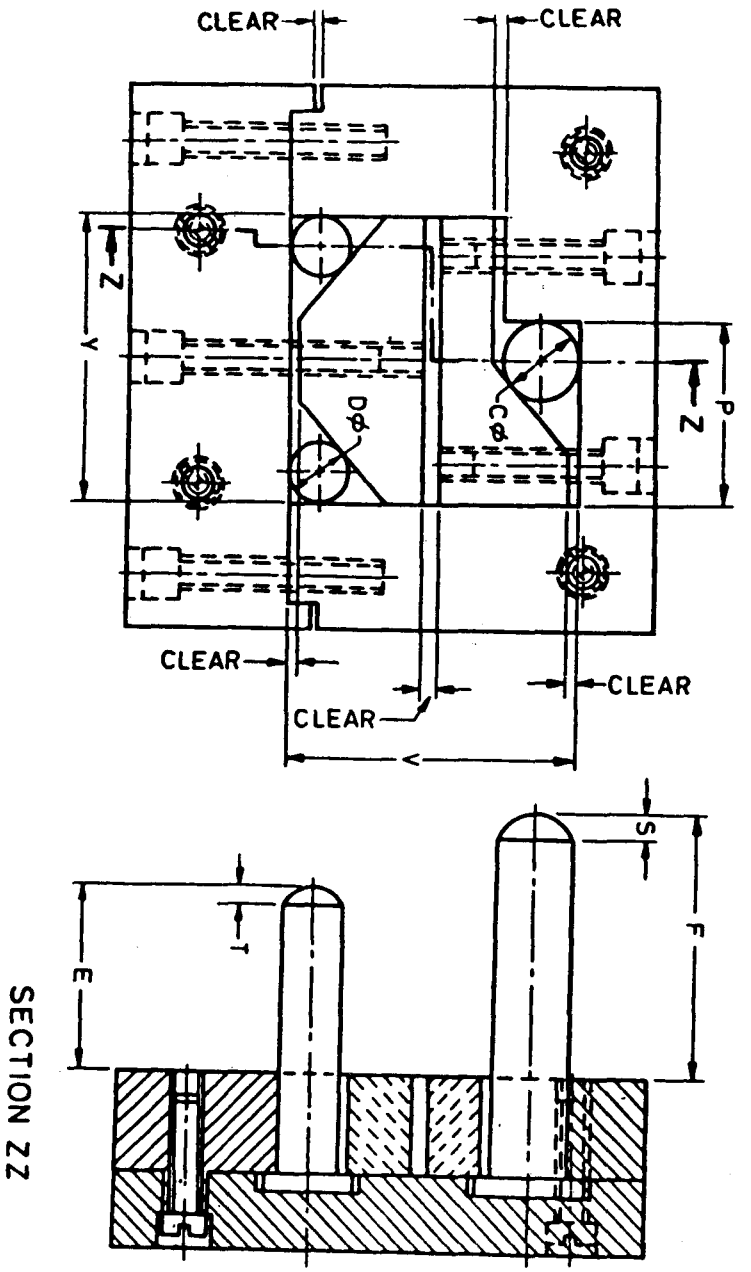


All dimensions in millimetres.

Rating A	*U*	*V*	*W*	*X*	*Y*	*E*	F_1	*G*	*J*	*K*	*R*	F_2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
6/10	13.83	26.33	7.24	13.79	24.31	7.6	16.92	21.67	20.50	15.75	27.18	17.02
16	17.53	33.66	8.89	18.16	32.64	10.2	21.67	29.62	28.45	20.50	32.26	21.59
Tolerance	+0.01 −0.00	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.25 −0.25	+0.01 −0.00	+0.01 −0.00	+0.00 −0.01	+0.00 −0.01	– –	+0.25 −0.25

NOTE — The drawings are not intended to be mandatory regarding details of construction.

