भारतीय मानक
Indian Standard

IS 1293 : 2019

घरेलू और ऐसे ही सामान्य प्रयोजनों के लिए 250 वोल्ट तक की रेटित वोल्टता वाले और 16 एम्पीयर तक की रेटित करंट वाले प्लग और सॉकेट-निकास — विशिष्टि

(चौथा पुनरीक्षण)

Plugs and Socket-Outlets for Household and Similar Purposes of Rated Voltage up to and Including 250 V and Rated Current up to and Including 16 A — Specification

(Fourth Revision)

ICS 29.120.30

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Electrical Wiring Accessories and Sectional Committee, ETD 14

FOREWORD

This Indian Standard (Fourth 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 and revised in 1967, 1988 and 2005. 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 a.c. and with and without earthing contact with a rated voltage above 50 V, but not exceeding 250 V and a rated current not exceeding 16 A 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.

The siginificant technical changes need to be added as attached herewith.

In case of two pin plugs and socket outlets, the user must ensure proper earthing practices in their wiring installation in line with IS 732 : 2019 'Code of practice for electrical wiring installations (*fourth revision*)' and IS 3043 : 1987 'Code of practice for earthing'. The use of two pin plugs are restricted only for Class II appliances.

This standard is based on IEC 60884-1 (2013) 'Plugs and socket outlet for household and similar purposes — Part 1: General requirements', issued by the International Electrotechnical Commission with the following modifications:

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

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 FOR HOUSEHOLD AND SIMILAR PURPOSES OF RATED VOLTAGE UP TO AND INCLUDING 250 V AND RATED CURRENT UP TO AND INCLUDING 16A — SPECIFICATION

(Fourth Revision)

1 SCOPE

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

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

This standard does not cover 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.

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.

This standard does not apply to,

a) plugs, socket-outlets and couplers for industrial purposes.
b) appliance couplers.
c) plugs, fixed and portable socket-outlets for extra low voltage (ELV).

NOTE — ELV values are specified in relevant ELV standard, if any.

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

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.

NOTES

1 General requirements for mounting boxes are given in IS 14772.

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

3 Plugs and socket-outlets complying with this standard should be suitable for use at ambient temperatures not normally exceeding +45 °C, but their average over a period of 24 h reaches a temperature +40 °C, with a lower limit of the ambient air temperature of –5 °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.

5 only plugs and socket outlets of dimensions as per Annex B are covered under the scope of this standard.

6 Requirements for 25 A is under consideration.

2 REFERENCES

The following standards are necessary adjuncts to this standard:

IS No.	*Title*
292 : 1983	Leaded brass ingots and castings
694 : 2010	polyvinyl chloride insulated unsheathed and sheathed cables/ cords with rigid and flexible conductor for rated voltages up to and including 450/750 V
1401 : 2008	Protection of persons and equipment by enclosures - Probes for verification
1885 (Part 74) : 2012	Electrotechnical vocabulary: Part 74 electrical and magnetic devices
2824 : 2007	Method for determining of the proof and the comparative tracking indices of solid insulating materials
3854 : 1997	Switches for household and similar fixed-electrical installations
4160 : 2005	Interlocking switch socket outlet — Specification
9000 (Part 5/Sec 1 and 2) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 5 Damp heat (cyclic) test
9000 (Part 7/Sec7) : 2006	Basic Environmental testing procedures for electronic and electrical items : Part 7 Impact Test, Test Eh: Hammer tests
9968 (Part 1) : 1988	Elastomer insulated cables: Part 1 For working voltages upto and including 1 100 V
10322 (Part 5/ Sec 7) : 2017	Luminaries: Part 5 Particular Requirements, Section 7 Lighting Chains (*first revision*)

IS No.	*Title*
11000 (Part 2/ Sec 1) : 2008	Fire hazard testing : Part 2 Test methods, Section 1 Glow-wire apparatus and common test procedure
14340 : 1996	Brass for current carrying parts in electrical wiring accessories
14763 : 2000	Conduits for electrical purposes — Outside diameters of conduits for electrical installation and threads for conduits and fittings
14772 : 2000	General requirements for enclosures for accessories for household and similar fixed electrical installations [Superseding IS 5133 (Parts 1 and 2)]
IS/IEC 60320	(All parts) Appliance couplers for household and similar general purposes
IS/IEC 60529 : 2001	Degrees of protection provided by enclosures (IP Code)
IS/IEC 61058 (Part 1) : 2000	Switches for appliances
IEC 60068 (Part 2/ Sec 31) : 2008	Environmental testing — Part 2-31: Tests — Test Ec: Rough handling shocks, primarily for equipment-type specimens

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1885 (Part 74) and the following shall apply.

NOTES

1 Where the terms 'voltage' and 'current' are used, they imply r.m.s. 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. Examples of the use of accessories are shown in Fig. 1A.

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

3.1 Plug — Accessory intended for frequent use by ordinary persons, 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).

NOTE — For special purposes such as lighting chains [*see also* IS 10332 (Part 5/ Section 7)], two or three single-core cables can be connected within the plug.

3.2 Socket-Outlet — Accessory intended for frequent use by ordinary persons having socket- contacts designed to engage with the pins of a plug and having terminals or terminations for the connection of cable.

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 one flexible cable, and which can easily be moved from one place to another while connected to the supply.

3.5 Multiple Socket-Outlet — Combination of two or more socket-outlets. Example of portable multiple socket-outlet is shown in Fig. 1B).

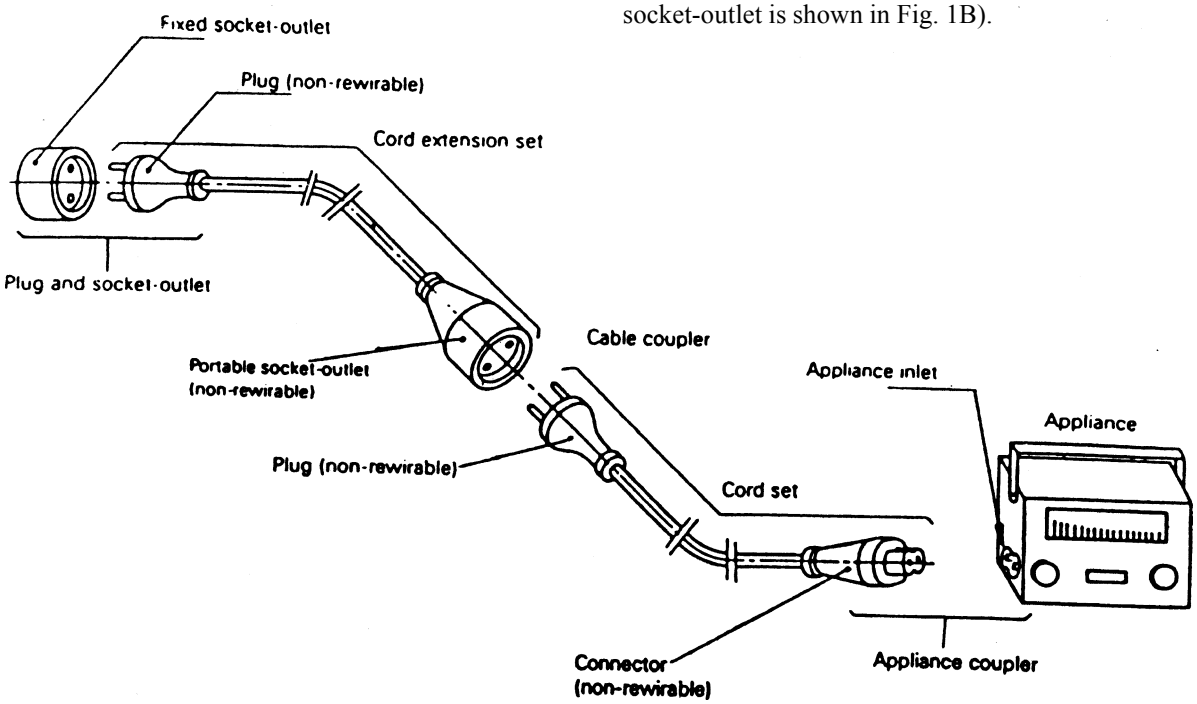


FIG. 1A DIAGRAM SHOWING VARIOUS ACCESSORIES AND THEIR USE

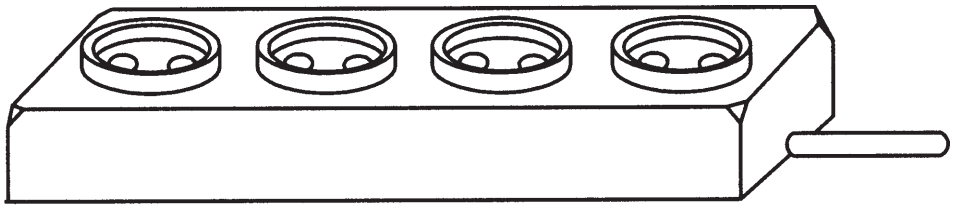


Fig. 1B Multiple Portable Socket Outlets (Table Type)

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-outlets — Accessory so constructed that the flexible cable can be replaced.

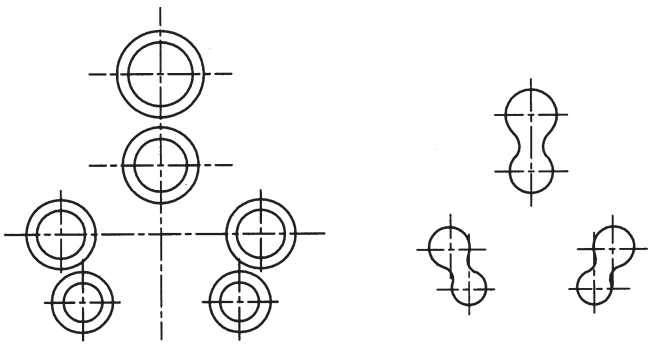
3.9 Non-rewirable Plug or Non-rewirable Portable Socket-Outlet — Accessory so constructed that it forms a complete unit with the flexible cable after connection and assembly by the manufacturer of the accessory (*see* **14.1**).

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

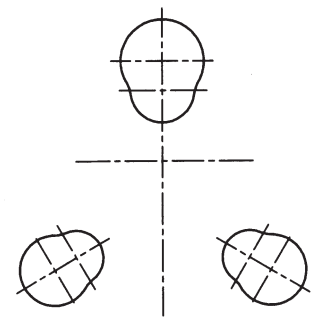
3.11 Mounting Box — Box intended for mounting in or on a wall, floor or ceiling, etc, for flush or surface application, intended for use with a fixed socket-outlet(s).

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

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



1A 1B



1C

FIG. 1 COMBINED SOCKET-OUTLETS

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'n being made, directly or indirectly, by means of screws or nuts of any kind.

3.17.1 *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. 2).

3.17.2 *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. 2).

3.17.3 *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. 3).

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. 4).

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. 5).

3.18 Screw Less Terminal — Connecting device for the connection and subsequent disconnection of a rigid (solid or stranded) or flexible 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, which will be that specified in the standard sheet, if any.

3.20 Rated Current — Current assigned to the plug or socket-outlet by the manufacturer, which will be that specified in the standard sheet, if any.

3.21 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 air uninterrupted thread, which by screwing in, forms a thread by displacing material (Example of a thread-forming screw is shown in Fig. 6).

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. 7).

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.

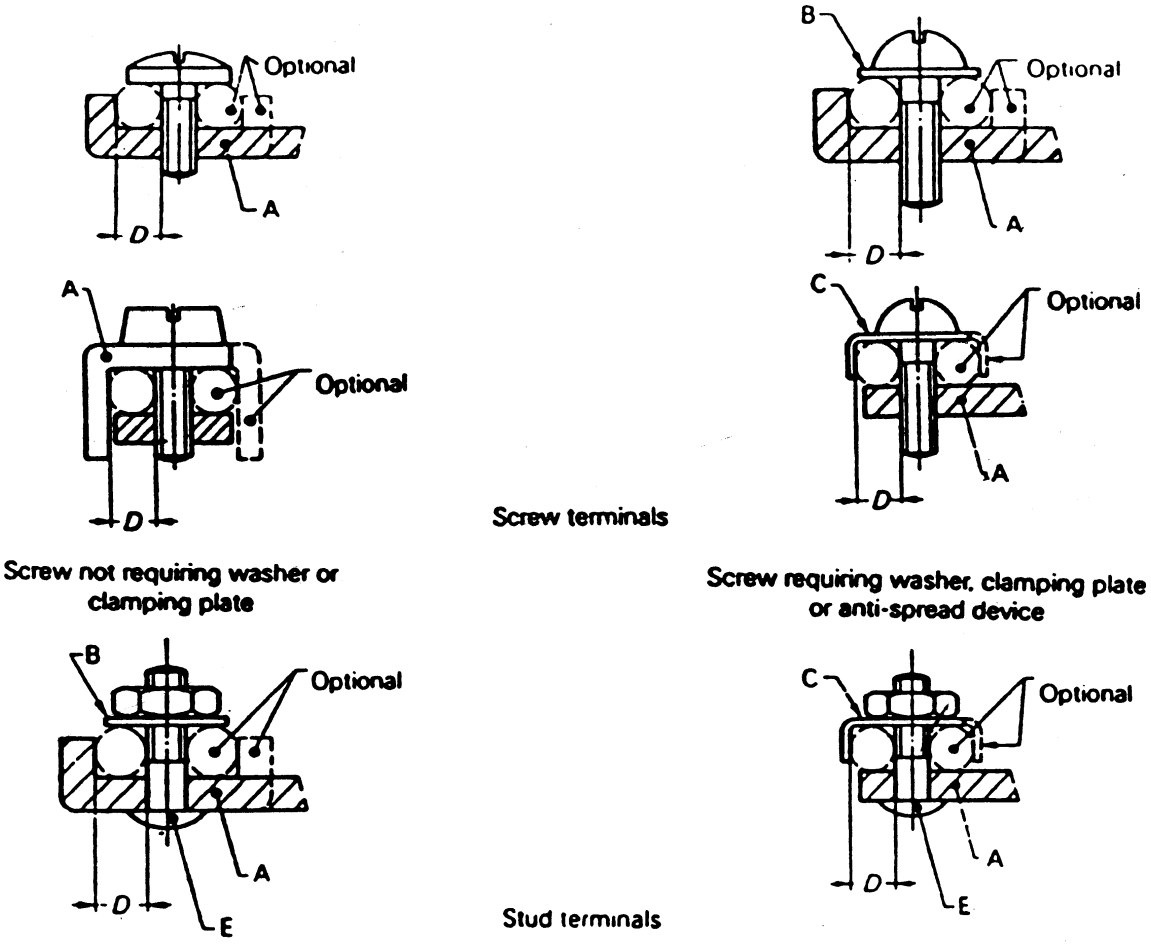
3.25 Acceptance Test — Test carried out on samples taken from a lot for the purpose of acceptance of the lot.

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) System — Nominal voltage not exceeding 32 V between conductors and between conductors and earth or, for



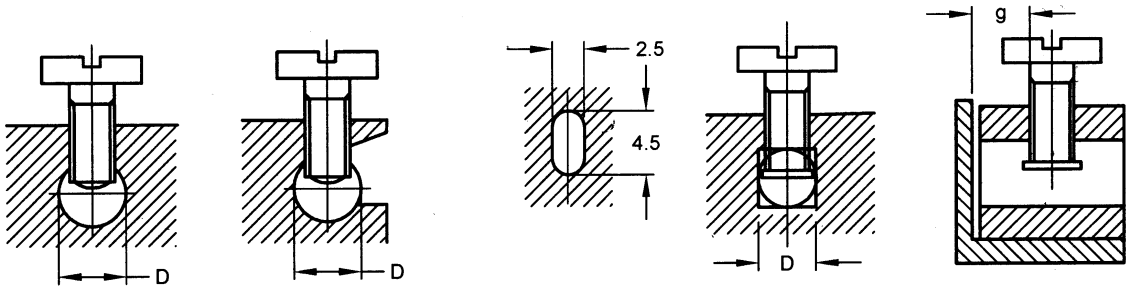
Cross- Section of Conductor Accepted by the Terminal mm^2	*Minimum Diameter of Conductor Space* mm	*Torque*[1)]	
		One Screw or Stud	Two Screws or Studs
(1)	(2)	(3)	(4)
Up to 1.5	1.7	0.5	–
Up to 2.5	2.0	0.8	–
Up to 4	2.7	1.2	0.5
Up to 6	3.6	2.0	1.2
Up to 10	4.3	2.0	1.2

[1)] The values specified apply to the screws covered by the corresponding columns in Table 1.

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 mm^2 may be used for the connection of the second conductor when it is required to connect two 2.5 mm^2 conductor.

FIG. 2 SCREW TERMINALS AND STUD TERMINALS



Cross-section of Conductor Accepted by the Terminal mm^2	*Minimum Diameter D (or Minimum Dimension) of Conductor Space* mm	*Minimum Distance g Between Clamping Screw and End of Conductor when Fully Inserted* mm		*Torque* Nm					
				1[1)]		2[1)]		3[1)]	
		One screw	Two screws	One screw	Two screws	One screw	Two screws	One screw	Two screws
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Up to 1.5	2.5	1.5	1.5	0.2	0.2	0.4	0.4	0.4	0.4
2.5 (circular hole)	3.0	1.5	1.5	0.25	0.2	0.5	0.4	0.5	0.4
2.5 (elongated hole)	2.5 x 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 screws covered by the corresponding columns in Table 1.

The part of the terminal containing the threaded hole and the part of the terminal against which tire 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 mm^2 can be inscribed.

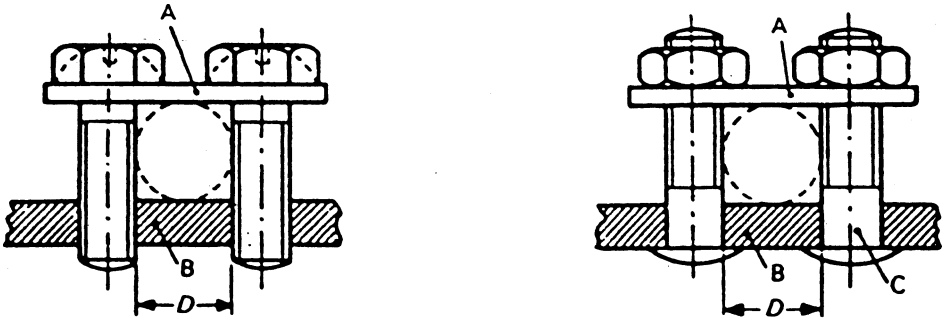
FIG. 3 PILLAR TERMINALS

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.

3.31 Base — Part of the socket-outlet supporting the socket- contacts.

3.32 Live Part — Conductor or conductive part intended to be energized in normal use, including a neutral conductor, but, by convention, not a PEN conductor.



Key
A = Saddle
B = Fixed part
C = Stud
D = Conductor space

Cross-section of Conductor Accepted by the Terminal mm^2	Minimum Diameter *D* of Conductor Space mm	Torque Nm
Up to 4	3.0	0.5
Up to 6	4.0	0.8
Up to 10	4.5	1.2

Cross-Section of Conductor Accepted by the Terminal mm^2	*Minimum Diameter D of Conductor Space* [1] mm	*Minimum Distance g Between Fixed Part and End of Conductor When Fully Inserted* mm
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 bottom of the conductor space must be slightly rounded in order to obtain a reliable connection.

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. 4 SADDLE TERMINALS

3.33 Cable Anchorage — That part of an accessory which has the ability to limit the displacement of a fitted flexible cable against pull, push and turning forces.

3.34 Main Part — Assembly consisting of the base and other parts. This assembly is not intended to be dismantled at any time after manufacture.

3.35 Grommet — Component used to support and protect the cable or conduit at the point of entry.

NOTES

1 It may also prevent the ingress of moisture or contaminants.

2 Examples of membranes and grommets are shown in Annex A.

3.36 Entry Membrane — Component or integral part of the accessory used to protect the cable which may be used to support the cable or conduit at the point of entry.

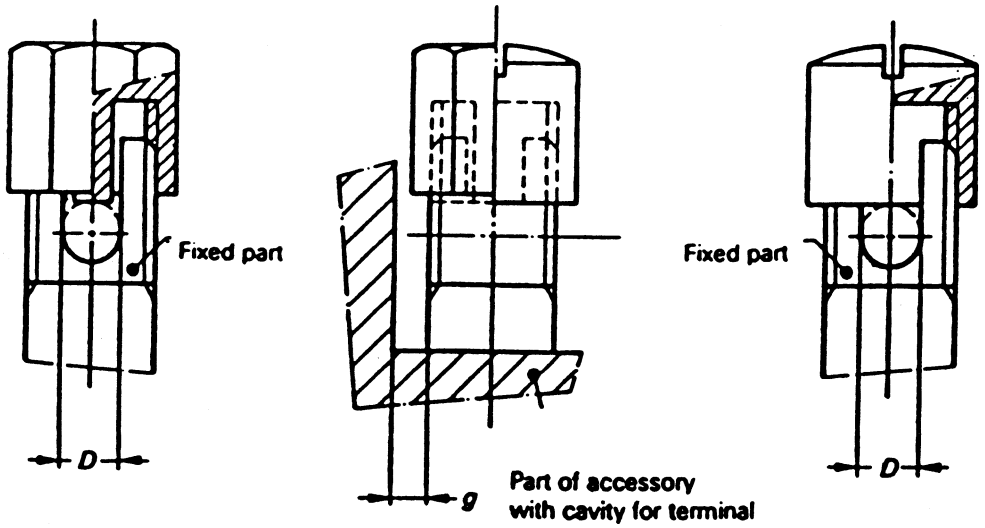
NOTES

1 An entry membrane may also prevent the ingress of moisture or contaminants and may be part of a grommet.

2 Examples of membranes and grommets are shown in Annex A.

3.37 Protecting Membrane — Component or integral part of the accessory that is not intended to be penetrated in normal use and is intended to provide protection against ingress of water or solid objects and/or to allow the operation of an accessory.

NOTE — Examples of membranes and grommets are shown in Annex A.



NOTE — The value of the torque to be applied is that specified in col 4 or col 5 of Table 1 as appropriate.

FIG. 5 MANTLE TERMINALS

4 GENERAL REQUIREMENT

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 and surroundings.

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

5 GENERAL NOTES ON TESTS

5.1 Tests according to this standard are type tests.

5.1.1 Schedule of routine, acceptance and type tests are given in **31**. Clauses **5.2** to **5.5** are applicable to type tests.

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

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

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

Table 1 Tightening Torques for the Verification of the Mechanical Strength of Screw-Type Terminals
(*Clauses* 5.2, 12.2.5, 12.2.6, 12.2.7, 12.2.8 *and* 24.1)

Sl No.	Nominal Diameter of Thread mm	Torque Nm		
(1)	(2)	(3)	(4)	(5)
i)	Up to and including 2.8	0.2	0.4	—
ii)	Over 2.8 up to and including 3.0	0.25	0.5	—
iii)	Over 3.0 up to and including 3.2	0.3	0.6	—
iv)	Over 3.2 up to and including 3.6	0.4	0.8	—
v)	Over 3.6 up to and including 4.1	0.7	1.2	1.2
vi)	Over 4.1 up to and including 4.7	0.8	1.8	1.2
vii)	Over 4.7 up to and including 5.3	0.8	2.0	1.4

NOTES

1 Column 3 applies to screws without a head if the screw, when tightened, does not protrude from the hole and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

2 Column 4 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.

3 Column 5 applies to nuts of mantle terminals which are tightened by means of a screwdriver.

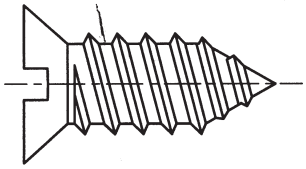


FIG. 6 EXAMPLE OF THREAD-FORMING SCREW

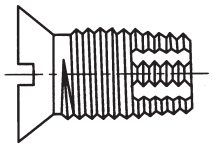


FIG. 7 EXAMPLE OF THREAD-CUTTING SCREW

Socket-outlet which does not comply with any accepted standard sheet 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.

The fixing screws of terminals, covers and cover plates shall be tightened with a torque equal to two-thirds of the values specified in Table 1 unless otherwise specified.

5.3 Unless otherwise specified the tests are carried out in the order of the clauses, at an ambient temperature between l5°C and 40°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 test (For the test of **10.6**, three additional specimens are required).

For the tests of **12.3.11**, additional samples of socket-outlets having in total at least 5 screwless terminals are required.

For the test of **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 **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 test of **23.2** and **23.4**.

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

For the test of **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 have a rated voltage not exceeding 250 V. The preferred combination of types and current ratings is as shown in Tabl 2.

Table 2 Preferred Combination of Types and Ratings
(*Clause* 6.1)

Sl No.	Type	Rated Current A
(1)	(2)	(3)
i)	2P (non-rewirable plugs only)	2.5
ii)	2P	6
iii)	2P + ⏚	16

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.

7 CLASSIFICATIONS

7.1 Accessories Classification

7.1.1 Accessories are classified according to the degree of protection against access to hazardous parts and against harmful effects due to the ingress of solid foreign object as described in IS/IEC 60529.

7.1.2 Accessories are classified according to the degree of protection against harmful effects due to the ingress of water as described in IS/IEC 60529.

7.1.3 Classification according to the provision for earthing,

a) accessories without earthing contact; and
b) accessories with earthing contact.

7.1.4 Classification according to the method of connecting the cable,

a) rewirable accessories; and
b) non-rewirable accessories.

7.1.5 Classification 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 Classification

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

a) Socket-outlet with normal protection (*see* **10.1**); and
b) Socket-outlet with increased protection (*see* **10.7**).

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

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

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

a) surface-type;
b) flush-type;
c) semi-flush type;
d) panel-type;
e) architrave-type;
f) portable-type;
g) table-type (single or multiple);
h) floor recessed type; and
j) appliances type.

7.2.3 Classification according to the existence of shutters,

a) without shutters; and
b) with shutters (*see* **10.5**).

7.2.4 Classification according to the intended use are,

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

7.3 Plug Classification

Plugs are classified according to the following 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 the following:

a) Rated current, in A.
b) Rated voltage, in V.
c) Nature of supply as a.c. (Alternate current).
d) Manufacture or responsible vendor's name, trade-mark or identification mark.
e) Type reference which may be a catalogue number.
   NOTE — The type reference may be the series reference only.
f) Country of manufacture.
g) First characteristic numeral for the degree of protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects, if declared to be higher than 2, and for fixed socket-outlets higher than 4 in which case the second characteristic numeral shall also be marked.
h) Second characteristic numeral for the degree of protection against harmful effects due to ingress of water, if declared to be higher than 0, and for fixed socket-outlets higher than 2 in which case the first characteristic numeral shall also be marked.

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/IEC 60529.

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

1) An appropriate marking indicating the length of insulation to be removed before the insertion of the conductor into the screw less terminal; and
2) 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……..…… ac/~

Neutral……......……..N

Protective earth…….…… 

Degree of protection, when relevant ……...IPXX

Degree of protection for fixed accessories to be installed on rough surfaces ……..... 

Terminal for line (live)……...……...L

For screw less terminals: suitability to accept rigid conductors only ……r

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.

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 ac/~ or 16/250 V ac/~ **or** 16/250 ac/~

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

a) Rated current, rated voltage and nature of supply;

b) 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.

c) Length of insulation to be removed before the insertion of the conductor into the screwless terminal;

d) An indication of the suitability to accept rigid conductors only for screwless terminals for those socket-outlets having this restriction;

e) The type reference, which may be a catalogue number

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.

Fixed socket-outlets classified according **7.2.4** (b) shall be identified by a triangle which shall be visible after installation unless they have an interface configuration which is different from that used in normal circuits.

NOTES

1 The type reference may be the series references only.

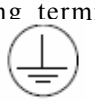
2 Additional type references may be marked on the main part, or on the outside or inside of the associated enclosure.

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

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

NOTE — The type reference of rewirable 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. 

These 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,

a) their marking with graphical symbols,

b) alpha-numeric system, or

c) 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 For surface type mounting boxes, the marking may be made on boxes forming an integral part of the socket-outlet, having an IP code higher than IP4X, or higher than IPX2, the IP code shall be marked on the outside of its associated enclosure so as to be easily discernible when the socket-outlet is mounted and wired as in normal use compliance is checked by inspection.

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

Compliance is checked by inspection.

8.8 Marking shall be durable and easily legible.

Compliance is checked by inspection and by the following test:

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

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 0.68g/cm^3.

8.9 BIS Certification Marking

The accessories may also be marked with the Standard Mark.

8.9.1 The use of the Standard Mark is governed by the provision of *Bureau of Indian Standards Act,* 2016 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 The dimensions of plugs and socket-outlets are given in Annex B. Accessories and surface-type mounting boxes shall comply with the appropriate standard sheet and corresponding gauges (*see* Annex C) for plug and socket-outlets systems.

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

Compliance is checked by measurement and/or by means of gauges. The manufacturing tolerances of these gauges shall be as shown in Table 3, if not otherwise, specified. The most unfavorable dimensions shall be used for the design of the gauges.

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 B having the maximum dimensions for the pins following which dimensions are checked by measurement and/or by means of gauges.

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

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 or of Class I with a socket-outlet exclusively designed

Table 3 Gauge Tolerances
(*Clause* 9.1)

Sl No.	Gauge for Checking	Gauge Tolerance mm
(1)	(2)	(3)
i)	Pin diameter or pin thickness	$^{0}_{-0.01}$
ii)	Dimensions 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	$^{0}_{-0.02}$ or $^{+0.02}_{0}$
v)	Distance from the engagement face to pint of first electrical contact (for socket-outlet)	$^{0}_{-0.05}$ or $^{+0.05}_{0}$
vi)	Guiding elements	± 0.03

to accept plugs for Class II equipment.

Compliance is checked by inspection or by manual test using gauges, the manufacturing tolerances of which shall be as specified in Table 3.

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

Where the use of elastomeric or thermoplastic material is likely to influence the result of the test, it is carried out at an ambient temperature of 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.

10 PROTECTION AGAINST ELECTRIC SHOCK

10.1 Fixed socket-outlets, plugs when engaged and portable socket-outlets 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 nominal cross-sectional are and the test is then repeated using conductors of the largest nominal cross-sectional areas as specified in Table 4.

For socket-outlets, the test probe b of IS 1401 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.

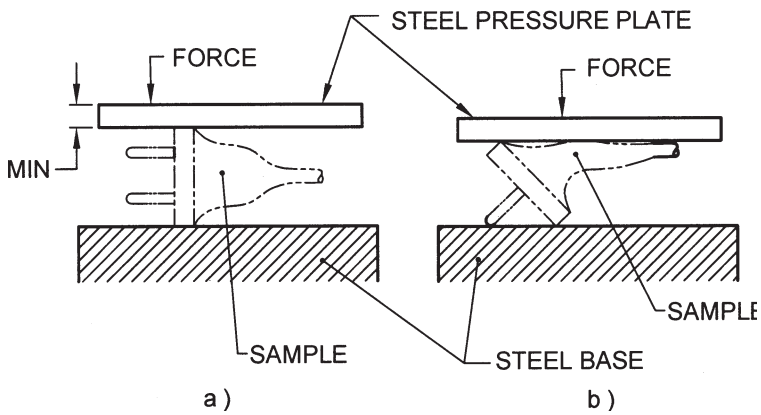
For accessories where the use of elastomeric or thermoplastic material is likely to influence the requirement, the test is repeated but at an ambient temperature of 40 ± 2°C, the accessories being at this temperature.

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, test probe 11 of IS 1401 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 membranes 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 B 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. 8. 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 B 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 main parts and covers or cover plates of socket-outlets, shall be made of insulating material; however the covers or cover-plate of fixed socket-



All dimensions in millimetres.

FIG. 8 ARRANGEMENT FOR COMPRESSION TEST

Table 4 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)

Sl No.	Current and Type of Accessory	Rigid (Solid or Stranded) Copper Conductors[1]		Flexible Copper Conductors	
		Nominal Cross-Sectional Area mm^2	Diameter of the Largest Conductor Mm	Nominal Cross-Sectional Area mm^2	Diameter of the Largest Conductor Mm
(1)	(2)	(3)	(4)	(5)	(6)
i)	2.5A/6A	—	—	From 0.75 up to 1.5 inclusive	1.73
ii)	2.5A/6A 2P and 2P+ (fixed accessory)	From 1 up to 2.5 Inclusive[2]	2.13	From 1 up to 2.5 Inclusive[2]	2.21
iii)	2.5A/6A 2P and 2P+ (portable accessory)	—	—	From 0.75 up to 1.5 inclusive	1.73
iv)	16A 2P+ (fixed accessory)	From 1.5 up to 2×2.5 Inclusive	2.13	—	—
v)	16A 2P+ (portable accessory)	—	—	From 0.75 up to 1.5 inclusive	1.73

[1] The terminal shall allow the connection of two 1.5 mm^2 conductors which have a diameter of 1.45 mm.
[2] The use of flexible conductors is permitted.

outlets and accessible parts of portable socket-outlets may be made of metal if the requirements given in **10.2.1** or **10.2.2** are fulfilled.

10.2.1 Accessible metal parts 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 accessible metal covers or cover-plates, for example, through their fixing screws, even if a conductor should come away from its terminal, and if precautions are taken in order to prevent creepage distances or clearances becoming less than the values specified in Table 5.

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

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 Accessible metal covers or cover-plates are reliably 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 b) and g) of Table 5 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

Table 5 Creepage Distance, Clearances and Distances through Insulating Sealing Compound
(*Clauses* 10.2.1, 12.3.8, 13.7.2 *and* 27.1)

Sl No.	Description	mm
i)	Creepage distance:	
	a) Between live parts of different polarity	4[1)]
	b) Between live parts and	3
	1) accessible surface of parts of insulating material	3
	2) earthed metal parts including parts of earthing circuit	3
	3) metal frames supporting the main part of flush-type socket-outlets	3
	4) screws or devices for fixing main parts, covers or cover-plates of fixed socket- outlets	3
	5) external assembly screws, other than screws which are on the engagement face of plugs and are isolated from the earthing circuit	6[4)] 6[4)]
	c) 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[2)] made according to the most unfavorable construction[3)]	6[4)]
	d) Between the accessible unearthed metal parts[2)] 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 unfavorable construction[3)]	
	e) Between live parts of a socket-outlet (without a plug) or of a plug and their accessible unearthed or functional earthed metal parts[2)]	
ii)	Clearance:	
	f) between live parts of different polarity[6)]	3
	g) between live parts and	3
	1) accessible surface of parts of insulating material	3
	2) earthed metal parts not mentioned under h) and j) including parts of earthing circuit,	3
	3) metal frames supporting the main part of flush-type socket-outlets	3
	4) screws or devices for fixing main parts, covers or cover-plates of fixed socket-outlets	3
	5) external assembly screws, other than screws which are on the engagement face of plugs and are isolated from the earthing circuit	3 4.5
	h) between live parts and	6
	1) exclusively earthed metal boxes[5)] with the socket-outlet in the most unfavorable position	6
	2) unearthed metal boxes, without insulating lining with the socket-outlet in the most unfavorable position	3
	3) accessible unearthed or functional earthed metal parts[2)] of socket-outlets and plugs	
	j) between livXe parts and the surfaces on which the main part of a socket-outlet for surface mounting is mounted	
	k) between live parts and the bottom of any conductor recess, if any, in the main part of a socket-outlet for surface mounting	
iii)	Distance through insulating sealing compound:	
	m) between live parts covered with at least 2 mm of sealing compound and the surface on which the main part of a socket-outlet for surface mounting is mounted	4[1)] 2.5
	n) between live parts covered with at least 2 mm of sealing compound and the bottom of any conductor recess, if any, in the main part of a socket-outlet for surface mounting	

[1)] This value is reduced to 3 mm for accessories having a rated voltage up to and including 250 V.
[2)] With exception of screws and the like.
[3)] The most unfavorable construction may be checked by means of a gauge which is as per Annex B to the system concerned
[4)] This value is reduced to 4.5 mm for accessories having a rated voltage up to and including 250 V.
[5)] Exclusively earthed metal boxes are those suitable only for use in installations where earthing of metal boxes is required.
[6)] Clearances between live parts of different polarity are reduced to 1 mm between the lead wires in the pinch of a neon lamp or LED or similar lighting sources with external resistor.

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 in Annex B whose dimensions are the less favorable for this kind of test; the tolerances of the gauges shall be as 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.

Compliance will be checked as per the gauge mentioned in Annex C.

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

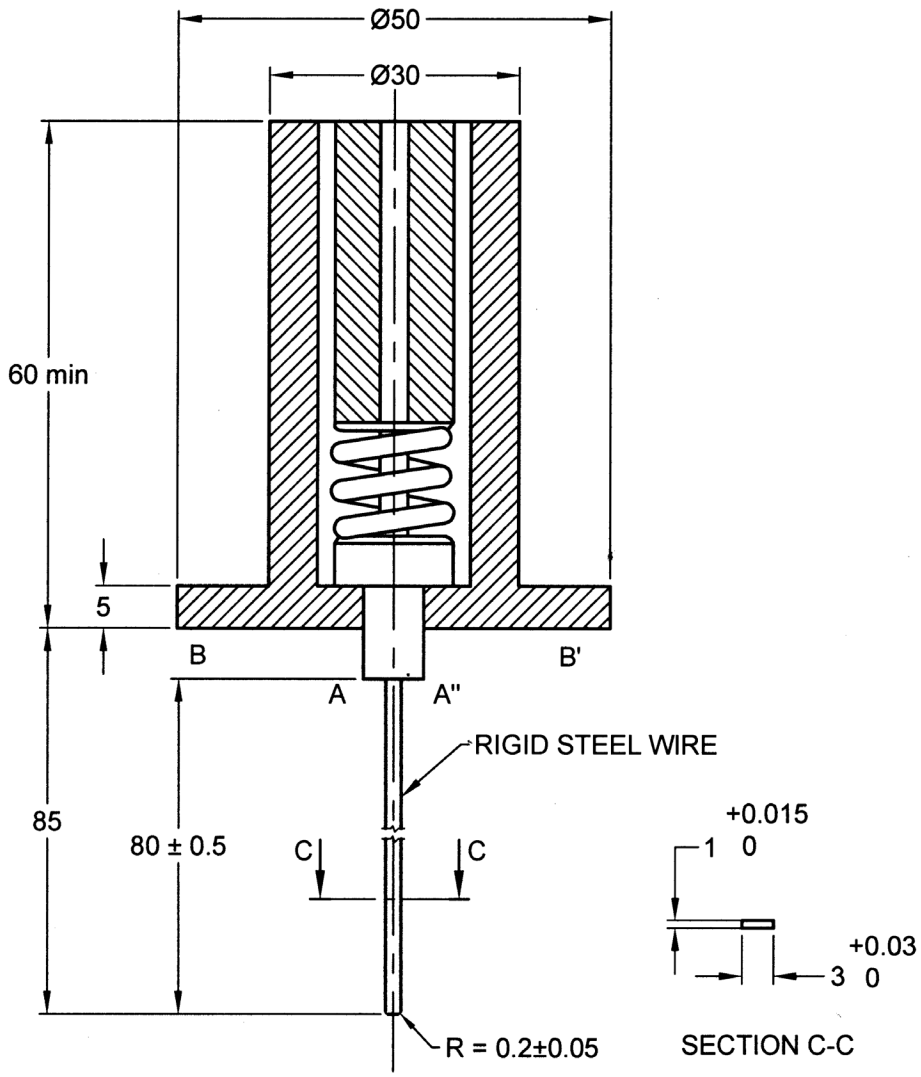
a) Sufficiently large cover or cover-plate; and
b) Other means (for example, shutters).

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, and accessible metal parts fulfilling the requirements of **10.2.1** or **10.2.2** shall be of insulating material.

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

Compliance is checked by the test of **10.2.1** or **10.2.2**.

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



All dimension in millimetres.

NOTE — 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. 9 GAUGE FOR CHECKING NON-ACCESSIBILITY OF LIVE PARTS, THROUGH SHUTTERS

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

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

Shutters shall be so designed that a plug is inserted with the same movement in a socket-outlet with shutters as in a socket-outlet without shutters.

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

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

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

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

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

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

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

For socket-outlets with enclosures or bodies of thermoplastic material, the test is made at an ambient temperature of 35 ± 2 °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:

a) Socket-outlet is placed in such a position that the socket-contacts are in the vertical position.
b) 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.
c) After this test, the socket-outlet shall still comply with the requirement of **9**.

10.7 Socket-outlets with or without lid, classified [according to **7.2.1** (b)] shall be so constructed that, when mounted and wired as in normal use, live parts shall not be accessible with a test wire of 1mm in diameter (*see* Fig. 10)

Compliance is checked by inspection and by applying with the gauge of Fig. 10, a force of 1N on all accessible surfaces in the most unfavorable conditions without a plug inserted. With the lid, if any, open.

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 PROVISIONS 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.**

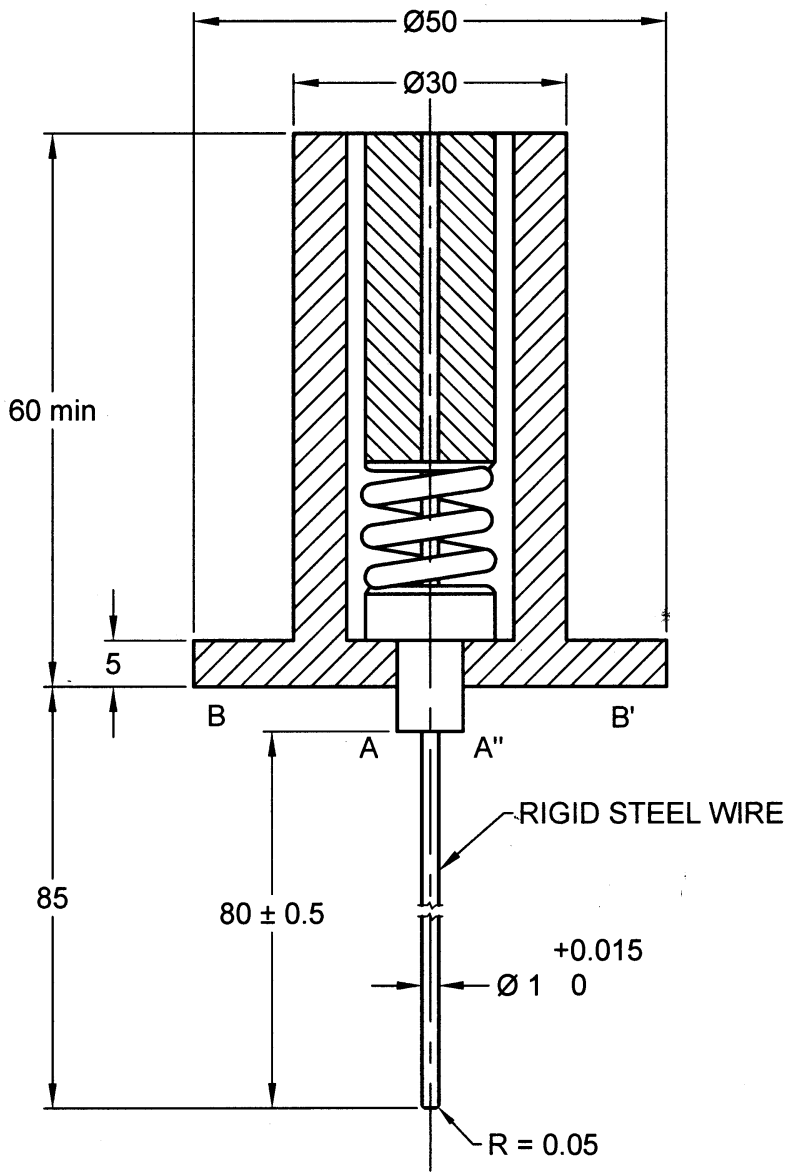
They shall be of the same size as the corresponding terminals for the supply conductors.

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

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.



All dimensions in millimetres.

NOTE — 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. 10 GAUGE FOR CHECKING NON-ACCESSIBILITY OF LIVE PARTS, THROUGH SHUTTERS AND OF LIVE PARTS OF SOCKET-OUTLETS WITH INCREASED PROTECTION

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.

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

11.3 Accessible metal parts of fixed socket-outlets with earthing contact, which may become live in the event

of an insulation fault, shall be permanently and reliably connected to the earthing terminal.

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 main parts, 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 having IP code higher than IP X0 with an enclosure of insulating material, having more than one cable inlet, shall be provided with an internal fixed earthing terminal or adequate space for a floating terminal allowing the connection of an incoming and outgoing conductor for the continuity of the earthing circuit, unless the earthing terminal of the socket-outlet itself is so designed that it allows the connection of an incoming and an outgoing earthing conductor.

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

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

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

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

Compliance is checked by the following test:

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

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.

11.6 Fixed socket-outlets [*see* **7.2.4** (b)], for use on circuits where electrical noise immunity is desired for connected equipment, shall have the earthings socket contact and its terminal electrically separated from any metal mounting means or other exposed conductive parts which may be connected to the protective earthing circuit of the installation.

Compliance is checked by inspection.

12 TERMINALS

All the tests on terminals, with the exception of the test of **12.3.11**, **12.3.12** 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 4.

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

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

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

Compliance is checked by inspection.

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

12.2.3 Terminals with screw clamping shall have adequate mechanical strength.

Screws and nuts for clamping the conductors shall have 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 aluminum.

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. 11 and fitted with rigid (solid or stranded) and/or flexible conductor(s), according to Table 4, first with the smallest and then with the largest nominal cross-sectional area, the clamping screws or nuts being tightened with the torque according to Table 1.

The length of the test conductor shall be 75 mm longer than the height (*H*) specified in Table 6.

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 6. 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 plate 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 6. The bushing may be lubricated to prevent binding, twisting, or rotation of the insulated conductor.