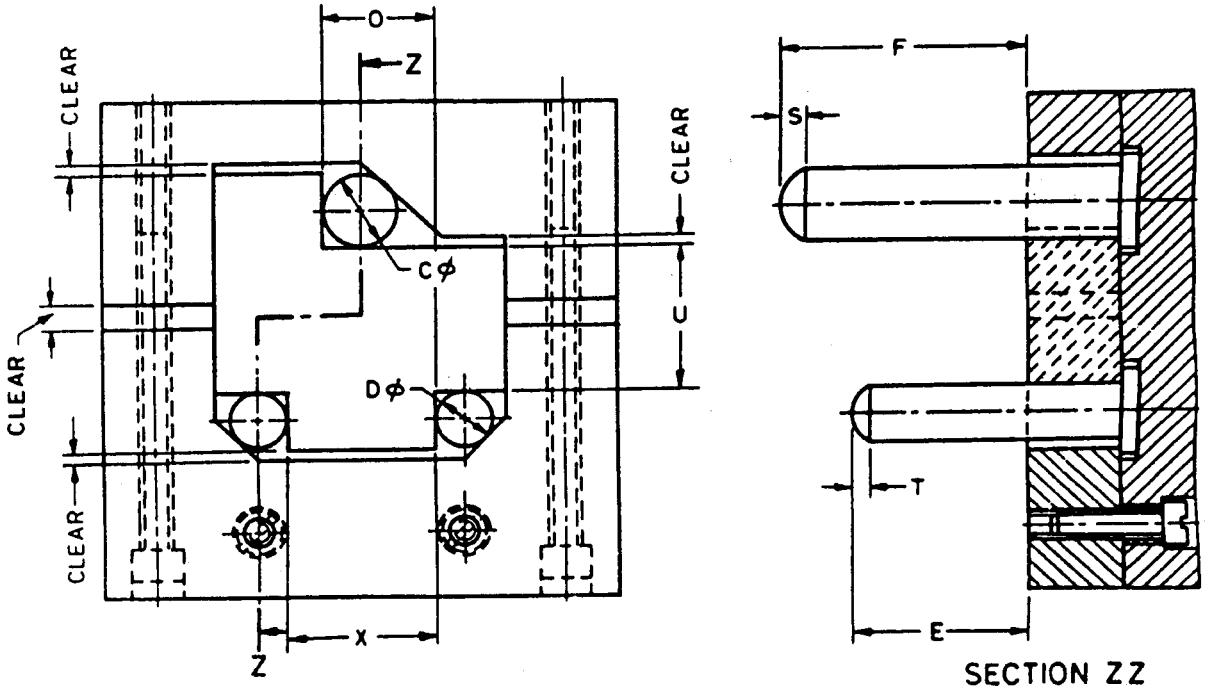
FIG. B-1 'GO' GAUGE FOR PLUG



All dimensions in millimetres.

Rating A	*V*	*Y*	*C*	*D*	*E*	*F*	*P=Y+C/2*	*S*	*T*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
6/10	26.33	24.31	7.09	5.10	16.92	21.67	15.70	1.98	1.57
16	33.66	32.64	8.74	7.09	21.67	29.62	20.69	2.36	1.98
Tolerance	+0.01 −0.00	+0.01 −0.00	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.005 −0.000	+0.25 −0.00	+0.25 −0.00

FIG. B-2 MAXIMUM 'GO' GAUGE FOR SOCKET-OUTLET



All dimensions in millimetres.

Rating A	*V*	*Y*	*C*	*D*	*E*	*F*	*O=X+C/2*	*S*	*T*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
6/10	13.83	13.79	7.09	5.10	16.92	21.67	10.44	1.98	1.57
16	17.53	18.15	8.74	7.09	21.67	29.62	13.45	2.36	1.98
Tolerance	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.00 −0.01	+0.00 −0.005	+0.25 −0.00	+0.25 −0.00

FIG. B-3 MINIMUM 'GO' GAUGE FOR SOCKET-OUTLET

ANNEX C
(*Clauses* 31.2.1)
SAMPLING PROCEDURE

C-1 LOT

In any consignment, all samples of the same type, designation, rating and manufactured under essentially similar conditions of production shall be grouped together to constitute a lot.

C-1.2 From each lot, a certain number of samples as specified in Table 20 shall be selected at random and subject to tests specified in **31.2**.