A mass as specified in Table 6 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 they exist, 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 nominal 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 1.

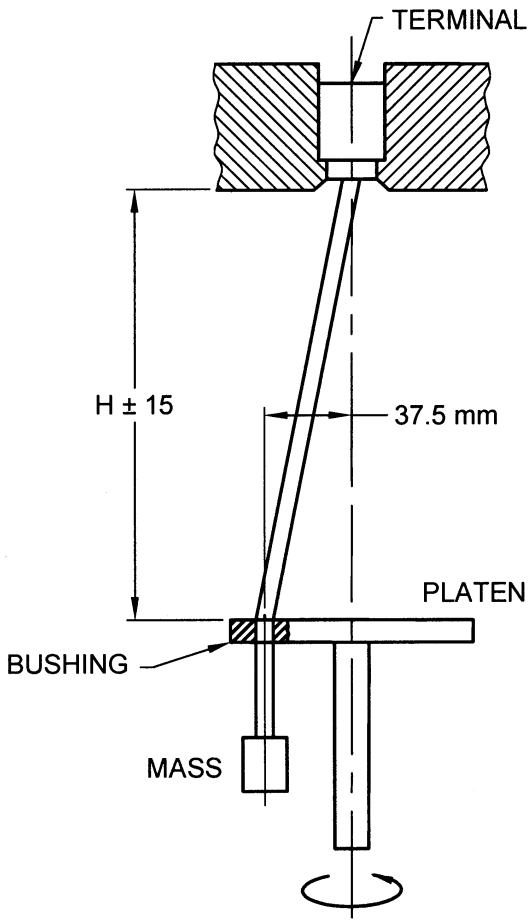
If the screw has hexagonal head with a slot, the torque applied is equal to two-thirds of the torque shown in col 5 of Table 1.

Each conductor is then subjected to a pull as specified

Table 6 Values for Flexing Under Mechanical Level Test for Copper Conductors
(*Clauses* 12.2.5, 12.3.10 *and* 12.3.11)

Sl No.	Nominal Cross-sectional Area of Conductor mm^2	Diameter of Bushing Hole[1)] mm	Height *H* mm	Mass for Conductor kg
(1)	(2)	(3)	(4)	(5)
i)	0.5	6.5	260	0.3
ii)	0.75	6.5	260	0.4
iii)	1.0	6.5	260	0.4
iv)	1.5	6.5	260	0.4
v)	2.5	9.5	280	0.7
vi)	4.0	9.5	280	0.9
vii)	6.0	9.5	280	1.4
viii)	10.0	9.5	280	2.0

[1)] If the bushing-hole diameter is not large enough to accommodate the conductor without bindings bushing having the next larger hole size may be used.



NOTE — Care should 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.

FIG. 11 ARRANGEMENT FOR CHECKING DAMAGE TO CONDUCTORS

in Table 7 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.

Table 7 Values for Pull Test for Screw-type Terminals
(*Clause* 12.2.6)

Sl No.	Nominal Cross-sectional Area of Conductors Accepted by the Terminal mm^2	Pull N
(1)	(2)	(3)
i)	Above 0.75 up to inclusive	40
ii)	Above 1.5 up to 2.5 inclusive	50
iii)	Above 2.5 up to 4 inclusive	50
iv)	Above 4 up to 6 inclusive	60
v)	Above 6 up to 10 inclusive	80

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

Compliance is checked by the following test:

The terminals are fitted with conductors having the largest nominal cross-sectional area specified in Table 4.

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

The terminals of plugs rand 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 8.

Before insertion into the clamping means of the terminal, wires of rigid (solid or stranded) conductors are

Table 8 Composition of Conductors
(*Clause* 12.2.7)

Sl No.	Nominal Cross-Sectional Area mm^2	Number of Wires (n) and Nominal Diameter of Conductors $n \times$ mm		
		Flexible Conductor	Rigid Solid Conductor	Rigid Stranded Conductor
(1)	(2)	(3)	(4)	(5)
i)	0.75	24 × 0.20	—	—
ii)	1.0	32 × 0.20	1 × 1.13	7 × 0.65[1)]
iii)	1.5	30 × 0.25	1 × 1.38	7 × 0.80[1)]
iv)	2.5	50 × 0.25	1 × 1.78	7 × 1.03[1)]
v)	4.0	56 × 0.30	1 × 2.25	7 × 0.86
vi)	6.0	84 × 0.30	1 × 2.76	7 × 1.05
vii)	10.0	—	1 × 3.57	7 × 1.35

[1)] Nominal diameter values are provisional.

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, or 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 1.

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.

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

a) the sealing compound or resin is not subject to stress during normal use; and

b) the effectiveness of the sealing compound or resin is not impaired by temperatures attained by the terminal under the most unfavorable 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 nominal cross-sectional area specified in Table 3 is placed in the terminal.

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

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

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

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 1 or in the table of the appropriate Fig 2, Fig. 3 and Fig. 4, whichever is the greater.

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

Where a screw has a hexagonal head with a slot, only the test with the screw driver is made with the torque values given in col 5 of Table 1.

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. 2 to Fig. 5 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 aluminum alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminum or its alloys.

Compliance is checked by manual 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. 3.

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. 5.

Compliance is checked by measurement, after a solid conductor of the largest nominal cross-sectional area specified in Table 4, has been fully inserted and fully clamped.

12.3 Screwless Terminals for External Copper Conductors

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

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

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

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

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

c) 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 9.

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

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

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

Compliance is checked by inspection.

NOTE — The term 'special preparation' covers soldering of the wires of the conductor, use of terminal ends etc, but not the reshaping of the conductor before 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.

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

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

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

The intended disconnection of a conductor shall require an operation, other than a pull on the conductor, so

Table 9 Relationship Between Rated Current and Connectable Cross-Sectional Areas of Copper Conductors for Screw less Terminals
(*Clauses* 12.3.2 *and* 12.3.10)

Sl No.	Rated Current	Conductors		
	A	Nominal Cross-Sectional Areas mm^2	Diameter of Largest Rigid Conductors mm	Diameter of Largest Flexible Conductors mm
(1)	(2)	(3)	(4)	(5)
i)	From 6 up to 16 inclusive	From 1.5 up to 2.5 inclusive	2.13	2.21

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

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

12.3.8 Screwless terminals of fixed socket-outlets shall be designed so that adequate insertion of the conductor is obvious and over insertion is prevented, if further insertion is liable to reduce the creepage distances and/ or clearances required in Table 5, or to influence the function of the socket-outlets.

Compliance is checked by inspection only.

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 sample for each test.

The test is carried out with solid copper conductor, first with conductors having the largest nominal cross-sectional area, and then with conductors having the smallest nominal cross-sectional area specified in Table 9.

Conductors are connected and disconnected five times, new conductors being used each time, except for the fifth time, when the conductors used for the fourth 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 10. The pull is applied without jerks, for 1 min in the direction of the longitudinal axis of the conductor space.

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

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

Screwless terminals intended for both rigid and flexible conductors shall also be tested with flexible conductors, 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. 11. The conductor is subjected to a pull having a value shown in Table 6.

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.

Table 10 Value for Pull Test for Screwless-Type Terminals
(*Clause* 12.3.10)

Sl No.	Rated Current A	Pull N
(1)	(2)	(3)
i)	From 6 up to 16 inclusive	30

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 11, and connecting rigid solid conductors 1 m long having the cross-sectional area as specified in Table 11.

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 15mV.

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 behavior 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.

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 11 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,

1) the current is flowing for approximately 30 min; and
2) 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) and is done at the following moments,

1) after the first 24 temperature cycles and after the 192nd temperature cycle; and
2) Additional measurements shall be carried out after any 3 of the following temperature cycles: after the 48th, 72nd, 96th, 120th, 144th or 168th temperature cycles.

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.

Table 11 Test Current for the Verification of Electrical and Thermal Stresses in Normal Use of Screwless Terminals
(*Clause* 12.3.11)

Sl No.	Rated Current A	Test Current A	Nominal Cross-Sectional Area of the Conductor mm^2
(1)	(2)	(3)	(4)
i)	6	10.5	1.5
ii)	16	22	2.5

NOTE — For socket-outlet having a rated current lower than 6A. The test current is proportionally determined and the cross-sectional area of the conductors is chosen equal to 1.5 mm^2.

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. 12 A, shall be so constructed that,

a) a specified conductor properly inserted into a terminal is allowed to be deflected in any of the 12 directions differing from each other by 30° with a tolerance referred to each direction by ±5°; and

b) 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,

1) the force is applied .in the direction perpendicular to the undeflected conductor;

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

3) 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. 12 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 insert 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.

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

A clamping unit is fitted as for normal use with a rigid solid copper conductor having the smallest nominal cross- sectional area specified in Table 12 and is submitted to a first test sequence; the same clamping unit is submitted to a second test sequence using the conductor having the largest nominal cross-sectional area, unless the first test sequence has failed.

The force for deflecting the conductor is specified in Table 13, 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.

Table 12 Nominal Cross-Sectional Areas of Rigid Copper Conductors for Deflection Test of Screwless Terminals
(*Clause* 12.3.12)

Sl No.	Rated Current of the Socket-outlet A	Nominal Cross-Sectional Area of the Conductor mm^2	
		First Test Sequence	Second Test Sequence
(1)	(2)	(3)	(4)
i)	Up to and including 6	1.0	1.5
ii)	Above 6 up to including 16	1.5	2.5

Table 13 Deflection Test Forces for Screwless Terminals
(*Clause* 12.3.12)

Sl No.	Nominal Cross-sectional Area of the Conductor mm^2	Force for Deflecting the Test Conductor[1)] N
(1)	(2)	(3)
i)	1.0	0.25
ii)	1.5	0.5
iii)	2.5	1.0

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

A test current equal to the rated current of the socket-outlet is passed through the clamping unit under test. A force according to Table 13 is passed to the conductor inserted in the clamping unit under test in the direction of one of the 12 directions shown in Fig. 12 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. 12 A following the same test procedure.

If, for 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 these new series of tests.

13 CONSTRUCTIONS OF FIXED SOCKET-OUTLETS

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

Parts of socket contact assemblies, which will be in contact with the portion of the pin intended to make electrical contact when the plug is fully inserted in the socket-outlet shall ensure metallic opposing contacts at least on two sides of each pin.

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.

Socket contacts and pin(s) of socket-outlets, which are made of copper or copper alloy, as specified in **26.5**, are considered as complying with this requirement.

Compliance is checked by inspection or by chemical analysis, if necessary.

The pin(s) of socket-outlets shall be constructed in such a way that the mechanical strength of the pin(s) does not depend on the plastic material.

NOTE — In certain designs the pin(s) of the accessories are hollow and filled with plastic.

Compliance is checked by inspection and in case of doubt by the tests of **14.2** and **21** on a new set of specimens without plastic.

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,

a) easy introduction and reliable connection of the conductors in the terminals; except for lead wires of pilot lights;

NOTE — Screw terminals as shown in Fig. 2 to Fig. 5 are considered suitable for reliable connection of the conductors.

b) easy fixing of the main part to a wall or in a mounting box;

c) correct positioning of the conductors; and

d) adequate space between the underside of the main part and the surface on which the main part is mounted or between the side of the main part 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.

Compliance is checked by inspection and by an installation test with conductors of the largest nominal cross- sectional area specified, for the relevant terminal size, in Table 4.

In addition, for socket-outlets having screw less terminals, the socket-outlets shall be so constructed that the connecting and/or disconnecting means of the screw less terminals cannot be activated by the conductors during and after installation of the socket-outlet in a box or on a wall.

NOTES

1 This requirement does not imply that the connecting and/or disconnecting means cannot be touched by the conductors.

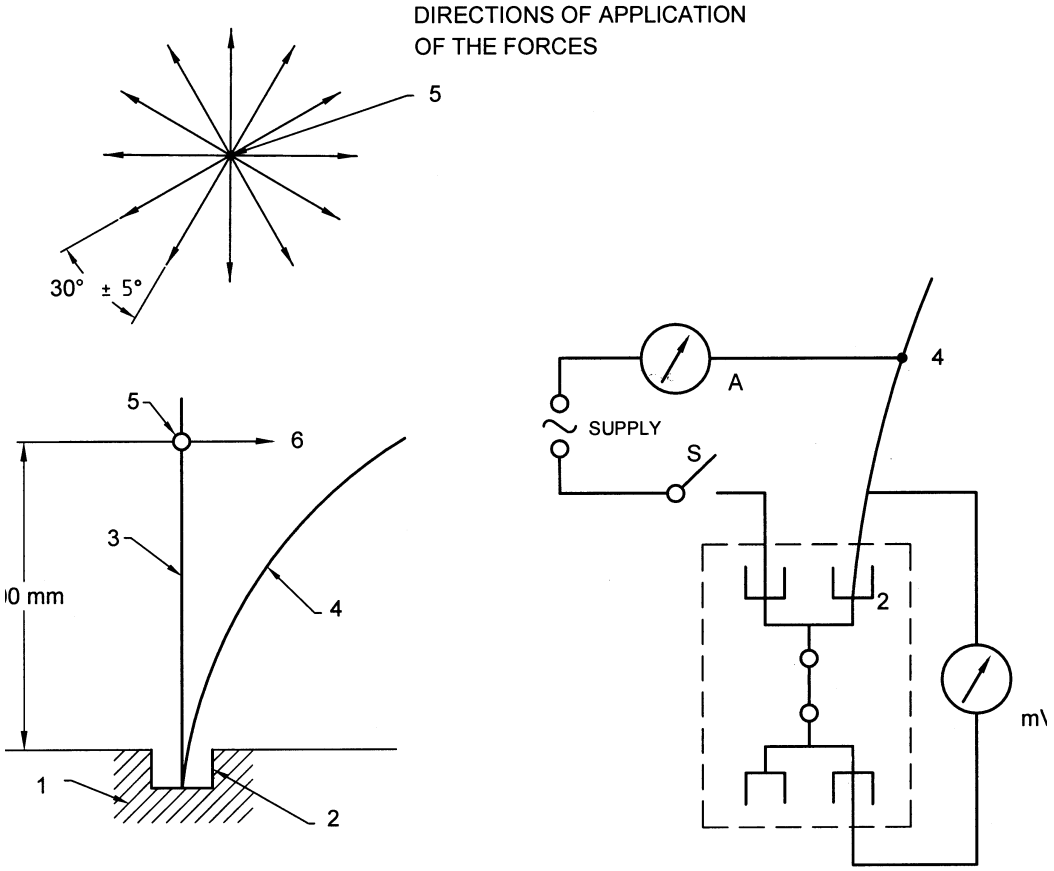
2 This requirement may be met by the placement of the connecting and/or disconnecting means and/or the use of protective barriers or shoulders placed around the connecting and/or disconnecting means.

Compliance is checked by inspection and in case of doubt by the following test.

The test is carried out with a solid copper conductor having the smallest nominal cross-sectional area, as specified in **12.3.2**.

The conductor is pushed as far as possible into the terminal under test or is inserted so that adequate connection is obvious.

A test probe according to IS 1401 test probe 1 is pushed



Key
A = Ammeter
mV = Millivoltmeter
S = Switch
1 = Specimen
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)

12 A Principle of the test apparatus for deflection on screwless terminals

12 B Example of test arrangement to measure the voltagte drop during deflection test on screwless terminals

FIG. 12 INFORMATION FOR DEFLECTION TEST

against the connecting or disconnecting means with a force of 120 N in the direction opposite to the mounting direction as described in Fig. 13 A.

During the application of the force, the conductor, except for lead wires of pilot lights, is subjected to a pull of 30N; the pull is applied in one smooth and continuous motion, for 1 min in the direction of the longitudinal axis of the conductor space.

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

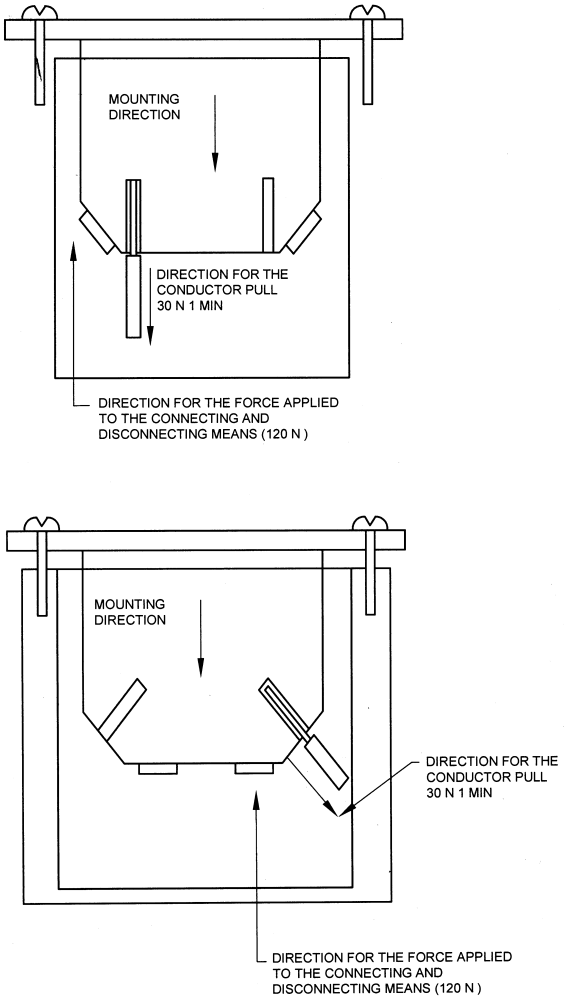
The force of 120 N has to be applied before the force of 30 N is applied. The force of 30 N is maintained on the conductor during the complete test.

Care shall be taken that the test probe does not touch the conductor during the application of the forces.

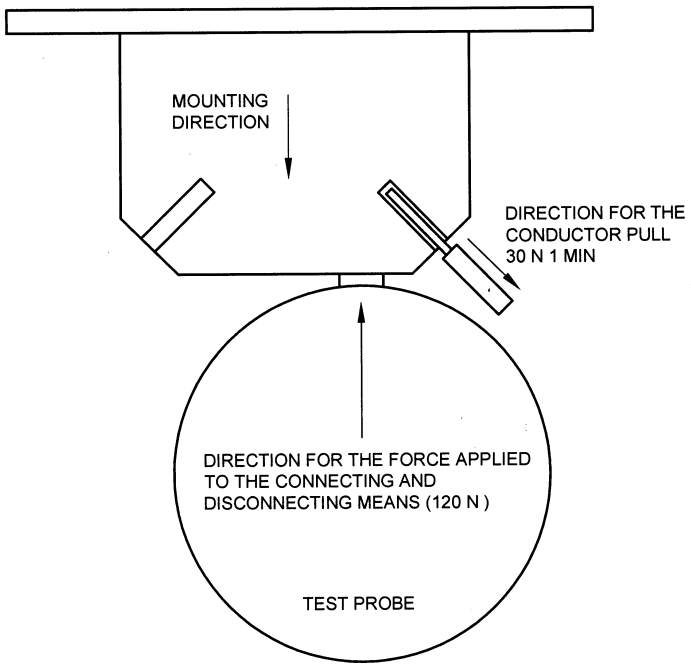
Where the axis between the application force and the axis through the force necessary to operate the connecting/disconnecting means deviates by more than 20°, it is allowed to exert the calculated resulting force directly onto the connecting/disconnecting means using the test probe; an example is shown in Fig. 13 B.

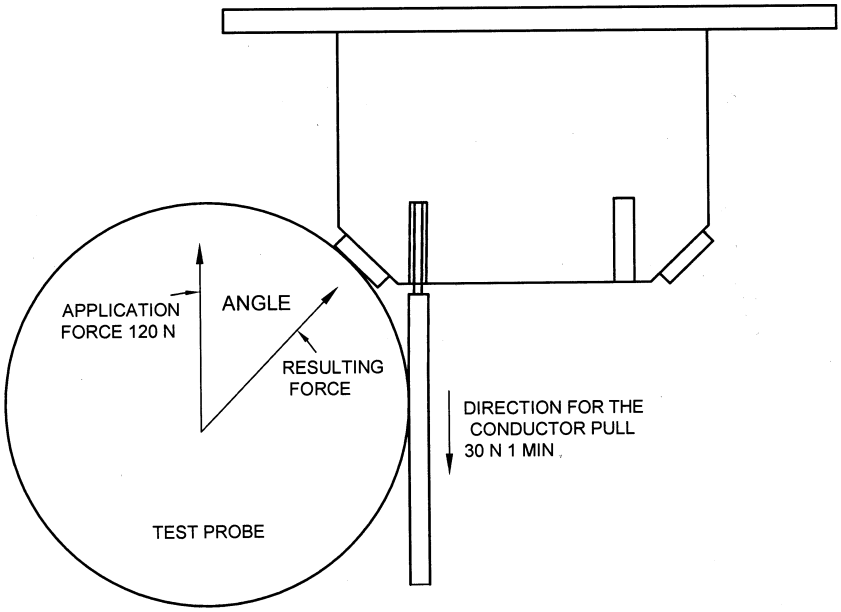
If the angle is greater than 60° no test is necessary and the product is deemed to comply with the requirements without further tests.

If it is not possible to exert a force onto the connecting/



13 A DETERMINATION OF THE DIRECTION OF THE FORCES TO BE APPLIED





13 B TEST SET UP

FIG. 13 VERIFICATION OF THE REQUIREMENTS

disconnecting device, the product is deemed to comply with the requirements without further tests.

Compliance is checked by inspection and by an installation test with conductors of the largest nominal cross-sectional area specified in Table 4.

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.

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

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).

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

Compliance is checked according to **13.7.1**, **13.7.2** or **13.7.3**.

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 5, are not considered as accessible if the requirements of this sub-clause are met.

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 14):

a) When their removal may give access, with the standard test finger, to live parts by the test of **24.14**;

b) 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 5 by the tests of **24.15**; and

c) When their removal may give access, with the standard test finger, only to,
   1) parts of insulating material, or
   2) earthed metal parts, or
   3) metal parts separated from live parts in such a way that creepage distances and clearances have twice the values specified in Table 5, or
   4) live parts of safety extra-low voltage (SELV) circuits not greater than 25 V a.c. 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 other documentation: 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 results in a change of the classification of the socket-outlet according to **7.1.3**.

Compliance is checked by inspection and by an installation test.

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

13.9 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 or other openings for contacts, for example locking devices, etc.

Drain holes, small gaps between enclosures or boxes and conduits, cables, or earthing contacts, if any, or between enclosures or boxes and grommets or membranes and knockouts are neglected provided they do not compromise the declared IP rating.

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

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

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

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

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

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

Table 14 Forces to be applied to Covers, Cover-Plates or Actuating Members Whose Fixing is Not Dependent on Screws
(*Clause* 13.7.2)

Sl No.	Accessibility with the Standard Test Finger after Removal of Covers, Cover-Plates or Parts of them	Tests According to Sub-clauses	Force to be Applied N			
			Number of Socket-outlets Complying with **24.17** and **24.18** which		Number of Socket-outlets Complying with **24.17** and **24.18** which	
			Shall not Come off	Shall Come off	Shall not Come off	Shall Come off
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	To live parts	**24.14**	40	120	80	120
ii)	To non-earthed metal parts separated from live parts by creepage distances and clearances according to Table 5	**24.15**	10	120	20	120
iii)	To insulating parts, earthed metal parts, live parts of SELV ?25 V a.c. or metal parts separated from live parts by creepage distance twice those according to Table 5	**24.16**	10	120	10	120

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.

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

Compliance is checked by means of the device shown in Fig. 14.

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 5N.

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 become disengaged from the socket-outlet.

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

Surface-type socket-outlet having a degree of protection from IPX4 to IPX6 shall have provisions for opening a drain hole. If a socket outlet has a drain hole, it shall not be less than 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 Adequate 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.

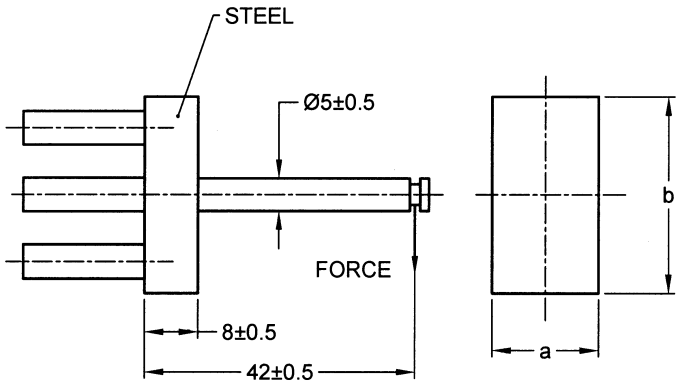
3 A drain hole in the back of the enclosure is deemed to be effective only, if the design of the enclosure ensure a clearance or at least 5 mm from the mounting surface or provided a drainage channel of at least the size specified.

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 tests of **21**.

13.18 Earthing contacts, phase contacts and neutral contacts shall be locked against rotation.

When the product is ready for the wiring it shall not be possible to remove the earthing contacts, phase contacts and neutral contact without the use of a tool.



NOTES

1 The dimensions *a* and *b* should be chosen according to the appropriate standard sheets.

2 Dimensions and arrangement of pins in compliance with standard sheets.

All dimensions in millimetres.

FIG. 14 DEVICE FOR CHECKING THE RESISTANCE TO LATERAL STRAIN

Compliance is checked by inspection and by manual test.

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 sheath of the cable so as to afford complete mechanical protection.

Surface-type socket-outlets shall be so constructed that the conduit or sheath of the cable can enter at least 1 mm into the enclosure.

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 according to IS 14763 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 15 or be as to specify 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 2h in a heating cabinet as described in **16.1**, the temperature being maintained at 40 ± 2°C.

Immediately after this period, a force of 30N is applied for 5s to various parts of the membranes by means of the tip of a straight unjointed test finger (Test probe 11 of IS 1401).

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.

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 freezer at a temperature of –15 ± 2°C.

After this period, the accessories are removed from the freezer 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.

Table 15 External Cable Dimension Limits for Surface Type Socket-Outlets
(*Clause* 13.21)

Sl No.	**Rated Current** A	**Nominal Cross-Sectional Areas of Conductors** mm^2	**Number of Conductors**	**Limits of External Dimensions of Cables** mm	
				Minimum	Maximum
(1)	(2)	(3)	(4)	(5)	(6)
i)	6	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
ii)	16	1.5 up to and including 4	4	7.6	18.0
			5		19.5

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

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.

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

14 CONSTRUCTION OF PLUGS AND PORTABLE SOCKET-OUTLET

14.1 Non-rewirable portable accessories shall be such that,

a) the flexible cable cannot be separated from the accessory without making it permanently useless; and
b) the accessory cannot be opened by hand or by using a general purpose tool, for example a screwdriver used as such.

Compliance is checked by inspection and manual test and by the test of **24.14.3**.

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.

14.2 Pins of portable accessories 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. 15, 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 and contact(s) of portable accessories shall be,

a) locked against rotation;
b) not removable without dismantling the plug; and
c) 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 arrange the earthing or neutral pins or contacts of plugs in an incorrect position.

The pin(s) of portable accessories shall be constructed in such a way that the mechanical strength of the pin(s) does not depend on the plastic material.

Compliance is checked by inspection, by manual test and in case of doubt by the test of **14.2** and **21** on a new set of specimens without plastic.

All exposed surfaces of plug pin(s) shall be smooth and free from burrs or sharp edges and other

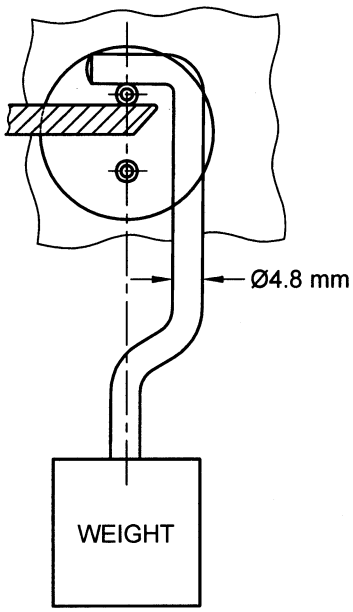


FIG. 15 DEVICE FOR TESTING NON-SOLID PINS

irregularities which could cause damage or excessive wear to corresponding socket contacts or shutters.

Compliance is checked by inspection and by manual test.

NOTE — In certain designs the pin(s) of the accessories are hollow and filled with plastic

14.4 Earthing contacts, phase 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 on plug pins.

Parts of socket-contact assemblies, which will be in contact with the portion of the pin intended to make electrical contact when the plug is fully inserted in the socket-outlet,

a) shall not be of insulating material except ceramic, or other material with no less suitable characteristics; and
b) shall ensure metallic contacts at least on two opposing sides of each pin.

The contact pressure of the contact tube shall not depend on soldered connection only.

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.

Socket contacts and pin(s) of socket-outlets, which are made of copper or copper alloy, as specified in **26.5**, are considered as complying with this requirement.

Compliance is checked by inspection or by chemical analysis, if necessary.

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

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,

a) pressing the cores together cause damage to the conductors insulation likely to result in a breakdown of the insulation;
b) a core, the conductor of which is connected to a live terminal, is necessarily pressed against accessible metal parts; and
c) a core, the conductor of which is connected to the earthing terminal, is necessarily pressed against live parts.

14.8 Rewirable portable accessories shall be so designed in such a way 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 portable 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 current carrying conductor of a flexible cable 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 when using the shortest possible path 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 portable accessories and terminations of non-rewirable portable accessories shall be so located or shielded in such a way that the loose wires form a conductor in the accessory will not present a risk of electric shock.

For non-rewirable moulded-on portable accessories, means shall be provided to prevent loose wires of a conductor from reducing the minimum isolation distance requirements between such wires and all accessible external surfaces of the accessory, with the exception of the engagement face of a plug,

a) for rewirable accessories, the test of **14.10.1**;
b) for non-rewirable non-moulded-on accessories, the test of **14.10.2**; and
c) for non-rewirable moulded-on accessories, by verification and inspection according to **14.10.3**.

14.10.1 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 4. 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.

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

14.10.2 A length of insulation equivalent to the maximum designed stripping length declared by the manufacturer plus 2 mm is removed from the end of a flexible conductor having the cross-sectional area as fitted. One wire of the flexible conductor is left free in the worst position whilst the remaining wires are terminated in a manner as used in the construction of the accessory.

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 termination shall not touch any accessible metal part or reduce the creepage distance and clearance through any constructional gap below 1.5 mm to the external surface.

The free wire of a conductor connected to an earth termination shall not touch any live part.

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

14.10.3 Non-rewirable moulded-on accessories shall be inspected to verify that there are means to prevent stray wires of the conductor and/or live parts reducing the minimum distance through insulation to the external accessible surface below 1.5 mm (with the exception of the engagement face of plugs).

NOTE — The verification of 'means' may require the checking of the product construction or assembly method.

14.11 For rewirable portable accessories,

a) it shall be clear how the relief from strain and the prevention of twisting is intended to be effected;
b) the cord anchorage, or at least part of it, shall be integral with or securely fixed to one of the component parts of the plug or portable socket-outlet;
c) make-shift methods, such as, tying the flexible cable or tying the ends with string, shall not be used;
d) cord anchorages shall be suitable for the different types of flexible cable which may be connected to it;
e) screws, if any, which have to be operated to clamp the flexible cable, shall not serve to fix any other component;

NOTE — This does not exclude a cover serving to retain the flexible cable in position in the cord anchorage provided the cable remains in place in the accessory when the cover is removed.

f) cord anchorages shall be of insulating material or be provided with an insulating lining fixed to the metal parts; and
g) 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 For rewirable portable accessories and non-rewirable non-moulded on portable accessories it shall not be possible to remove covers, cover-plates or parts of them intended to ensure protection against electric shock without the use of a tool.

Compliance is checked as follows:

a) For covers, cover-plates or parts of them whose fixing is of screw-type, compliance is checked by inspection; and
b) For covers, cover-plates or parts of them whose fixing is not dependent on screws and whose removal may give access to live parts, compliance is checked by the tests of **24.14**.

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 nominal cross-sectional area specified in Table 4.

NOTE — The earthing contacts 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 Portable accessories of IP code higher than IP20 shall be enclosed according to their IP classification when they are fitted with cables.

Plugs having IP code higher than IP20, with the exception of the engagement face, shall be adequately enclosed when fitted with a flexible cable as for normal use.

Portable socket-outlets having IP code higher than IP20, shall remain totally enclosed when fitted with a flexible cable as for normal use and 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**.

NOTES

1 Adequate 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 close 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.

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

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

14.19 Combinations of portable accessories and switches and circuit-breakers or other protective devices shall comply with the relevant individual Indian Standards, if a relevant combined product standard does not exist.

Compliance is checked by testing the components according to relevant Indian Standards if any.

14.20 Portable accessories shall not be an integral part of lamp holders.

Compliance is checked by inspection.

14.21 Plugs classified exclusively as plugs for equipment of Class II may 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.

Compliance is checked by inspection.

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

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.

Components incorporated in portable accessories shall be so rated, or so protected, that overloading of either the component or the plug or the socket-outlet portion cannot occur in normal use.

Requirements for switches incorporated in portable accessories are detailed in Annex D.

For portable socket-outlets and rewirable plugs the incorporated over current protective device in the accessory shall have a rated current equal to or less than the rated current of the accessory.

Any other component(s), such as switches or control devices, shall have a rated current not less than,

a) the rated current of the accessory; or
b) the rated current of the incorporated over current protective device, if any.

For components having different rated currents for resistive and inductive loads, the rated current to be referred to is the rated current for the resistive load.

For non-rewirable plugs, any other incorporated

component(s), such as switches or control devices, shall have a rated current not less than,

a) the test current for the combination of the accessory and the cable as indicated in Table 16, for **21**; or
b) the rated current of the incorporated over current protective device, if any.

Any incorporated component(s) shall have a rated voltage not less than the rated voltage of the accessory.

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

NOTE — Examples of over current protective devices are: fuses, thermal or current cut-outs, MCBs (Miniature Circuit Breakers), RCBOs (Residual Current operated circuit breaker with integral over current protection).

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.

Plugs having a rating above 16 A and 250 V shall not be an integral part of other equipment.

For two-pole plugs, with or without earthing contact, having ratings up to and including 10A and 250 V compliance is checked by the tests of **14.23.1** and **14.23.2.**

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

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 l h, the temperature-rise of the pin 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-

Table 16 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* 14.22, 19.1 *and* 23.3)

Sl No.	Rating of Accessory	Rewritable Fixed Accessories		Rewritable Portable Accessories		Non-rewritable Portable Socket-Outlets			Non- rewritable Plugs		
		Test Current A		Test Current A		Nominal Cross Sectional Area mm^2	Test Current A		Nominal Cross sectional Area mm^2	Test Current A	
		Clause **19**	Clause **21**	Clause **19**	Clause **21**		Clause **19**	Clause **21**		Clause **19**	Clause **21**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	2.5 A 250 V	–	–	–	–	–	–	–	Tinsel	1	1
									0.5	2.5	2.5
									0.75	4	2.5
									1	4	2.5
ii)	6A					0.75	10	10	Tinsel	1	1
	250 V	16	10	14	10	1	12	10	0.5	2.5	2.5
						1.5	16	10	0.75	10	10
									1	12	10
iii)	16A								Tinsel	1	1
	250 V	22	16	20	16	1[1)]	16	16	0.5	2.5	2.5
						1.5	16	16	0.75	10	10
									1	12	12
									1[1)]	16	16
									1.5	16	16

NOTES

1 Tinsel cords and flexible cables having a nominal cross–sectional area of 0.5 mm^2 are allowed in lengths up to 2 m only.

2 Plugs and connectors incorporated in cord sets are tested as specified in the respective relevant standard (this standard for plugs and the IS/IEC 60320 series for connectors), each accessory being tested independently.

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 for **19** test currents for rewirable portable accessories, which are obtained as follows:

a) for $I_n \leq 10$ A, test current = 1.4 I_n;
b) for $I_n > 10$ A, test current = 1.25 I_n.

[1)] Flexible cables having a cross-sectional area of 1 mm^2 are allowed with a length up to 2 m only.

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/or 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.

Compliance is checked by inspection and in case of doubt by test.

NOTE — Examples of possible tests are given in Annex E.

14.25 Membranes in inlet opening shall meet the requirements of **13.22** and **13.23.**

14.26 Rewirable portable socket-outlets which can be assembled and wired for normal use after their rear part has been fixed onto a surface shall comply both with the requirements for portable socket-outlets and with the following additional requirements for surface fixed socket-outlets:

a) Provision for earthing (*see* **11.2**, **11.3** and **11.6**);
b) Terminals and terminations (*see* **12.2.1**);
c) Construction of fixed socket-outlets (*see* **13**);
d) Resistance to ageing, protection provided by enclosures, and resistance to humidity (*see* **16.2.1, 16.2.2**);
e) Temperature rise (*see* **19**);
f) Mechanical strength (*see* **24**);
g) Resistance to heat (*see* **25**);
h) Creepage distances, clearances and distances through sealing compound (*see* **27**); and
j) Resistance of insulating material to abnormal heat, to fire and to tracking (*see* **28.1.1**), glow wire test.

15 INTERLOCKED SOCKET-OUTLETS

Socket-outlet interlocked with a switch shall be so constructed that a plug cannot be inserted into or completely 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 specified in IS 4160.

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, shall be removed, if possible and these parts are not subjected to 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 having an IP code higher than IPX0 are tested after having been mounted and assembled as prescribed in **16.2.**

For accessories having a lid, the lid is closed during the test.

For portable socket-outlets, the plug of the same system having the same rated current as the socket-outlet shall be inserted into the socket-outlet during the test. The plug can be suitably modified if necessary to allow the closure of the lid, if any.

For portable socket-outlets, after having withdrawn the test plug from the socket-outlet the contact pressure of the contact assembly is checked as specified in **22.2** with the single-pin gauge. The gauge shall not fall from the contact assembly within 30 s.

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:

a) With the forefinger wrapped in a dry piece of rough cloth the sample is pressed with a force of 5N.
b) 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 5N can be obtained in the following way:

a) 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.

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

16.2 Protection Provided by Enclosures

Enclosures shall provide protection against access to hazardous parts, harmful effects due to ingress of solid foreign objects and harmful effects due to ingress of water in accordance with the IP designation of the accessory.

Compliance is checked by the tests of **16.2.1** and **16.2.2**.

16.2.1 *Protection against Access to Hazardous Parts and Against Harmful Effects Due to Ingress of Solid Foreign Objects*

Accessories and their enclosures shall provide a degree of protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects.

Fixed socket-outlets are mounted as in normal use 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. 16 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. 16 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 16 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.

Accessories with screwed glands or membranes are fitted and connected with cables which shall be within the connecting range specified in Table 4. Glands are tightened with a torque equal to two-thirds of that applied during the test of **24.6**.

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 nominal cross-sectional area given in Table 4, as appropriate to their rating.

Screws when mounting the accessory are tightened with a torque equal to two-third of the applicable torque given in Table 1.

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

If an accessory has passed the test successfully, then this test is deemed to be passed for a combination of such single accessories.

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

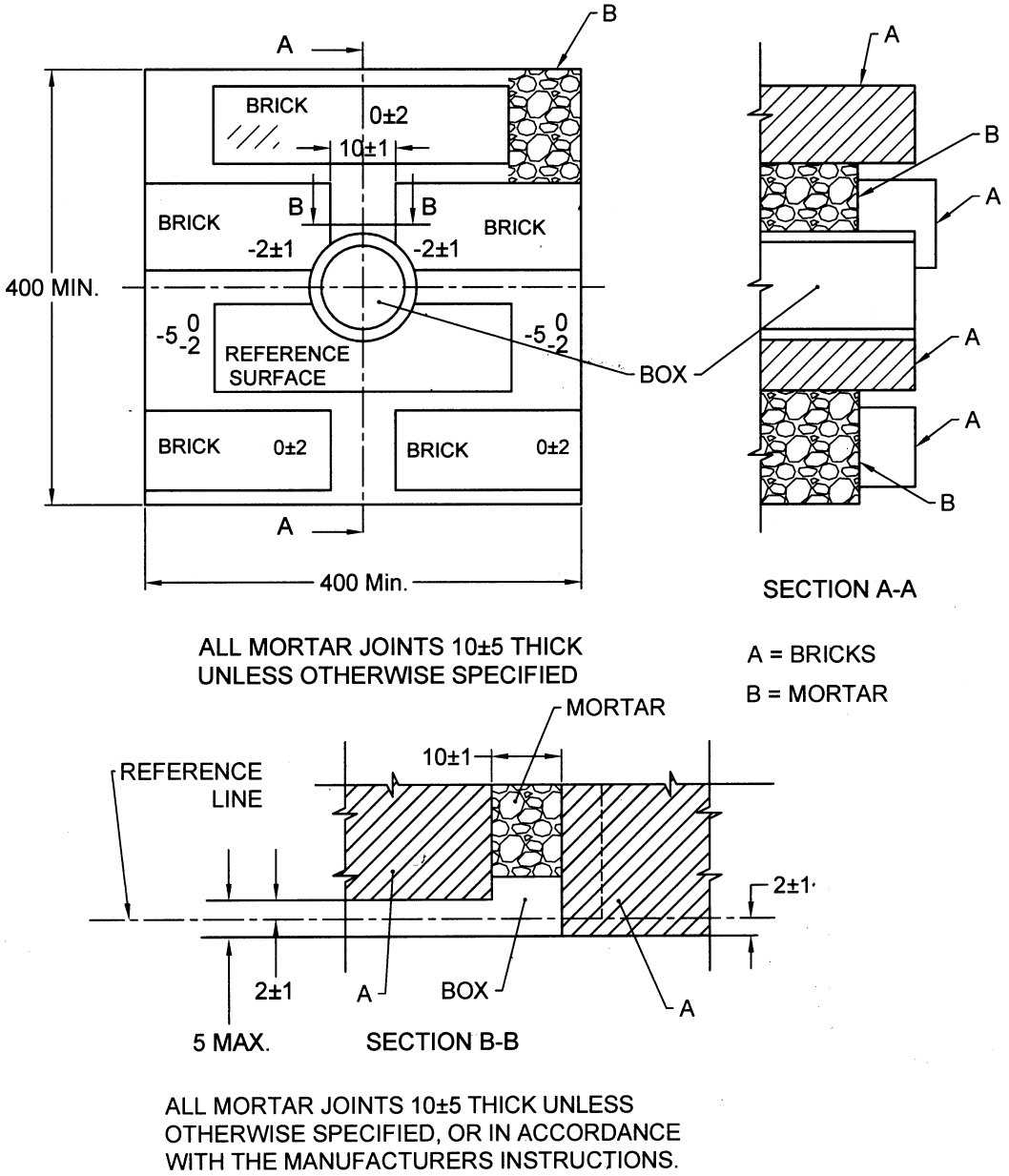
N0TE — Glands are not fitted with sealing compound or the like.

Table 17 External Dimensions of Flexible Cables to be Accommodated by Cord Anchorage
(*Clauses* 16.2.1, 17.1.1, 17.1.2 *and* 23.2)

Sl No.	Rating of Accessory	Number of Poles[1)]	Types of Flexible Cable (Cable References)	Number of Conductors and Nominal Cross Sectional Area mm^2	Limits for External Dimensions for Flexible Cables mm	
					Minimum	Maximum
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	6A Up to and including 250 V [2)]	2	IS 694	2 × 0.75 2 × 0.75	2.7 × 5.4 3.8 × 6.0	3.2 × 6.4 5.2 × 7.6
ii)	6A Up to and including 250 V	2	IS 694	2 × 0.75 2 × 1	2.7 × 5.4 6.4	3.2 × 6.4 8.0
		3		3 × 0.75 3 × 1	6.4	8.4
iii)	Above 6A up to and including 16A Up to and including 250 V	3	IS 694	3 × 0.75 3 × 1.5	6.4	9.8

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

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



All dimensions in millimetres.

FIG. 16 TEST WALL IN ACCORDANCE WITH THE REQUIREMENTS OF **16.2.2**

16.2.1.1 *Protection against access to hazardous parts*

The appropriate test specified in IS/IEC 60529 is performed (*see* **10**).

16.2.1.2 *Protection against harmful effects due to ingress of solid foreign objects*

The appropriate test specified in IS/IEC 60529 is performed.

For the test of accessories with numeral 5 as the first characteristic, the accessories are considered to be of category 2; dust shall not penetrate in a quantity to interfere with satisfactory operation or to impair safety.

For the test of the first characteristic numeral 6, enclosures of socket-outlets are considered to be of category 1 (*see* **13.6** of IS/IEC 60529); no dust shall penetrate.

The test probes shall not be applied to drain holes.

16.2.2 *Protection Against Harmful Effects Due to Ingress of Water*

Accessories and their enclosures shall provide a degree of protection against harmful effects due to ingress of water in accordance with their IP classification.

Compliance is checked by the appropriate tests of IS/IEC 60529 under the conditions specified below.

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

Where the manufacturer's instructions specify that the accessory is suitable to be installed on a rough wall the test wall according to Fig. 16 is used. It is made with bricks having flat smooth surfaces. When the box is mounted in the test wall, it shall fit tight against the wall.

NOTES

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

2 Figure 16 shows an example where the edge of the box is positioned in the reference plane; other positions are possible, according to the manufacturer's instructions.

Surface type socket-outlets are mounted as for normal use in a vertical position and fitted with cables or conduits or both in accordance with the manufacturer's instructions. Cables shall have conductors of the largest and smallest nominal cross-sectional area given in Table 4, 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 flexible cables (*see* Table 17) having conductors of the largest and smallest nominal cross-sectional area given in Table 4, as appropriate to their rating.

Screws of the enclosure operated when mounting the accessory are tightened with a torque equal to two-thirds of the applicable torque given in Table 1.