C-2 CRITERIA FOR CONFORMITY

C.2.1 In Table 24, N_1 is the size of the first sample.

If the number of failures is greater than or equal to C_1, the lot shall be considered to be conforming to this standard and accepted. If the number of failure is greater than or equal to C_2 the lot shall be rejected. If the number of failures is between C_1 and C_2, further sample of N_2 pieces shall be taken and subjected to all tests.

C-2.1.1 If the number of failures in the two samples combined is less than C_2 the lot shall be accepted otherwise rejected.

Table 24 Sampling Plan
(*Clause* C-2.1)

Lot Size	N_1	N_2	$(N_1 + N_2)$	C_1	C_2
(1)	(2)	(3)	(4)	(5)	(6)
51 to 100	10	20	30	0	3
101 to 200	13	26	39	0	5
201 to 300	20	40	60	1	5
301 to 500	25	50	75	1	6
501 to 800	35	70	105	2	7
800 to 1 300	50	100	150	3	10
1 300 and above	75	150	225	5	12

NOTE — The plan recommended in this table assures that lots with defectives 4 percent or less would be accepted most of the time, and lots with defectives 25 percent and above would be rejected most of the time. The exact consumers risk depends on the lot size and it would be minimum when the lost size is maximum.

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This Indian Standard has been developed from Doc: No. ET 14 (5223).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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AMENDMENT NO. 1 AUGUST 2006
TO
IS 1293 : 2005 PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO AND INCLUDING 16 AMPERES — SPECIFICATION

(Third Revision)

(*Page* 78, *col* 1, *row* 8) — Delete.

(ET 14)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 JUNE 2007
TO
IS 1293 : 2005 PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO AND INCLUDING 16 AMPERES — SPECIFICATION

(Third Revision)

(*Page* 4, *clause* **6.1**) — Substitute the following for the existing:

'Accessories shall have a rated voltage not exceeding 250 V. Accessories shall preferably be of a type and preferably have voltage and current ratings as shown in Table 1.'

[*Page* 5, *clause* **8.1**(e)] — Insert the following word after 'Type reference':

'(Optional)'

(*Page* 6, *clause* **8.3**, *line* 5) — Insert the following word after 'type reference':

'(Optional)'

(*Page* 11, *Table* 3, *col* 1, *row* 5) — Add '⏚' after '2 P +'.

(*Page* 11, *Table* 3, *col* 1, *row* 7) — Add '⏚' after '2 P +'.

(*Page* 20, *clause* **13.11**) — Substitute the following for the existing matter:

'Multiple socket-outlets with a common base shall be provided either with fixed links for interconnection of the contacts in parallel or provision for connecting externally the two in case independent terminals are provided.'

(*Page* 27, *clause* **17.1**, *second para*) — Substitute '5 M Ω' *for* '5 M W'.

(*Page* 27, *clause* **17.2**, *third para*) — Add the following sentence after the existing matter:

'No flashover or breakdown shall occur during the test.'

(*Page* 31, *clause* **22.1**, *para* 7 *last line*) — Substitute the word 'onto' *for* 'into'.

(*Page* 31, *clause* **23.1**, *first line*) — Substitute 'when' *for* 'where'.

(*Page* 38, *clause* **24.5**, *first sentence*) — Substitute 'Fig. 22' *for* 'Fig. 21'.

(*Page* 39, *clause* **24.10**, *fifth para*) — Substitute 'on each pin' *for* 'or each pin'.

(*Page* 45, *clause* **28.1.1**, *matter against third dash*) — Substitute the following for the existing:

'for parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even though they are in contact with them, by the test made at a temperature of 650°C.'