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

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

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

If the enclosure of a socket-outlet that has an IP code less than IPX5 is designed with drain holes, one drain hole is opened, as for normal use, in the lowest position. If the enclosure of a socket-outlet that has an IP code equal to or greater than IPX5 is designed with drain holes, they shall not be opened.

Socket-outlets are tested without a plug in engagement and 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 harmful effects due to ingress of water, if defined in the system.

NOTE— In some systems plugs and socket-outlets may not have the same degree of protection.

Care shall be taken not to disturb, for example, to knock or shake, the assembly, in such a way that the test result will be affected.

If an accessory has drain holes which have been opened, 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.

The specimens shall withstand an electric strength test specified in **17.2** which shall be started within 5 min of 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 resistance 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,

a) 2 days (48 h) for accessories, having a IP code of IPX0; and

b) 7 days (168 h) for accessories having a IP code higher than IPX0.

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) 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.

4 For the purpose of acceptance test, the humidity treatment is subjected for 24 h.

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 d.c. voltage of approximately 500 V, the measurement being made 1 min after application of the voltage.

The insulation resistance shall be not less than 5MΩ.

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 in engagement;
b) between each pole in turn and all others, these being connected to the body with a plug 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 terminal, including clamping screws and earthing terminal (s) or earthing contact (s), if any, of portable socket-outlet; and
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 inserted in its place (as specified in Table 17).

The term 'body' used in (a) and (b) includes all 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 main parts 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 test probe 11 of IS 1401.

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 tum 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; and
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 test probe 11 of IS 1401.

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 2 000 V for accessories having a rated voltage upto and including 250V.

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.

No flashover or break down shall occur during the test.

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.

No flashover or break down shall occur during the test.

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

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

Socket-outlets and plugs are tested according to **19.1** except for,

a) fixed socket outlets of a socket outlets and fused plug system, for which **19.2** applies; and

b) plugs and portable socket-outlets with incorporated components, for which **19.3** applies.

Non-rewirable accessories are tested as delivered.

Rewirable accessories are fitted with polyvinyl chloride insulated conductors having a normal nominal cross-sectional area as shown in Table 18.

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 80 ±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.

NOTES

1 In the case of non rewirable accessories care should be taken to minimize the influence on the structure/design/performance of the accessory when accessing the terminations of the accessory.

2 Adequate measures should be taken to avoid electric shocks during the test.

For accessories having three poles or more (earthing contacts, irrespective of their number, are considered as one pole) 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 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. With the test current as specified in Table 16 passed through that one socket-outlet.

The temperature rise of the terminals, terminations and clamping units determined by means of thermocouples 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 Accessories incorporate elements such as dimmers, fuses, switches, energy regulators etc., the incorporated elements shall be tested in accordance to the ratings specified by the manufacturer. Any protective element such as fuses or thermal cut-outs is to be electrically short circuited with a link of negligible resistance, for the execution of the test.

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

The test plug is inserted into the socket-outlet, and an alternating current as specified in Table 16 is passed for min 60^{+5}_{0} min.

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

Table 18 Nominal Cross-Sectional Areas of Copper Conductors for Temperature-Rise Test
(*Clause* 19.1)

Sl No.	Rated Current A	Nominal Cross-Sectional Area mm^2	
		Flexible Conductors for Portable Accessories	Rigid Conductors (Solid or Stranded) for Fixed Accessories
(1)	(2)	(3)	(4)
i)	Up to and including 6	1	1.5
ii)	Over 6 and up to including 16	1.5	2.5
iii)	Over 16	4	6

with the test current as specified in Table 16 passed through that one socket-outlet.

For this test the temperature rise is measured on the terminals and terminations.

The plug shall be tested in a draught-free environment at the centre of a plane wooden sheet which shall be at least 20 mm thick, 500 mm wide and 500 mm high.

Plugs are tested as follows:

Clamping units having the dimensions specified in are fitted on each live pin and earthing pin, if any, of the plug. Each clamping unit is equipped with a thermocouple which can be mounted either together with the pin or fixed permanently within the dotted area of Fig. 18.

If it is not possible to use the clamping unit of Fig. 39 due to the design of the plug, the clamping unit may be modified in order to perform the test.

In this case the diameter of the screw, the threaded hole and the total volume of the modified clamping unit shall be identical to Fig. 18.

The screw is then placed approximately in the middle of the bare part of the pin and tightened with a torque of 0.8 Nm.

An alternating current as specified in Table 16 is then passed for 60^{+5}_{0} min.

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

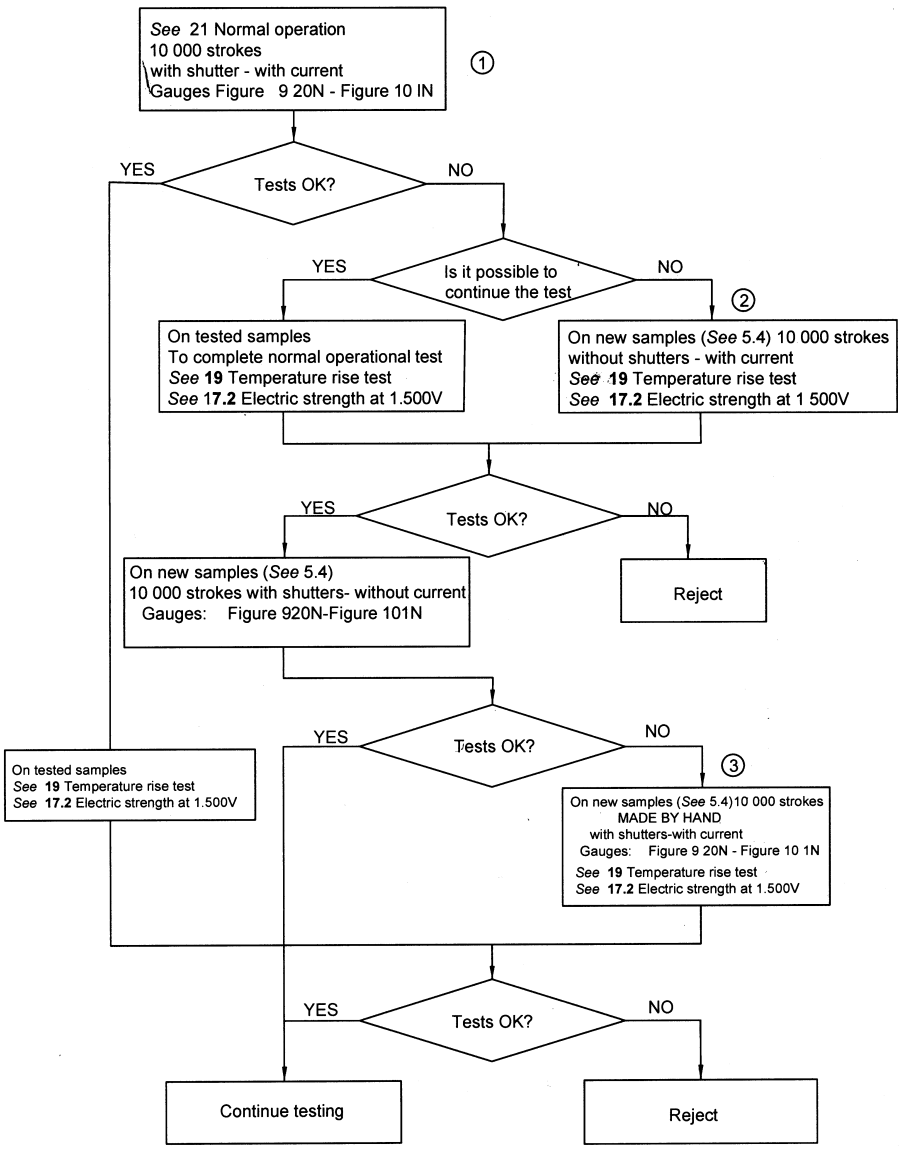
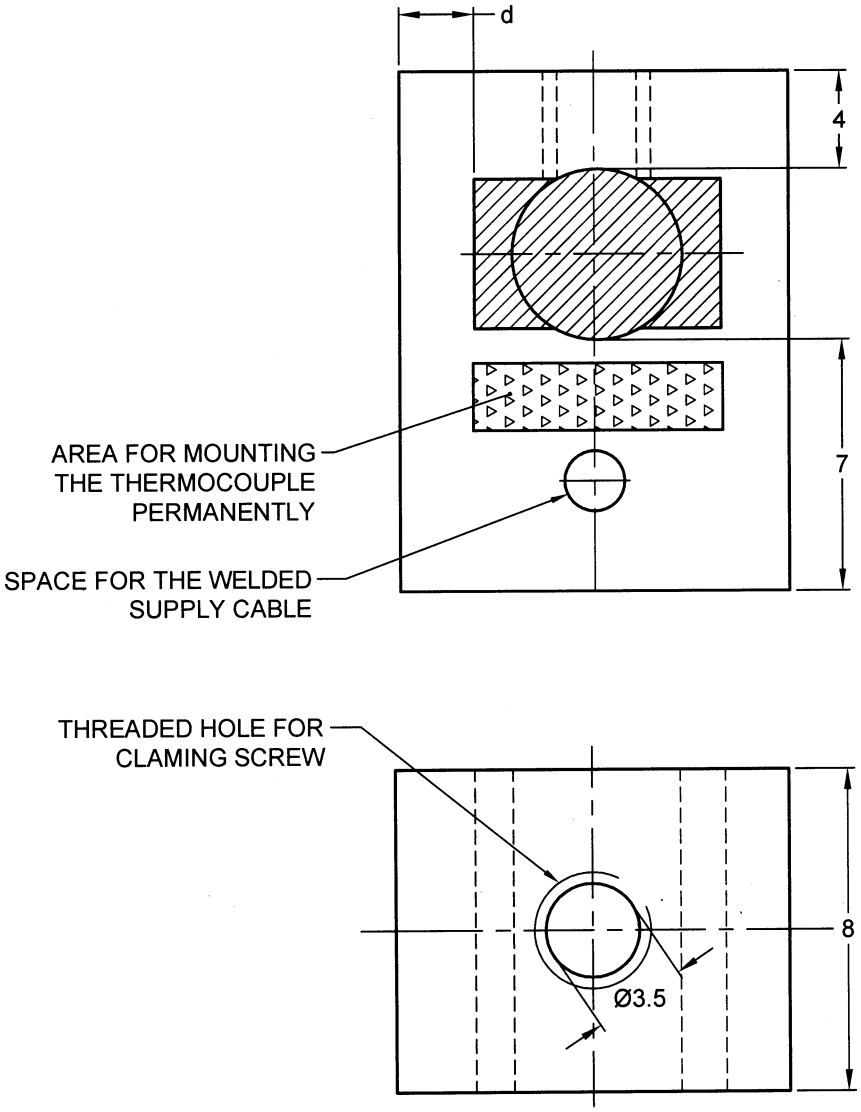


FIG. 17 TEST PROCEDURES FOR NORMAL OPERATION



Material: brass with at least 52 percent of copper.

Tolerance: ±0.2 mm unless otherwise stated.

NOTES

1 The dimension(s) for the shaded area is (are) the maximum plug pin dimension(s) + 0.8 mm.

2 $1.5 \leq d \leq 3$.

3 The thermocouple should be placed within the shaded area but not directly under the clamping screw.

FIG. 18 CLAMPING UNIT FOR THE TEMPERATURE RISE TEST

The plug under test is inserted into the fixed socket-outlet, and an alternating current as specified in Table 16 is passed for 60^{+5}_{0} min.

19.2 For fixed socket-outlets of a socket-outlet and fused plug system, an alternating current as specified in Table 20 is passed for 60^{+5}_{0} min as follows:

a) For a single socket-outlet the plug is inserted into the socket-outlet and 70 percent of the test current is passed through the plug.

The balance of the total test current is passed simultaneously through a looped connection, connected to the socket-outlet terminals.

The total nominal load on the supply cable is passed for 60^{+5}_{0} min.

b) For a multiple socket-outlet a plug is inserted into one socket-outlet and 70 percent of the test current is passed.

A second plug is inserted into another socket-outlet and the balance of the total test current is passed simultaneously through this plug.

The total nominal load on the supply cable is passed for min.

NOTES

1 The value of 70 percent relates to the fuse characteristics and is specified in the relevant national standards.

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

19.3 Portable socket-outlets and rewirable plugs with incorporated components are tested by the following two tests:

a) With a current which is equal to the test current as indicated in Table 16, for **19**. For this test the incorporated components are short circuited;

b) With a current which is equal to the rated current of the portable accessory or the rated current of the component(s), whichever is the lower.

Non-rewirable plugs with incorporated components are tested by the following two tests:

1) With a current which is equal to the test current for the combination of the plug and the cable as indicated in Table 16, for **19**. For this test the incorporated components are short circuited;

2) With a current which is equal to the test current for the combination of the plug and the cable as indicated in Table 16, for **21**, or the rated current of the component(s), whichever is the lower.

In addition to the verification of the temperature rise of the terminals, the maximum temperature rise of accessible metal parts shall be measured and shall not be higher than 30 °C and of accessible non-metallic parts not higher than 40 °C.

NOTES

1 In the case of non-rewirable accessories care should be taken to minimize the influence on the structure/design/performance of the product when accessing the terminations of the product.

2 Examples of 'incorporated components' are switches and fuses.

20 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. 19.

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, with insulating sleeves, and having the maximum specified dimension, with a tolerance of $^{0}_{-0.06}$ mm, and spaced at the nominal distance, with a tolerance of $^{+0.05}_{0}$ mm; however, as far as the extremities of the sleeves are concerned, it is sufficient that their dimensions are within the tolerances given in Annex B, if any.

NOTES

1 Dimensions of insulation sleeves are as per Annex B.

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 of the test plug should not be electro-plated and shall be as specified in IS 292 type CuZn39Pb2 or CuZn39Pb3 and their 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.

For accessories with a rated voltage lower than or equal to 250 V and a rated current lower than or equal to 16 A, The length of the stroke of the test apparatus shall be between 50 mm and 60 mm.

NOTE — The length of the stroke for accessories with other ratings is under consideration.

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

a) 30 strokes per minute for accessories having a rated current up to and including 16 A and a rated voltage up to and including 250 V; and

b) 15 strokes per minute for other accessories.

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 withdrawal are as follows:

a) For accessories with rated current $\leq 16\,\text{A}: 1.5^{+0.5}_{0}$ s

b) For accessories with rated current $> 16\,\text{A}: 3^{+0.5}_{0}$ s

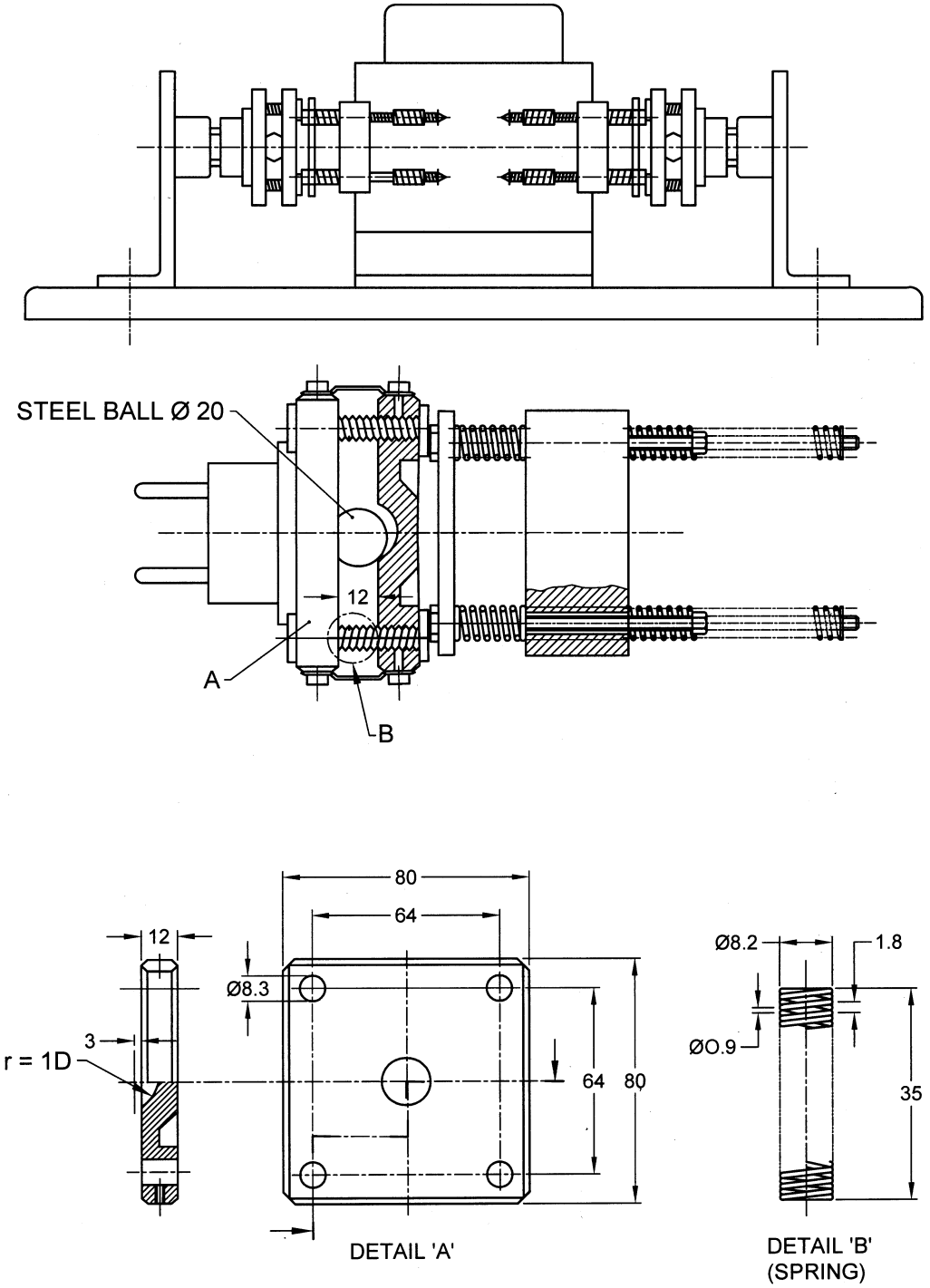


FIG.19 EXAMPLE OF APPARATUS FOR BREAKING CAPACITY AND NORMAL OPERATION TEST

Accessories are tested using an alternating current with cos Φ = 0.6 ± 0.05.

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

The test is made with the connections shown in Fig. 20.

Two-pole accessories with neutral contact (2P + N and 2P + N + ⏚) are connected to two phases and the neutral of a three phase system.

Resistors and inductors are not connected in parallel, except that, if an air-core 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

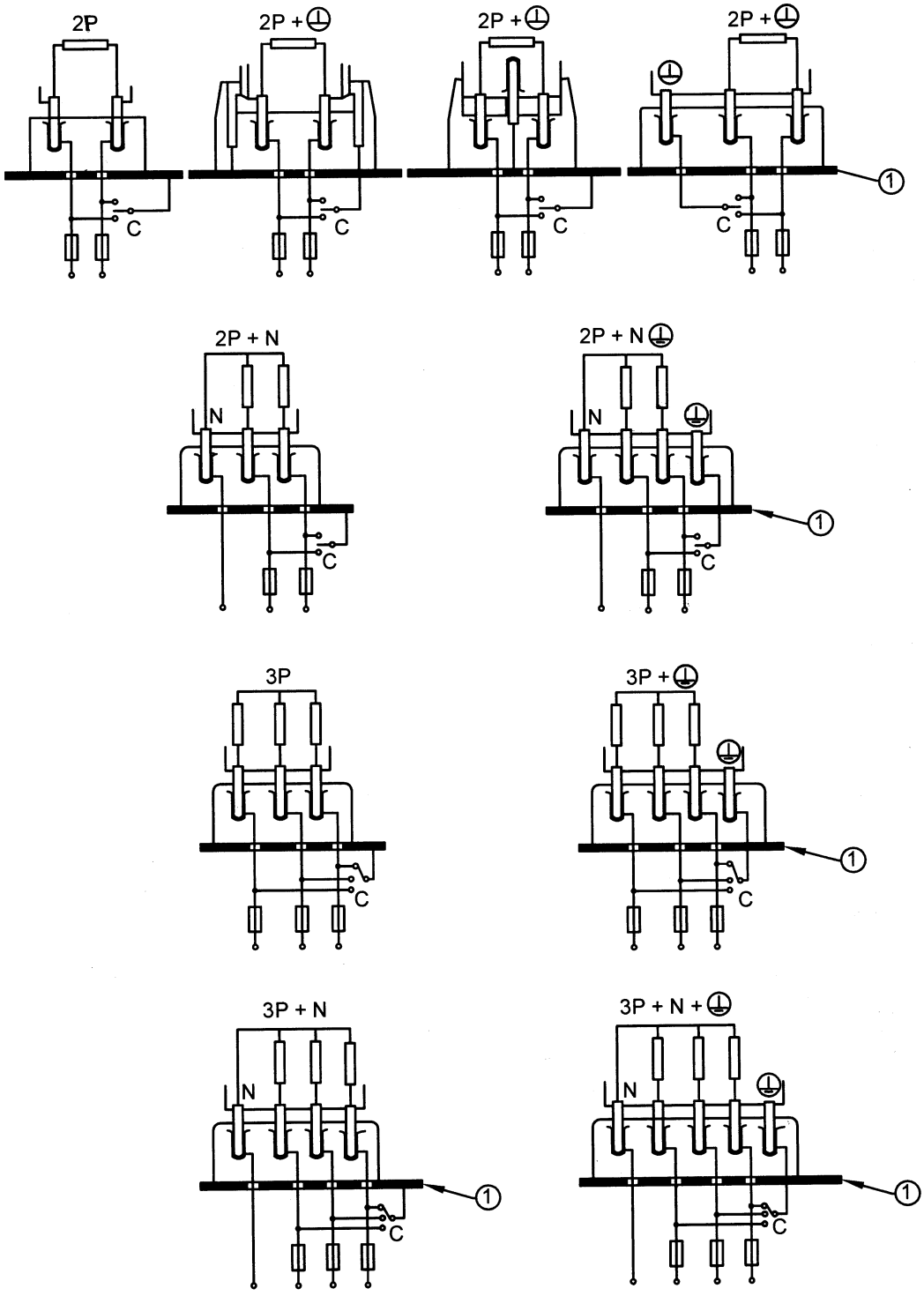


FIG. 20 CIRCUIT DIAGRAMS FOR BREAKING CAPACITY AND NORMAL OPERATION TESTS

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, for three pole accessories, they are connected consecutively to each pole of the supply for one third of the number of strokes.

In the case of multiple and combined socket-outlets, 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 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. 19.

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 after 4 500 and 9 000 strokes.

The procedure specified in Fig. 17 shall be followed.

The manufacturer shall be permitted to indicate at which point 1, 2 or 3 of Fig. 17 the test program shall begin. If the manufacturer indicates to start at point 2 or point 3, the test shall be performed on new specimens that have previously been subjected to the test of **20** in the conditions required to the relevant starting points 2 or 3.

Socket-outlets are tested using a test plug with brass pins provided, with insulating sleeves, and having the maximum specified dimensions, with a tolerance of $^{0}_{-0.06}$ mm , and spaced at the nominal distance with a tolerance of $^{0.05}_{0}$ 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 insulation sleeves are as per Annex B.

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 should not be electro-plated and shall be as specified in IS 292 type CuZn39Pb2 or CuZn39Pb3 and their micro-compositions shall be homogeneous.

The end of round pins is rounded.

Plugs are tested using a fixed socket-outlet complying with this standard and having 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 specimens are tested with an alternating current as specified in Table 16, at rated voltage, in a circuit with $\cos \phi = 0.8 \pm 0.05$.

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

a) 30 strokes per minute for accessories having a rated current up to and including 16 A and a rated voltage up to and including 250 V; and

b) 15 strokes per minute for other accessories.

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

For accessories having a rated current lower than or equal to 16A, the test current is passed during each insertion and engagement of the plug.

In all other cases, the test current is passed during alternate insertion and withdrawal, the other insertion and withdrawal being made without current flowing.

The periods during which the test current is passed from engagement of the plug until subsequent withdrawals are as follows:

a) for accessories with rated current $\leq 16\,\text{A}: 1.5^{+0.5}_{0}$ s

b) for accessories with rated current $> 16\,\text{A}: 3^{+0.5}_{0}$ 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,

a) deterioration of enclosures, insulating linings or barriers;

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

c) loosening of electrical or mechanical connections; and

d) seepage of sealing compound.

For shuttered socket-outlets, a gauge according to Fig. 9 is applied to the entry holes corresponding to the live contacts with a force of 20 N.

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

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

A gauge according to Fig. 10 is then applied with a force of 1 N and in three directions, for approximately

5 s in each of the three directions, with independent movements, withdrawing the gauge after each movement.

It shall not be possible to touch live parts with the gauges of Fig. 9 and Fig. 10 when they remain under the relevant forces.

An electrical indicator, with a voltage between 40 V and 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 equal to the test current required for the normal operation test of this **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 being reduced to 1 500 V for accessories having a rated voltage upto and including 250 V.

NOTE — The humidity treatment, according to **16.3**, is not repeated before the electric strength test of this clause.

The tests 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 working out of the socket-outlet in normal use.

For the purpose of this test, resilient earthing contacts, irrespective of the number, are considered as one pole, and non-resilient earthing contacts, irrespective of the number, are considered not to be a pole.

NOTE — A solid pin used for earthing is a non-resilient earthing contact.

Interlocked accessories are tested in the unlocked position.

Compliance is checked, for socket-outlets-only by,

a) 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 19; and

b) a test to ascertain that the minimum force necessary to withdraw a single pin gauge from the individual from the contact assembly is not lower than the force specified in Table 19.

For plugs with resilient earthing contact assemblies, by

1) a test to ascertain that the maximum force necessary to withdraw a single pin gauge from the individual resilient earthing contact assembly of the plug is not higher than the force specified in Table 19; and

2) a test to ascertain that the minimum force necessary to withdraw a single pin gauge from the individual earthing contact assembly is not lower than the force specified in Table 19.

22.1 Verification of the Maximum Withdrawal Force

22.1.1 *Test for Socket-Outlets*

The socket -outlet is fixed to the mounting plate *A* of an apparatus as shown in Fig. 21, 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 0.6 µm and 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, shall have respectively the maximum specified dimensions, with a tolerance of $^{0}_{-0.01}$ mm.

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

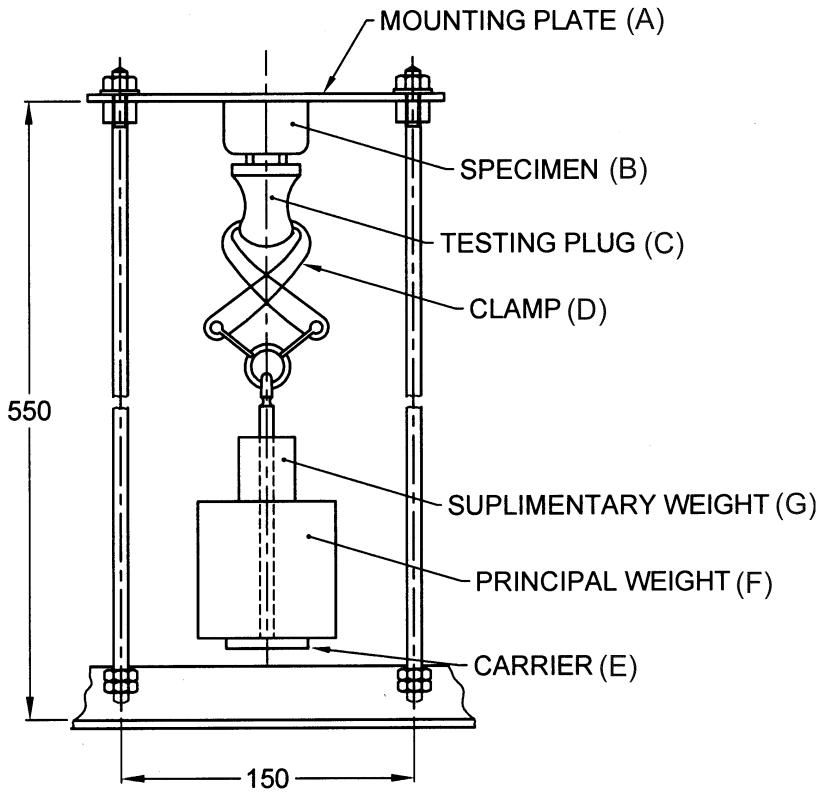
The pins are wiped free from grease, before each test, using a cold chemical degreaser.

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

Table 19 Maximum and Minimum Withdrawal Force for Plugs and Socket-outlets
(*Clauses* 22, 22.1, 22.2, 24.10, 24.11 *and* 24.13)

Sl No.	Ratings of the Accessory	Number of the Poles of the Accessory	Withdrawal Force N	
			Multi Pin Gauge Maximum	Single Pin Gauge Minimum
(1)	(2)	(3)	(4)	(5)
i)	Up to and including 6A	2	40	1.5
		3	50	
ii)	Above 6A up to and including 16A	3	54	2.0



All dimensions in millimetres.

FIG. 21 APPARATUS FOR VERIFICATION OF MAXIMUM WITHDRAWAL FORCE

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 as specified in Table 19.

The principal mass, together with the supplementary mass, the clamp, the carrier and the plug exert a force equal to the maximum withdrawal force as specified in Table 19.

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

The plug shall not remain in the socket-outlet.

22.1.2 *Test for Plugs with Resilient Earthing Contact Assemblies*

The test pin gauge, illustrated in Fig. 22, is applied to the resilient earthing contact assembly, while the plug is held vertically and the gauge is hanging downwards.

The test pin gauge is made of hardened steel, having a surface roughness between 0.6 µm and 0.8 µm over its active length.

The diameter, for round pins, and the distance between contact surfaces shall have respectively the maximum specified dimensions, with a tolerance of $^{0}_{-0.01}$ mm. The mass of the gauge shall be such that it exerts a force equal to that specified in Table 19.

The pin is wiped free from grease, before the test, using a cold chemical degreaser.

The test pin with the maximum dimension(s) is inserted into and withdrawn from the earthing contact ten times. It is then inserted again and shall not remain in the contact assembly.

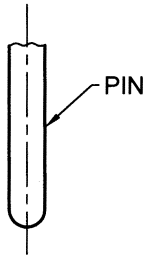
NOTES

1 The maximum specified dimension is the nominal plus the maximum tolerance.

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

22.2 Verification of Minimum Withdrawal Force

The test pin gauge, illustrated in Fig. 22, is applied to each individual contact with the socket-outlet or the plug held in such way that the gauge is hanging downwards.



NOTES

1 The mass should be equally positioned around the centreline(s) of the pin.

2 Dimensions according to the relevant standard sheet.

FIG. 22 GAUGE FOR THE VERIFICATION OF MINIMUM WITHDRAWAL FORCE

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 between 0.6 µm and 0.8 µm over its active length.

The diameter, for round pins, and the distance between contact surfaces, for other types of pins, shall have respectively the minimum specified dimensions, with a tolerance of and a length sufficient to make adequate contact with the contact assembly. The force of the gauge shall be equal to that specified in Table 19.

If the socket-outlet is intended to accept plugs having pins with different nominal dimensions the smallest appropriate one shall be used.

In this case, the rating of the accessory in Table 19 is the rating of the plug with the smallest dimensions for the pins.

NOTE — The minimum specified dimension is the nominal minus the maximum tolerance.

The pin is wiped free from grease, before each test, using a cold chemical degreaser.

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

The test pin gauge is 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 Rewirable plugs and rewirable portable socket-outlets shall be provided with a cord anchorage such that the conductors are relieved from strain, including twisting, when they are connected to the terminals or terminations, and that their covering is protected from abrasion.

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

Compliance is checked by inspection and by the test of **23.2**.

Non-rewirable plugs and non-rewirable portable socket-outlets shall be designed in such a way that the cable is maintained in position and the terminations are relieved from strain and twisting.

The sheath, if any, of the flexible cable shall be maintained inside the accessory.

Compliance is checked by the test of **23.2** and **23.4**.

23.2 The effectiveness of the retention of the cable by the cord anchorage is checked by the following test by means of an apparatus as shown in Fig. 23.

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 Table 1.

After reassembly of the specimen the component parts

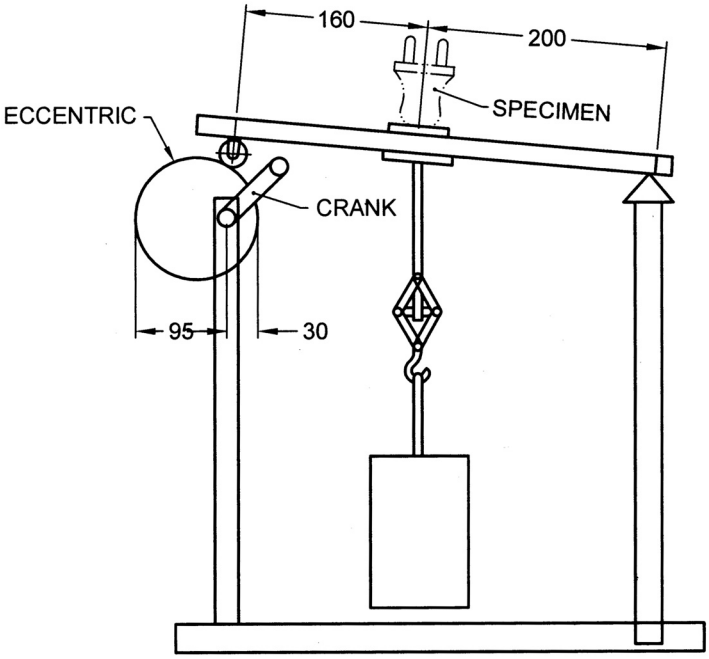


FIG. 23 APPARATUS FOR TESTING CORD RETENTION

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 flexible cable is vertical where it enters the sample.

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

a) 50 N, if the rated current is 2.5 A.
b) 60 N, if the rated current is above 2.5 A. but not more than 16 A and the rated voltage is up to and including 250 V.
c) 80 N, if the rated current is above 2.5 A, but not more than 16 A and the rated voltage is above 250 V.
d) 100 N, if the rated current greater than 16 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 (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 20.

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 having a rated current up to and including 16 A, it shall be checked by a manual test that they are suitable for fitting with the appropriate cable as shown in Table 21.

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 nominal cross-sectional areas of the conductors in relation to the rating of accessories are given in the relevant columns of Table 16.

NOTE — Table 16 also specifies the test currents for the test of temperature-rise and normal operation.

Flexible cables shall have the same number of conductors as there are poles in the plug or

Table 20 Torque Test Values for Cord Anchorage
(*Clause* 23.2)

Sl No.	Rating of Plug or Portable Socket-Outlet	Flexible (Number of Cores × Nominal Cross-Sectional Area in mm^2)				
		2 × 0.5	2 × 0.75	3 × 0.5	3. × 0.75	(2 or more) × 1 or greater
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to and including 16A and 250V	0.1 Nm	0.15 Nm	0.15 Nm	0.25 Nm	0.25 Nm

Table 21 Maximum Dimensions of Flexible Cables to be Accommodated by Rewirable Accessories
(*Clause* 23.2)

Sl No.	Rating of Accessory	Number of Poles[1)]	Types of Flexible Cable (Cable References)	Number of Conductors and Nominal Cross Sectional Area mm^2	Maximum Dimensions for Flexible Cables mm
(1)	(2)	(3)	(4)	(5)	(6)
i)	2.5A/6A Up to and including 250V [2)]	2	IS 9968 (Part 1)	2 × 0.75	8.0
		2	IS 694	2 × 0.75	5.2 × 7.6
ii)	2.5A/6A Up to and including 250V	2	IS 9968 (Part 1)	2 × 1	8.8
		3	IS 9968 (Part 1)	3 × 1	9.2
iii)	Above 6A up to and including 16A Up to and including 250V	3	IS 9968 (Part 1)	3 × 1.5	11.0

[1)] Earthing contacts, irrespective of their number, are considered as one pole.
[2)] Exclusively designed for flat and circular two conductor flexible cables.

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 the relevant parts of either IS 694 or IS 9968 (Part 1) as applicable.

23.4 Non-rewirable plugs and non-rewirable portable 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 flexible cable guards.

Compliance is checked by inspection and by a flexing test made by means of an apparatus as shown in Fig. 24.

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.

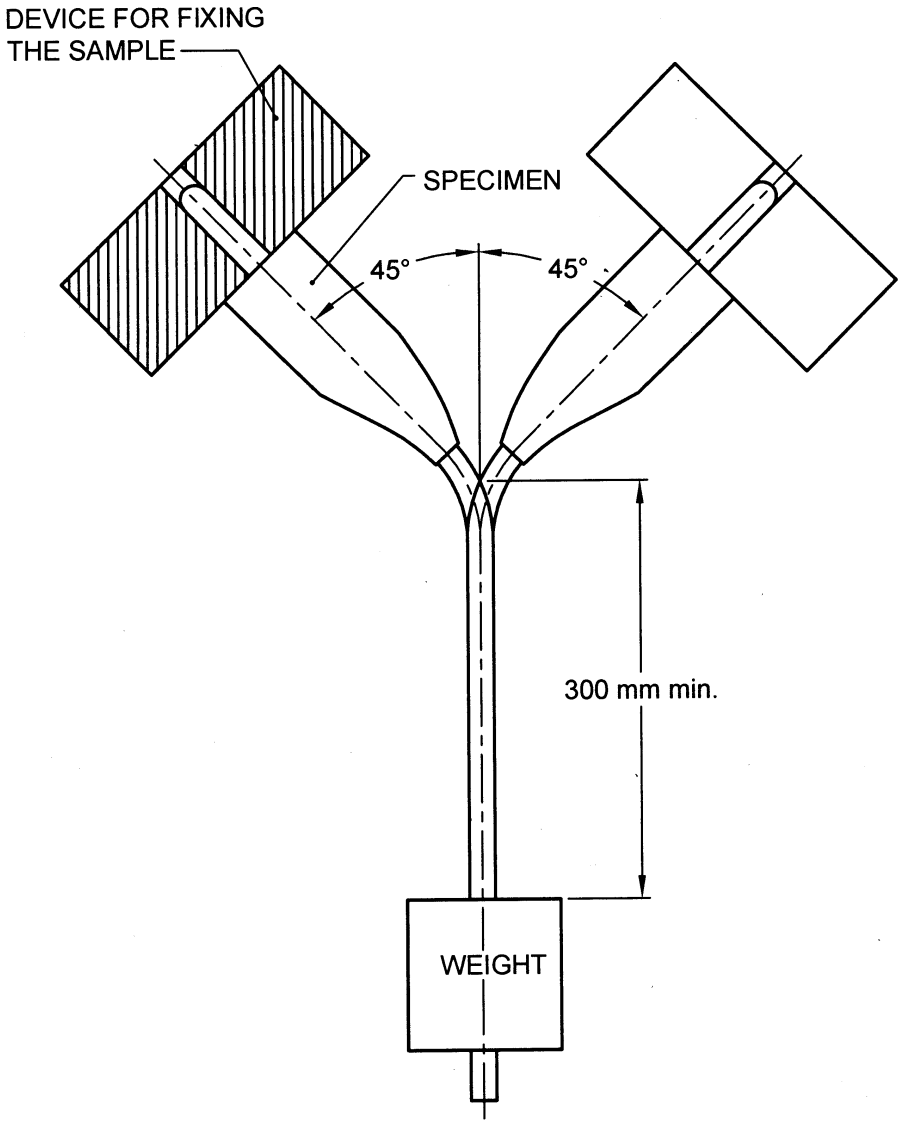
The accessory shall be fixed in the test apparatus in the following way,

a) Plugs: by the pins; and
b) Portable socket-outlet: at a distance of 4 mm to 5 mm 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



An adjustment of the different supports for the accessories by means of a threaded spindle shall be provided according to the explanation in **23.4**.

FIG. 24 APPARATUS FOR FLEXING TEST

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,

a) 20 N for accessories with flexible cables having a nominal cross-sectional area exceeding 0.75 mm^2; and
b) 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,

a) 16 A for accessories with flexible cables having a nominal cross-sectional area exceeding 0.75 mm^2; and
b) 6 A / 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/min.

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, screwed glands and shrouds shall have adequate mechanical strength so as to withstand the stresses imposed during installation and use.

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

a) For all kinds of fixed socket-outlets (*see* **24.1**).
b) for fixed socket-outlets with a main part intended to be mounted directly on a surface (*see* **24.3**).
c) For portable single socket-outlets:
   1) with enclosures, covers or bodies other than thermoplastic or elastomeric material (*see* **24.2**).
   2) with enclosures, covers or bodies of elastomeric or thermoplastic material (*see* **24.2**, **24.4** and **24.5**).
d) For portable multiple and combined socket outlets:
   1) with enclosures, covers or bodies other than thermoplastic or elastomeric material (*see* **24.1** and **24.9**).
   2) with enclosures, covers and bodies of elastomeric or thermoplastic material (*see* **24.2**, **24.4** and **24.5**).
e) For plug
   1) with enclosures, covers or bodies other than thermoplastic or elastomeric material (*see* **24.2** and **24.10**).
   2) with enclosures, covers and bodies of elastomeric or thermoplastic material (*see* **24.2**, **24.4**, **24.5** and **24.10**).
f) For screwed glands of accessories having an IP code higher than IP20 (*see* **24.6**).
g) For plug pins provided with insulating sleeves (*see* **24.7**).
h) For shuttered socket-outlets (*see* **24.8**).
j) For surface mounting boxes (*see* **24.1**).
k) For portable socket-outlets having means for suspension on a wall (*see* **24.11**, **24.12** and **24.13**).
m) For shroud of portable socket-outlets (*see* **24.19**).

24.1 The specimens are checked by applying blows by means of the pendulum hammer test apparatus as described in IS 9000 (Part 7/ Sec 7) (Test EHA), with an equivalent mass of 250 g.

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,

a) the specimen can be so placed that the point of impact lies in the vertical plane through the axis of the pivot;
b) the specimen can be removed horizontally and turned about an axis perpendicular to the surface of the plywood; and
c) 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 fibers 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 main parts

and covers are tightened with a torque equal to two-third of that specified in Table 1.

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 22.

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:

a) For parts A, five blows (*see* Fig. 25 A and Fig. 25 B):
   1) One blow to the centre;
   2) One blow on each of the two most unfavorable points between the centre and the edges after the specimen has been moved horizontally; and
   3) One blow on similar points, after the specimen has been turned 90° about its axis perpendicular to the plywood,

b) For parts B (as far as applicable), C and D four blows:
   1) One blow is applied on one of the sides of the specimen where the blow can be applied, after the plywood sheet has been turned 60° about a vertical axis (*see* Fig. 25 C); and
   2) One blow on the opposite side of the specimen where blows can be applied, after the plywood sheet has been turned 60° about a vertical axis, in the opposite direction (*see* Fig. 25 C).

c) After the specimen has been turned 90° about its axis perpendicular to the plywood sheet:
   1) One blow is applied on one of the sides of the specimen where the blow can be applied, after the plywood sheet has been turned 60° about a vertical axis (*see* Fig. 25 D); and
   2) One blow on the opposite side of the specimen where blows can be applied, after the plywood sheet has been turned 60° about a vertical axis in the opposite direction (*see* Fig. 25 D).

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, having an IP code higher than IPX0, the test is made with lids, if any, closed and in addition,

Table 22 Height of Fall for Impact Tests
(*Clause* 24.1)

Sl No.	Height of Fall mm	Parts of Enclosures to be Subjected to the Impact [1)]	
		Accessories Having an IP Code IPX0	Accessories Having an IP Code Higher than IPX0
(1)	(2)	(3)	(4)
i)	80	A and B	–
ii)	120	C	A and B
iii)	160	D	C
iv)	200	–	D

[1)] A Parts on the front surface, including the parts which are recessed.

B Parts which do not project more than 15mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exceptions of the above part A.

C Parts which project more than 15mm and not more than 25mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exceptions of the above part A.

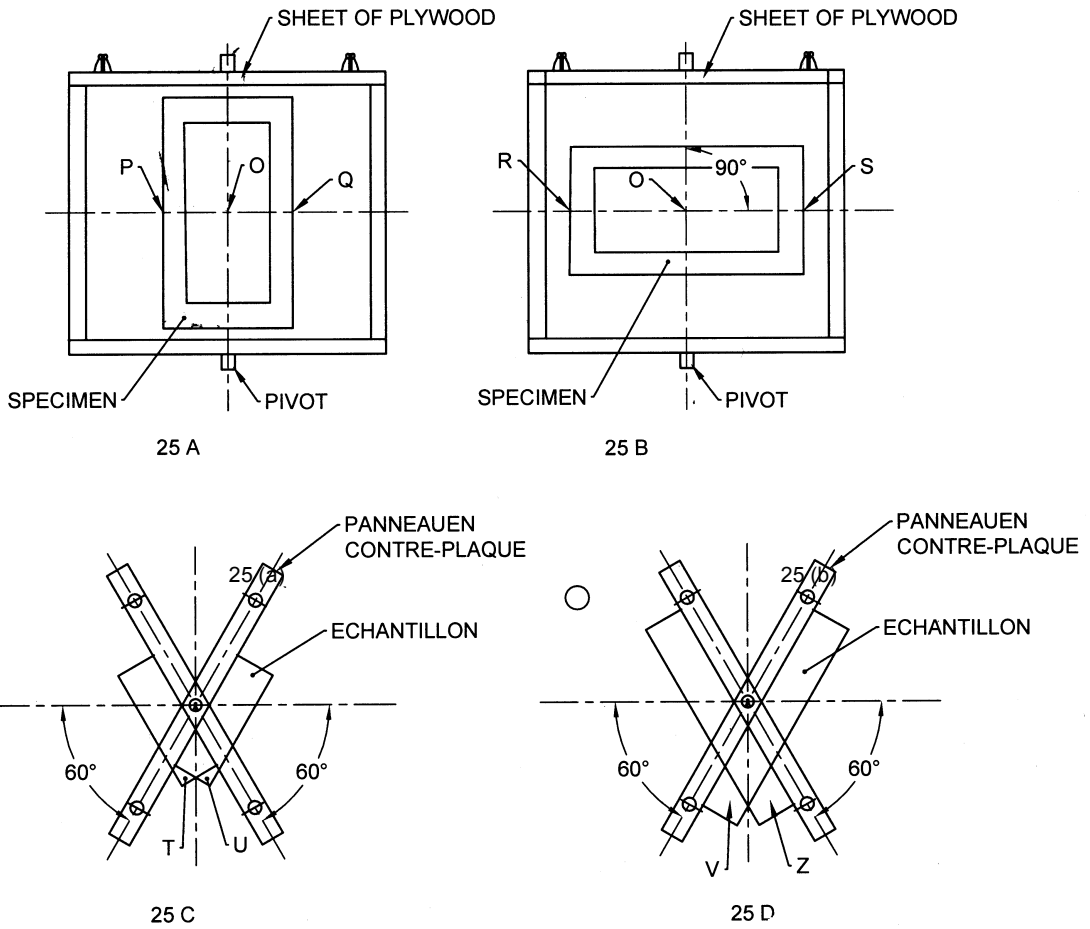
D Parts which project more than 25mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exceptions of the above part A.