[*Page* 78, *Annex* A, *Informal table* (*see also Amendment No.* 1)] — Substitute the following for the existing table:

(1)	Rating		
	2.5 A mm (2)	6A/10A mm (3)	16A mm (4)
A	-	-22.2 ± 0.15	28.6 ± 0.15
B	19.10 ± 0.15 16.50[1] ± 0.15	19.1 ± 0.15	25.4 ± 0.15
C	-	$7.06^{+0.025}_{-0.050}$	$8.71^{+0.025}_{-0.050}$
D	$5.08^{+0.025}_{-0.050}$	$5.08^{+0.025}_{-0.050}$	$7.07^{+0.025}_{-0.050}$
E	$15.9^{+1.04}_{-0.13}$	$15.9^{+1.04}_{-0.13}$	$20.6^{+1.04}_{-0.13}$
F	-	$20.06^{+1.04}_{-0.13}$	$28.6^{+1.04}_{-0.13}$
G[2], *Min*	7.94	7.94	9.52
H	5.16 to 7.54	5.16 to 7.54	6.76 to 9.12

H = distance between the base of plug and socket-outlets at position of first contact of live pins.

[1] Shall be phased out after 30 June 2005.

[2] Dimension '*G*' is the minimum distance between the pins (live and neutral) and the periphery of the plug. It is not applicable for the earth pin.

(ET 14)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 OCTOBER 2007
TO
IS 1293 : 2005 PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO AND INCLUDING 16 AMPERES — SPECIFICATION

(Third Revision)

[*Page* 5, *clause* **8.1**(h), *last line*] — Delete ',' in between 'even' and 'if'.

(*Page* 6, *clause* **8.7**, *second line of para* 2) — Substitute 'soaked' *for* 'socked'.

(*Page* 11, *clause* **12.2.5**, *seventh line of para* 5) — Substitute 'plate' *for* 'platen'.

(*Page* 12, *clause* **12.2.6**, *second line of para* 1) — Delete ',' after the word 'clamp'.

(*Page* 15, *clause* **12.3.10**, *second line of para* 4) — Delete the words 'Table 7'.

(*Page* 17, *Table* 10, *last line of the title*) — Substitute '**Normal Use of Screwless Terminals**' *for* existing line.

(*Page* 21, *clause* **13.21**, *last line of para* 1) — Add the word 'to' after 'as'.

(*Page* 22, *clause* **13.23**, *second line of para* 2 *below Table* 14) — Delete ',' after the word 'ageing'.

(*Page* 25, *clause* **14.25**, *last line*) — Delete the words 'shall apply'.

(*Page* 26, *clause* **16.2.1**, *first line of para* 10) — Delete 'operated' after 'Screws'.

(*Page* 26, *clause* **16.2.1**, *last line of para* 17) — Substitute 'water if both types are defined in the system' *for* 'water it both type are defined in the system'.

(*Page* 26, *clause* **16.3**, *third line of para* 2) — Substitute 'resistance' *for* 'insistence'.

(*Page* 30, *clause* **21**, *second line of para* 16) — Add 'disengagement' between 'from engagement of the plug until subsequent' and 'shall be'.

(*Page* 30, *clause* **21**, *first line of para* 27) — Add ',' after the words 'socket-outlets'.

(*Page* 30, *clause* **21**, *second line of para* 29) — Add the word 'not' between words 'and' & 'more'.

(*Page* 30, *clause* **22**, *third line of para* 1) — Substitute 'working' *for* 'work'.

(*Page* 34, *Table* 20, *title of col* 4) — Substitute '**Non-rewirable Portable Socket Outlets**' *for* '**Non-rewirable Portable**' and delete '**Cross-Section**' from the titles of columns 4 and 5.

(*Page* 35, *clause* **23.4**, *first line of last para*) — Insert ',' after the words 'After the test'.

(*Page* 38, *clause* **24.5**, *fourth line of para* 1) — Substitute '150 N' *for* '300 N'. This would be phased out after 30 June 2008.

(*Page* 38, *clause* **24.5**, *second line of para* 2) — Substitute '5 min' *for* '1 min'. This would be phased out after 30 June 2008.

(*Page* 39, *clause* **24.10**, *first line of para* 5) — Substitute 'P' *for* 'on' after the words 'A pull'.

(*Page* 42, *clause* **26.3**, *first line of para* 1) — Substitute 'Electrical connections' *for* 'Electrical connecting'.

(*Page* 43, *clause* **26.5**, *second line of para* 1) — Insert 'non-ferrous' in between 'shall be of a' and 'metal'.