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,

a) the test probe B of IS 1401 under the conditions stated in **10.1**;
b) the test probe B of IS 1401 under the conditions stated in **10.1**, but with a force of 10 N; and
c) the steel wire of Fig. 10, applied with a force



Sketch	*Application of the Blows*		Parts to be Tested
	Total Number of Blows	Points of Application	
25 (a)	3	One of the centre One between O and P[1)] One between O and Q[1)]	A
25 (b)	2	One between O and R[1)] One between O and S[1)]	A
25 (c)	2	One on the surface T[1)] One on the surface U[1)]	B, C and D
25 (d)	2	One on the surface V[1)] One on the surface Z[1)]	B, C and D

[1)] The blow is applied to the most unfavourable point.

FIG. 25 SKETCHES SHOWING THE APPLICATION OF THE BLOWS ACCORDING TO TABLE 22

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.

Cracks not visible with the normal or corrected vision, without additional magnification, and surface cracks in fiber 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.

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.

24.2 The specimens are tested in a tumbling barrel as shown in Fig. 26.

Rewirable accessories are fitted with the flexible cables specified in **23.2** having the smallest nominal cross-sectional area specified in Table 4 and a free length of approximately 100 mm measured from the outer end of the guard.

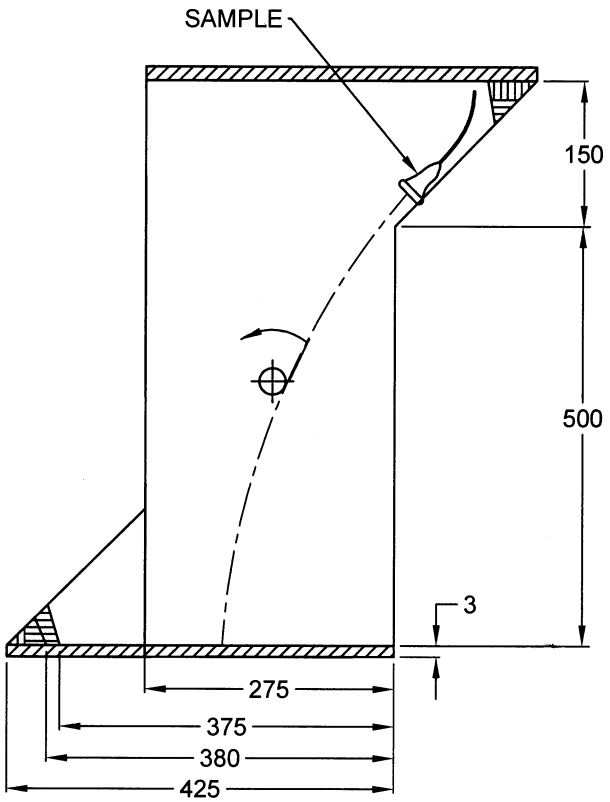
Terminal screws and assembly screws are tightened with a torque equal to two-thirds of the specified in Table 1.

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.

The specimens are individually subjected to the test Ec: Rough handling shocks, primarily for equipment-type specimens, procedure 2 of IEC 60068-2-31 the number of falls being:

a) 1 000, if the mass of the specimen without flexible cable does not exceed 100 g;
b) 500, if the mass of the specimen without flexible cable exceed 100 g. but does not exceed 200 g; and
c) 100, if the mass of the specimen without flexible cable exceeds 200 g.

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



All dimensions in millimetres.

The axial length of the tumbling barrel, on the inside is 275 mm.

FIG. 26 TUMBLING BARREL

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

1) no part shall have become detached or loosened;
2) 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 B and also fails to comply with the requirements of **9.1** and **10.3**; and
3) the pins shall not turn when a torque of 0.4 Nm is applied, first in one direction for 1min and then in the opposite direction for 1 min.

The shutters of socket-outlets shall be tested again according to **21.1**, from paragraph 18 up to paragraph 23 (only the test of shutters).

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 The main parts of 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 of the base 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 main parts of socket-outlets are then fixed in a similar manner to a flat steel sheet.

During and after the tests, the main parts of 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. 27. The apparatus on a pad of sponge rubber, 40 mm thick is placed together with the specimen in a freezer at a temperature of -15 ± 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. 27, and the falling weight is allowed to fall from a height of 100 mm. The mass of the falling weight is 1 000 ± 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. 8 the temperature of the pressure plate, of the base and of the samples being 27 ± 2°C and the force applied being 300 N.

The specimens are first placed in the position (a) shown in Fig. 8, and the force is applied for 1min. They are then placed in the position (b) shown in Fig. 8 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 millimeters, of the packing.

The glands are then tightened by means of a suitable spanner, the torque shown in Table 23 being applied to the spanner for 1 min.

Table 23 Torque Test Values for Glands
(*Clause* 24.6)

Sl No.	**Diameter of Test Rod** mm	**Torque** Nm	
		Metal Glands	Glands of Moulded Material
(1)	(2)	(3)	(4)
i)	Up to and including 14	6.25	3.75
ii)	Above 14, up to and	7.5	5.0
iii)	including 20	10.0	7.5
	Above 20		

After the test, the glands and the enclosures of the 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. 28.

The test apparatus comprises a horizontally disposed beam, which is pivoted about its centre point. A short length of steel wire, 1mm 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

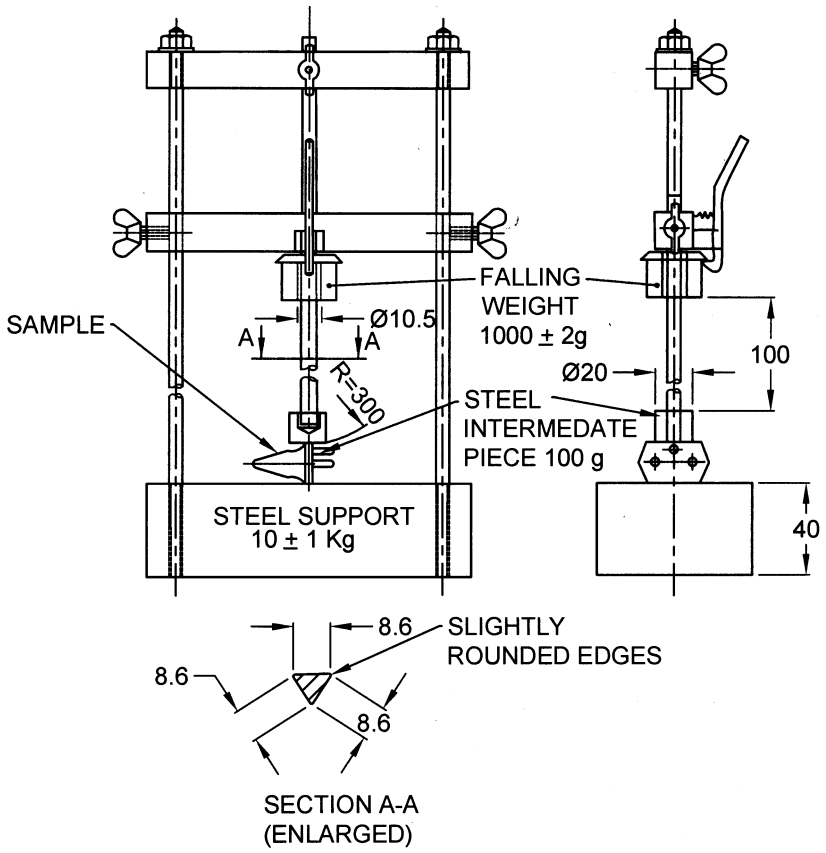


FIG. 27 APPARATUS FOR IMPACT TEST AT LOW TEMPERATURE

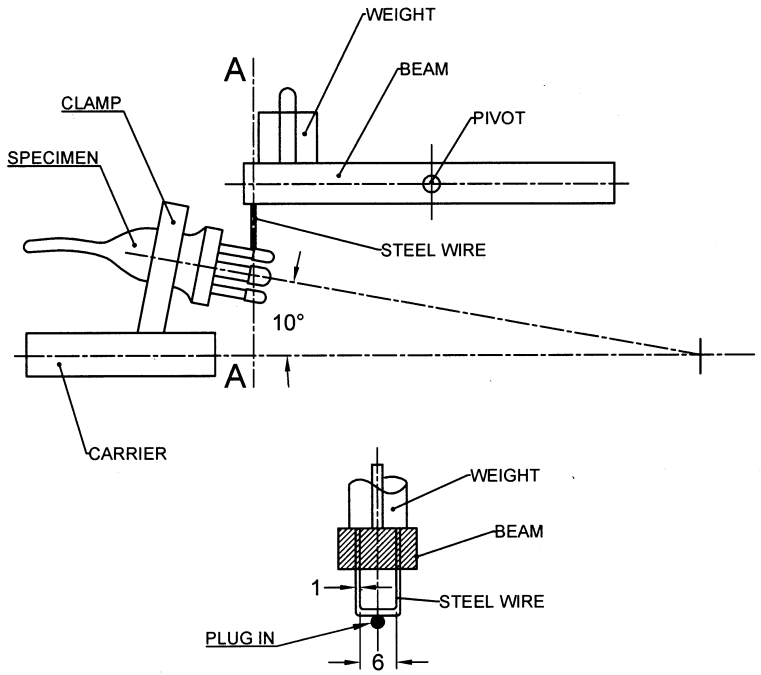


FIG. 28 APPARATUS FOR ABRASION TEST ON INSULATING SLEEVES OF PLUG PINS

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 nominal cross-sectional area specified in Table 4.

The free end of the cable is fixed to a wall at a height of 750 mm above the floor, as shown in Fig. 29.

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 flexible cable being rotated through 45° at its fixing after each fall.

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 IP code higher than IPX0 ones shall be submitted again to the relevant test as specified in **16.2**.

The shutters of socket-outlets shall be tested again according to **21** and **23** (only the test of shutters).

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

24.10. The test is made on a new sample.

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. 30.

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

Each hole shall have a diameter equal to that of the circle circumscribed around the cross-sectional area of the pin plus 6 ± 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 P equal to the maximum withdrawal force as given in Table 19 is applied, without jerks, for 1 min on 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, 1 h 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 it shall be verified that no pin shall have been displaced in the body of the plug more than 1 mm.

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 unfavorable position, for 10 s against the barrier, the force being equal to 1.5 times the maximum plug withdrawal force (as specified in **22.2**, Table 19).

The rod shall not pierce the barrier.

24.12 The portable socket-outlet mounted with an appropriate flexible cable is suspended on the wall as

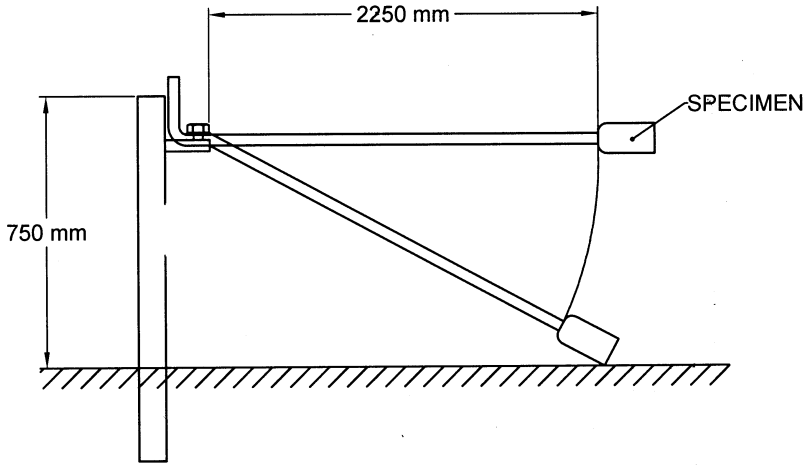
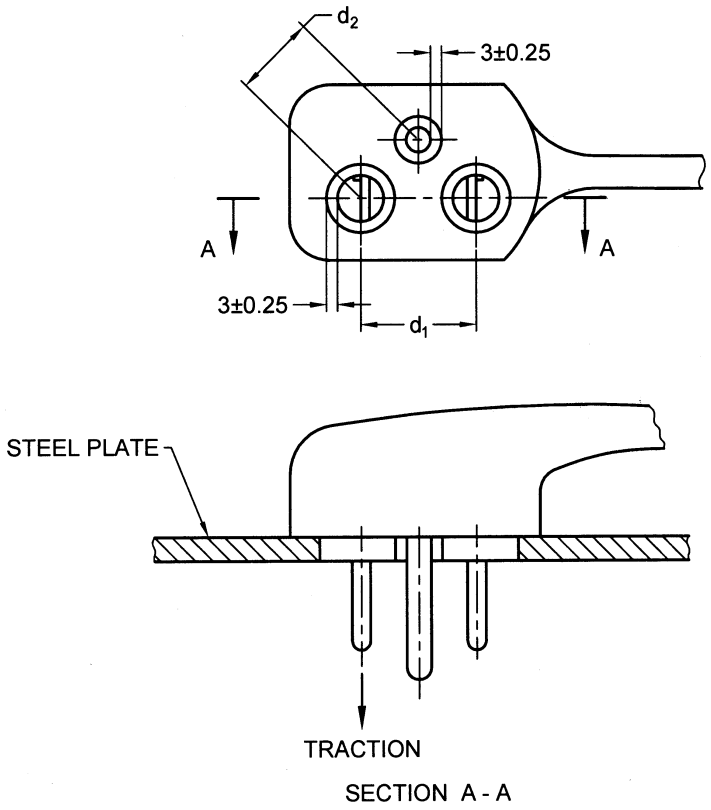


FIG. 29 ARRANGEMENT FOR MECHANICAL STRENGTH TEST ON MULTIPLE PORTABLE SOCKET-OUTLETS



Key
P Traction

FIG. 30 EXAMPLE OF TEST ARRANGEMENT TO VERIFY THE FIXATION OF PINS IN THE BODY OF THE PLUG

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 flexible cable anchorage is applied, in the most unfavourable position, to the flexible cable for 10s.

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 19 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 accessible to the test probe B of IS 1401.

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 of suspension exist

24.14 When testing the forces necessary to retain or remove covers, cover-plates, or parts of them, the accessories 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.

Plugs and portable socket-outlets are fixed in a suitable manner so that the force can be applied to the cover, cover-plates or parts of them.

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.

For fixed socket-outlets, compliance is then checked according to **24.14.1** and **24.14.2** (*see* **13.7.2**).

For plugs and portable socket-outlets compliance is checked according to **24.14.3**.

24.14.1 *Verification of the Retention 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,

a) 40 N, for covers, cover-plates or parts of them complying with the tests of **24.17** and **24.18**; or
b) 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. 31.

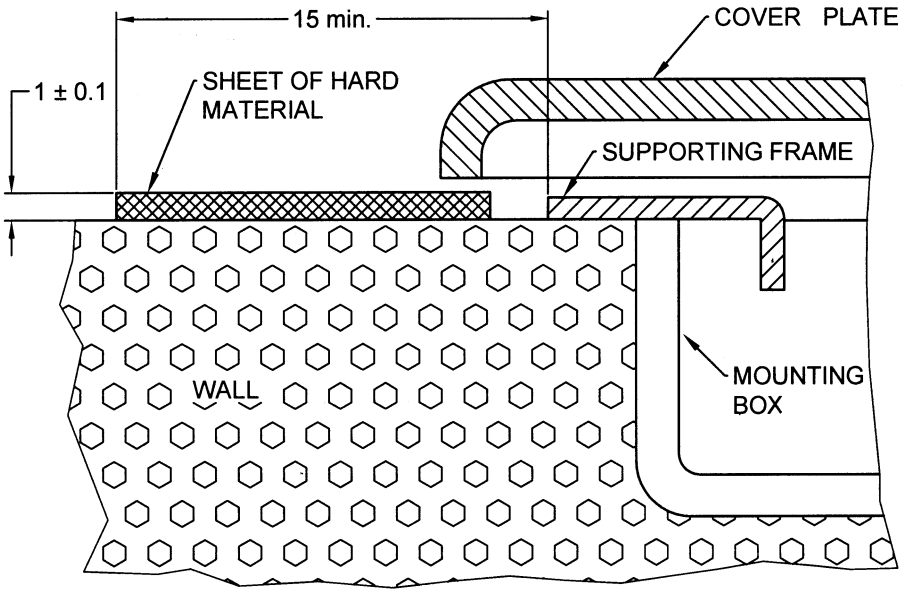
After the test the specimens shall show no damage within the meaning of this standard.

NOTE — The sheet of hard material is used to simulate wall paper and may consist of a number of pieces.

24.14.2 *Verification of the Removal 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.



All dimensions in millimetres.

FIG 31. ARRANGEMENT FOR TEST ON COVERS OR COVER-PLATES

The test is made 10 times to each separable part, the fixing of which is not dependent on screws, the removal force is applied each time to the different grooves, holes or the like provided for removing the separable part equally distributing as far as practicable the application points.

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 ± 0.1 mm thick, has been fitted around the supporting frame, as shown in Fig. 31.

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

24.14.3 For plugs and portable socket-outlets, a force is gradually applied until 80N is achieved and maintained for 1 min, to covers, cover-plates or parts of them while the other parts of the accessory are fixed.

The test shall be carried out in the most unfavourable conditions.

During the test the covers, cover-plates or parts of them shall not come off.

The test is then repeated with a force of 120 N.

a) For rewirable plugs and rewirable portable socket-outlets the cover, the cover-plate or parts of them may come off during the test but the specimen shall show no damage within the meaning of this standard.
b) For non-rewirable, non moulded-on accessories, during the test, the cover, the coverplate or parts of them may come off but the accessories shall be permanently useless (*see* **14.1**).

24.15 The test is made as described in **24.14**, but applying, for **24.14.1**, the following forces:

a) 10 N, for covers or cover-plates complying with the test of **24.17** and **24.18**.
b) 20 N, for other covers or cover-plates.

24.16 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. 32 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. 33. 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. 34).

24.18 A gauge according to Fig. 35, applied with a force of 1.0 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. 36.

NOTE — Verification as to whether the gauge according to Fig. 31 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.

24.19 The shrouds of portable socket-outlets are subjected to a compression test at an ambient temperature of 25 ± 5°C in an apparatus similar to that shown in Fig. 37.

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 specimens are clamped in such a way that the front face of the jaws coincides with the front face of the shroud.

The force applied through the jaws is 20 ± 2 N.

After 1 min, and while the shrouds are still under pressure, the dimensions shall comply with the appropriate standard sheet.

The test is repeated with the specimen rotated 90°.

25 RESISTANCE TO HEAT

Accessories and surface mounting boxes shall be resistant to heat.

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

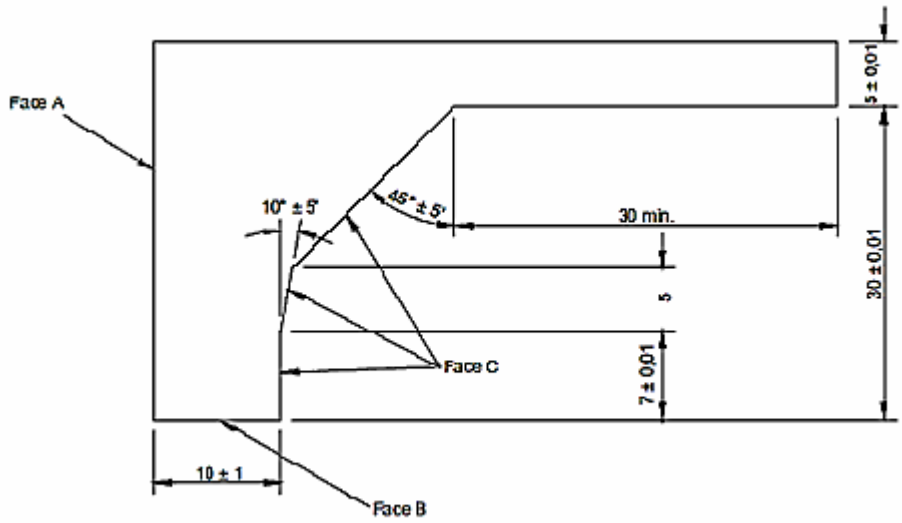


FIG. 32 GAUGE (THICKNESS ABOUT 2 MM) FOR THE VERIFICATION OF THE OUTLINE OF COVERS OR COVER-PLATES

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 probe B of IS 1401 is applied with a force not exceeding 5 N.

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, as well as 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. 38, except that insulating parts necessary to retain the earthing terminal in position in a box, shall be tested as specified in **25.3**.

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 the hemispherical tip of the test equipment 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 1h, the ball shall be removed from the specimen, which is then immersed, in cold water for cooling down within l 0 s, to approximately room temperature.

The diameter of the impression caused by the ball is measured and shall not exceed 2 mm.

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 which is cut out of a new set of aged specimens If this is not possible, up to and including four layers, each cut out of the same specimen may be used, in which case the total thickness of the layers shall be not less than 2.5 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. 37, 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.

Table 24 Resistance to Heat of Different Types or Parts of Accessories
(*Clauses* 25.1, 25.2, 25.3 *and* 25.4)

Sl No.	Specimen	Test According to 25.1	Test According to 25.2	Test According to 25.3	Test According to 25.4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Surface-mounting boxes, separable covers, separable cover-plates and separable frames with the exception of parts of the front surface zone of thermoplastic material of 2 mm width surrounding the phase and neutral pin entry holes	–	–	X	–
ii)	Portable accessories with the exception of the partscovered by A	X	X	X	X
iii)	Portable accessories made of natural or synthetic rubber or a mixture of both or PVC	X	X	–	X
iv)	Fixed socket-outlets with the exception of the parts covered by A	X	X	X	–
v)	Fixed socket-outlets made of natural or synthetic rubber or a mixture of both	X	X	–	–

X : Test applicable.
– : Test not applicable.