(*Page* 43, *clause* **26.5**, *para* 3, *item* 3) — Delete '— stainless steel containing.....0.09 percent carbon'.

(*Page* 43, *clause* **26.5**, *para* 3, *item* 4) — Delete '— steel provided with.....25 µm, for jet-proof equipment'.

(*Page* 43, *clause* **26.5**, *para* 3, *item* 5) — Delete '— steel provided with an.....40 µm, for jet proof equipment'.

(*Page* 43, *clause* **26.5**, *para* 3, *item* 6) — Delete '— steel provided with.....30 µm, for jet proof equipment'.

(*Page* 43, *clause* **26.5**, *para* 4) — Delete.

(*Page* 46, *clause* **28.1.2**, *first line of Note just above clause* **28.2**) — Delete the word 'vision'.

[*Page* 47, *clause* **31.2**(e)] — Delete and renumber subsequent item.

(*Page* 57, *second line of caption below the diagram*) — Substitute 'GAUGE' *for* 'GUAGE'.

(*Page* 58, *second line below the diagram*) — Add ',' after the word 'position' and substitute 'as' *for* 'or'.

(*Page* 58, *third column of the table*) — Substitute '3.5 N' *for* '3.5' and '7.2 N' *for* '7.2'.

(*Page* 58, *captions of Fig.* 12) — Substitute 'TEST' *for* 'FORCE'.

(*Page* 63, *Fig.* 21) — Substitute '**24.4**' *for* '**24.5**' in the captions of figure.

(*Page* 72, *Title of col* 2 *of the table*) — Substitute 'Space' *for* 'Shape'.

(*Page* 74, *footnote marked* [1] *in table below Fig.* 37) — Add 'specified in' after the word 'that'.

[*Page* 78, *Annex* A, *footnote* [1] *below Table* (*see also Amendments No.* 1 *and* 2)] — Under H 1) Substitute 'Shall be phased out after 30 June 2010' *for* 'Shall be phased out after 30 June 2005'.

(*Page* 82, *Annex* **C**, *clause* **C-1**, *first para*) — Add '**C-1.1**' before the start of the text.

(*Page* 82, *Annex* C, *clause* **C-1.2**, *para* 1, *line* 2) — Substitute 'Table 24' *for* 'Table 20'.

(*Page* 82, *second and third line of Note below Table* 24) — Substitute 'consumer' *for* 'consumers' and 'lots' *for* 'losts'.

(ET 14)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 DECEMBER 2009
TO
IS 1293 : 2005 PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO AND INCLUDING 16 AMPERES — SPECIFICATION

(Third Revision)

(*Page* 27, *clause* **16.3**, *Note* 3) — Insert the following as Note 4 at the end:

'**4** For the purpose of acceptance test, the humidity treatment is subjected for 24 hours.'

(*Page* 37, *clause* **24.2**, *first para*) — Substitute the word 'plugs' *for* 'specimen'.

(*Page* 41, *clause* **25.2**, *after first para*) — Add the following after the existing matter:

'For moulded plug, resistance to heat test on inner material to be done by ball pressure test and on outer material by glow wire test till December 2009 and subsequently tests as per **25.2** and **28.1.1** will continue.'

[*Page* 47, *clause* **31.2**(b)] — Substitute the following for the existing matter:

'b) Resistance to harmful ingress of water and to humidity (*see* **16.2** and **16.3**).'

(ET 14)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 5 AUGUST 2011
TO

IS 1293 : 2005 PLUGS AND SOCKET-OUTLETS OF RATED VOLTAGE UP TO AND INCLUDING 250 VOLTS AND RATED CURRENT UP TO 16 AMPERES — SPECIFICATION

(Third Revision)

(*Page* 35, *clause* **23.4**) — Delete the following para:

'The voltage drop between each contact and the corresponding conductor, with a test current flowing having a value as prescribed for **21**, shall not exceed 10 mV.'

[*Page* 78, *table, col* 2, *Subscript 1 for (B)* (*see also Amendments No.* 1 *and* 2)] — Substitute the following for the existing: .

'Shall be phased out after 31 December 2011.'

(ET 14)

Reprography Unit, BIS, New Delhi, India