The comers 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 screws or thread-cutting 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,

a) 10 times for screws in engagement with a thread of insulating material and for screws of insulating material.
b) 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 Table 1.

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 main part of a fixed socket-outlet.

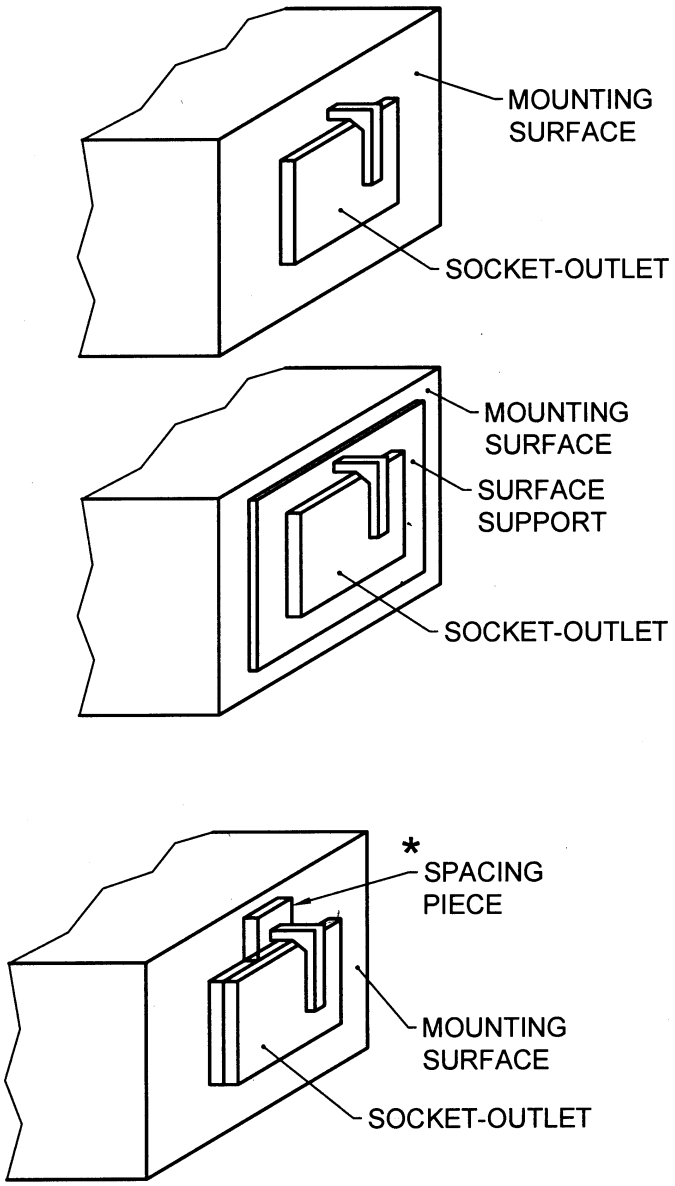
2 The shape of the blade of the screwdriver used for the test must match the head of the screw to be tested. The screws and nuts must not be tightened in jerks. Damage to covers is ignored.

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.



* Spacing piece having the same thickness as that of the supporting part.

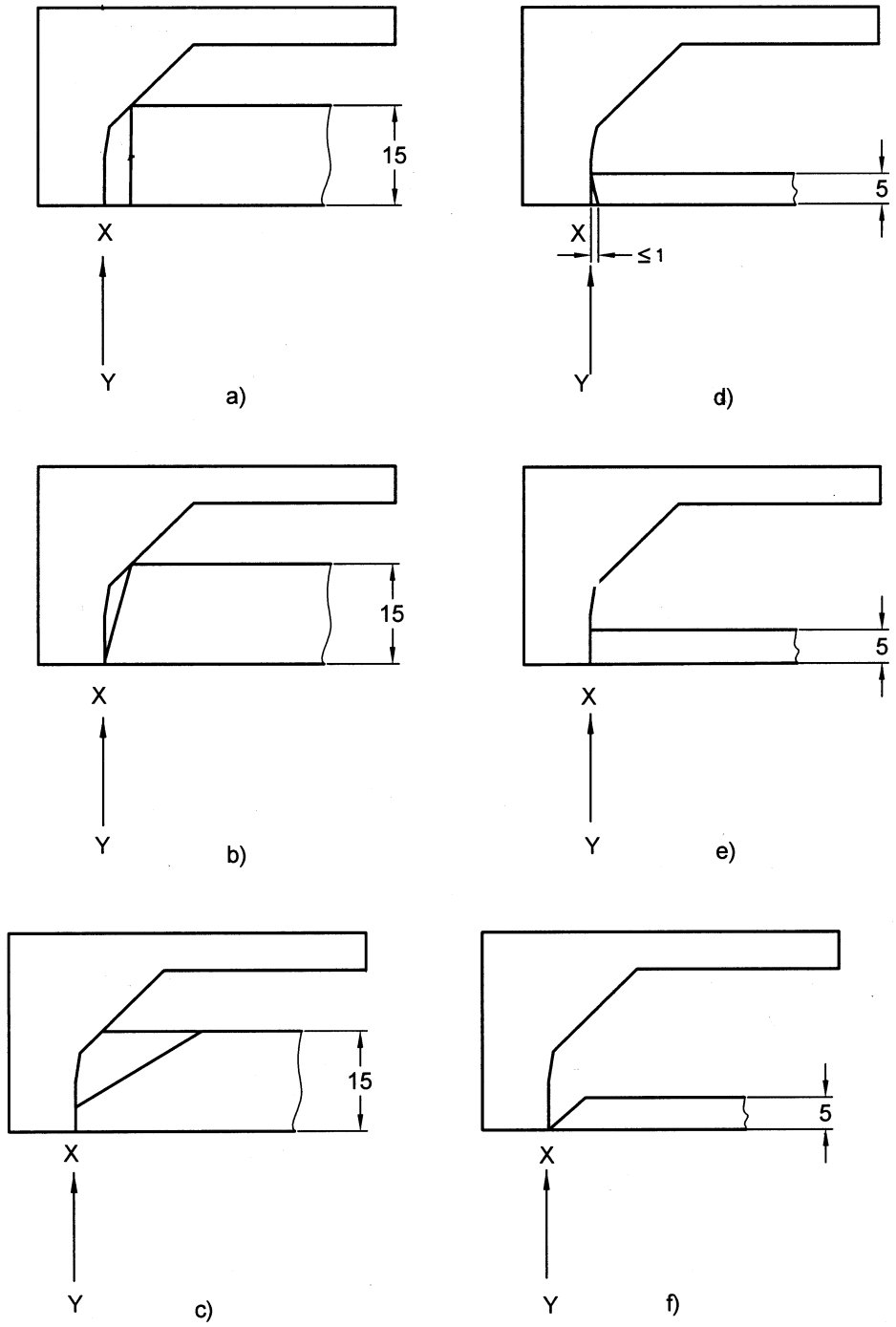
FIG. 33 EXAMPLES OF APPLICATION OF THE GAUGE OF FIG. 29 ON COVERS FIXED WITHOUT SCREWS ON A MOUNTING SURFACE OR SUPPORTING SURFACE

26.3 Electrical connections 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.



Cases a) and b) do not comply.
Cases c), d), e) and f) comply (compliance shall, however, also be checked with the requirements of **24.18**, using the gauge shown in Fig. 35).

FIG. 34 EXAMPLES OF APPLICATION OF THE GAUGE OF FIG. 29 IN ACCORDANCE WITH THE REQUIREMENTS

NOTE — The suitability of the material is considered in respect of the stability of the dimensions.

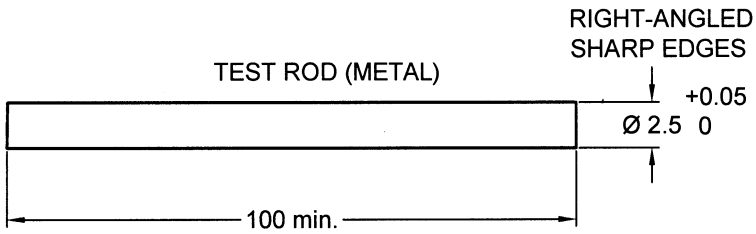
26.4 Screws and rivets, which serve as electrical as well as mechanical connections, shall be locked against loosening and/or turning.

Compliance is checked by inspection and manual test.

NOTES

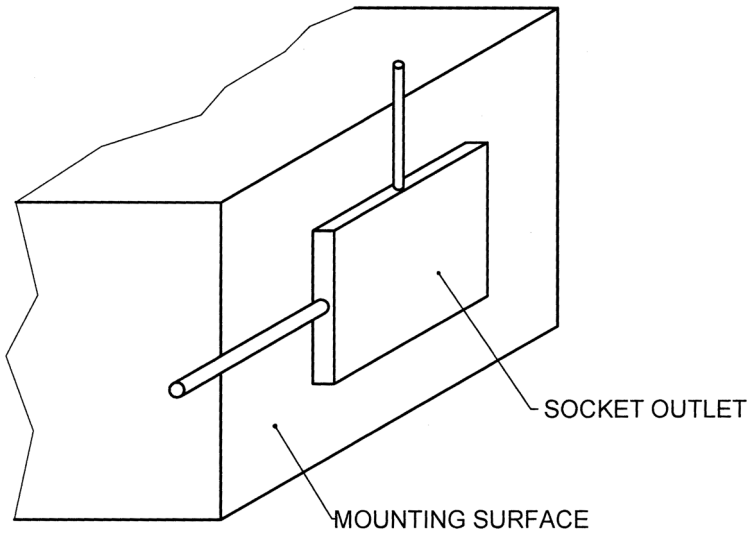
1 Spring washers may provide satisfactory locking.

2 For rivets, a non-circular shank or an appropriate notch may be sufficient.



All dimensions in millimetres.

FIG. 35 GAUGE FOR VERIFICATION OF GROOVES, HOLES AND REVERSE TAPERS



All dimensions in millimetres.

FIG. 36 SKETCH SHOWING THE DIRECTION OF APPLICATION OF THE GAUGE OF FIG. 35

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:

a) Copper

NOTE — The requirement of copper used for current carrying parts are given in IS 14340.

b) An alloy containing at least 58 percent copper for parts made from cold rolled sheet or at least 50 percent copper for other parts.

c) Stainless steel containing at least 13 percent chromium and not more than 0.09 percent carbon;

Under moist conditions, metals showing a great difference of electro- mechanical potential with respect to each other shall not be used in contact with each other.

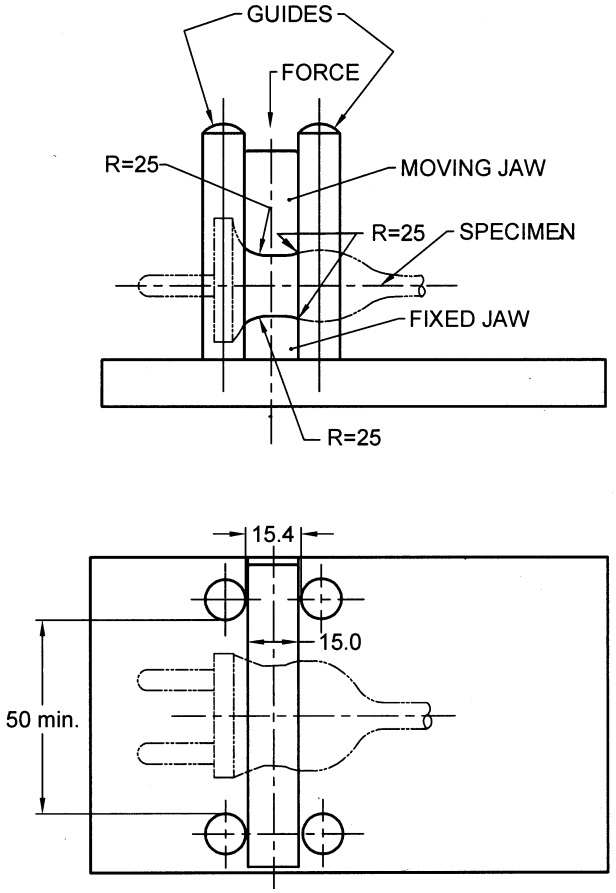
Compliance is checked by a test, which is under consideration.

NOTE — The requirement of this sub-clause does not apply to screws, 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



All dimensions in millimetres.

FIG. 37 APPARATUS FOR COMPRESSION TEST FOR THE VERIFICATION OF RESISTANCE TO HEAT

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 5.

Compliance is checked by measurement.

For rewirable accessories, the measurements are made on the specimen fitted with conductors of the largest nominal cross-sectional area specified in Table 4, and also without conductors.

The conductor shall be inserted into the terminal and connected in such a way that the core insulation touches the metal part of the clamping unit or, where 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 using a 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 test probe 11 of IS 1401, but is not pressed into openings.

For surface-type socket-outlets classified IP20 according to IS/IEC 60529 the most unfavorable conduit or cable is introduced for a distance of 1mm 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 unfavorable position.

NOTES

1 The contribution to the creepage distance of any groove less than 1 mrn wide is limited to its width.

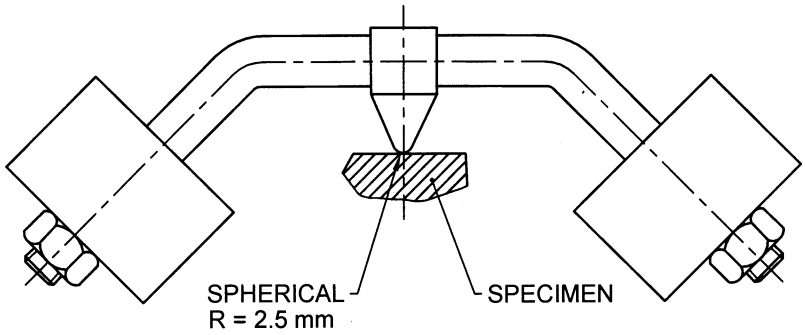


FIG. 38 BALL PRESSURE TEST APPARATUS

2 Any air gap less than 1 mm wide is ignored in computing the total clearance.

3 The surface on which the main part of a socket-outlet for surface mounting is mounted includes any surface in contact with the main part when the socket-outlet is installed. If the main part is provided with a metal plate at the back, this plate is not regarded as the mounting surface.

27.2 Insulating sealing compound shall not protrude above the edge of the cavity in which it is contained.

27.3 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:

a) 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 850°C, with the exception of parts of insulating material needed to retain the earth terminal in position in a box, which shall be tested at a temperature of 650 °C;

NOTE — Side earthing contacts fixed to the base of the socket-outlet are not considered to be retained in position by a removable cover when the plug is not inserted.

b) 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; and

c) 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.

A current-carrying part or a part of the earthing circuit retained by mechanical means is considered to be retained in position. The use of grease or the like is not considered to be a mechanical means.

External conductors cannot be considered as retaining the current-carrying parts.

In case of doubt, to determine whether an insulating material is necessary to retain current carrying parts and parts of the earthing circuit in position, the accessory is examined without conductors while held in positions most likely to cause displacement of the current-carrying parts or parts of the earthing circuit with the insulating material in question removed.

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, where each surface lies completely within a circle of 15 mm diameter, or where any part of the surface lies outside a 15 mm diameter circle and where it is not possible to fit a circle of 8 mm diameter on any of the surfaces, are not subjected to the test of this sub clause (*see* Fig. 37 for diagrammatic representation).

NOTE — When checking a surface, projections on the surfaces and holes which are not greater than 2 mm on the largest dimension are disregarded.

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 bum 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 unfavorable 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,

a) there is no visible flame and no sustained glowing; or if
b) flames and glowing at 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.

NOTE — If the material to be tested is not accessible due to the presence of moulded-on material, the moulded-on material should be removed to gain access. Alternatively, the manufacturer may provide the product as separate components and drawings to allow material retaining in position the current carrying parts to be tested.

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. 39.

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 a distance 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. 39.

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 B; 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 unfavorable 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 and 180 ± 5°C for accessories having a higher current rating.

The temperature is maintained at the relevant 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 subject to a visual inspection.

NOTE — During the visual inspection, no cracks on the insulating sleeves shall be visible with the normal o r 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 IP code higher than IPX0 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.

A flat surface of the part to be tested, If possible at least 15 × 15 mm, is placed in a horizontal position.

The material under test shall pass a tracking index of 175 V using test solution A with the interval between drops 30 ± 5s.

No flashover or breakdown between electrodes shall occur before a total of 50 drops has fallen.

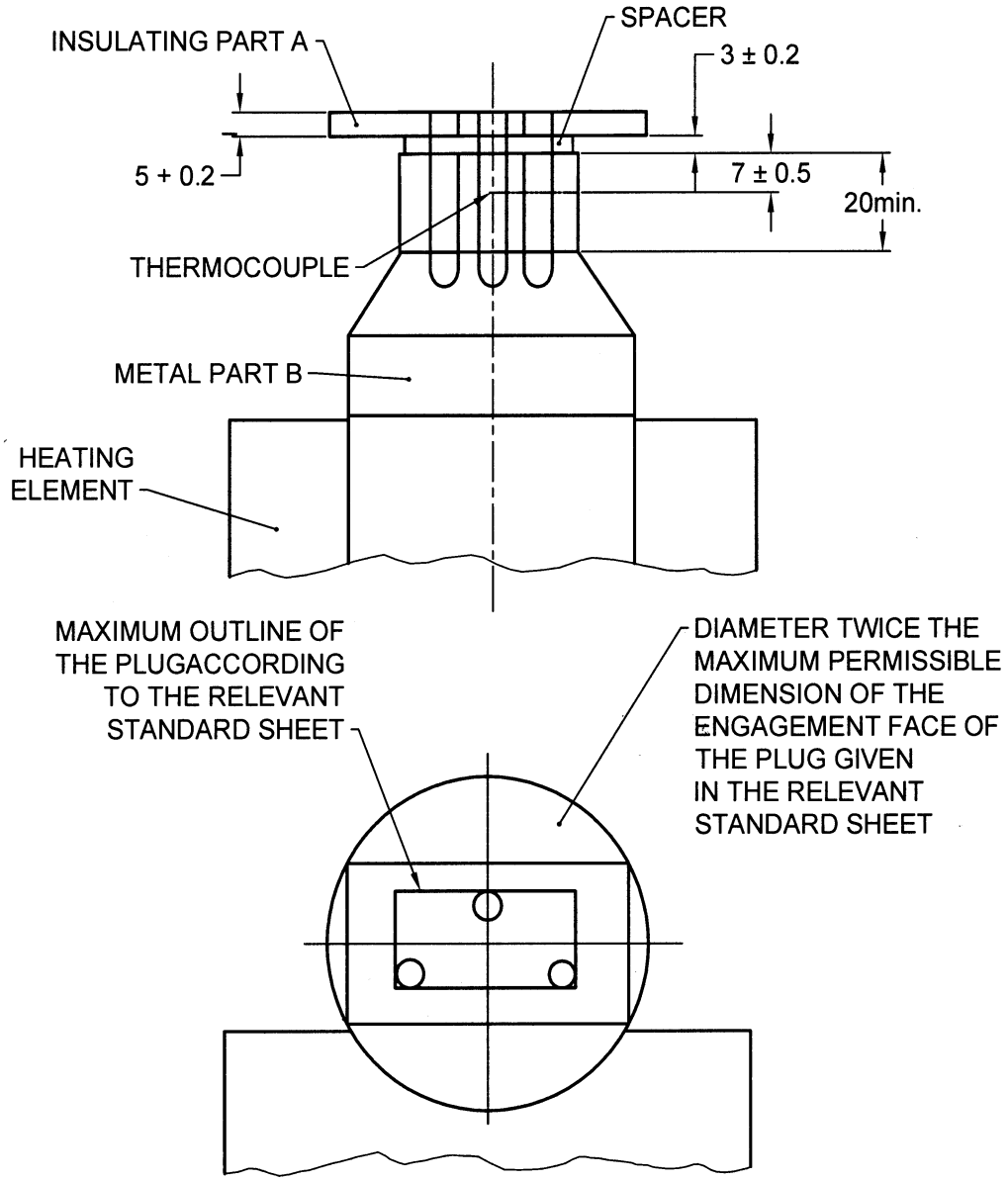


FIG. 39 APPARATUS FOR TESTING RESISTANCE TO ABNORMAL HEAT OF INSULATING SLEEVES OF PLUG PINS

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 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 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. 40. This apparatus has a rectangular blade with an edge 0.7 mm wide, to be used in the case of round pins.

The specimens are placed in position as shown in Fig. 40.

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 regaining to ambient temperature, the specimens are submitted to the following tests:

a) Insulation resistance and electric strength test in accordance with **17**; and
b) Abrasion test, in accordance with **24.7**.

30.3 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:

a) Insulation resistance and electric strength test, in accordance with **17**; and
b) Abrasion test, in accordance with **24.7**.

30.4 Impact Test at Low Temperature

The specimens are subjected to an impact test by means of the apparatus as shown in Fig. 41. 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 freezer 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. 41 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.

After the test, the specimens are allowed to attain approximately room temperature and are then examined.

No cracks of the insulating sleeves shall be visible with the normal or corrected vision without additional

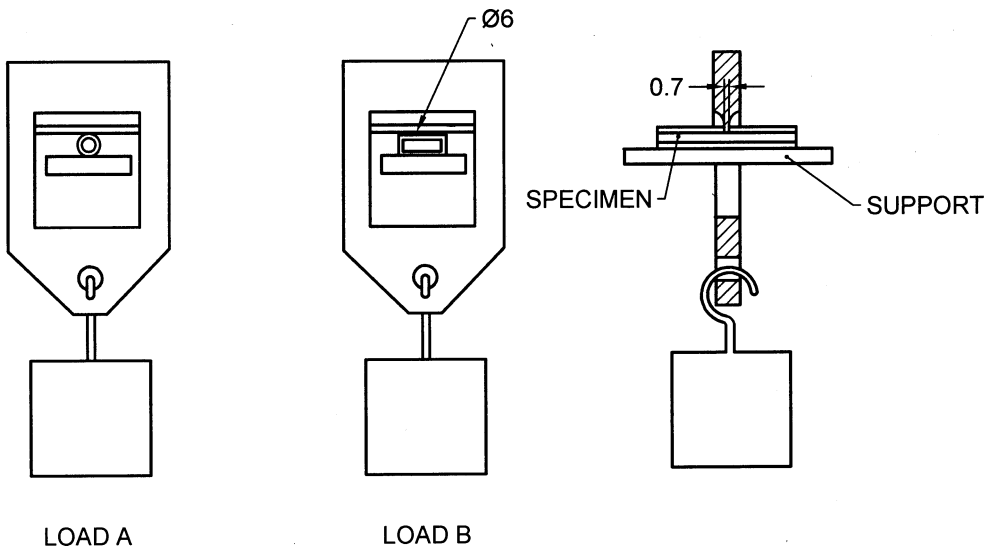
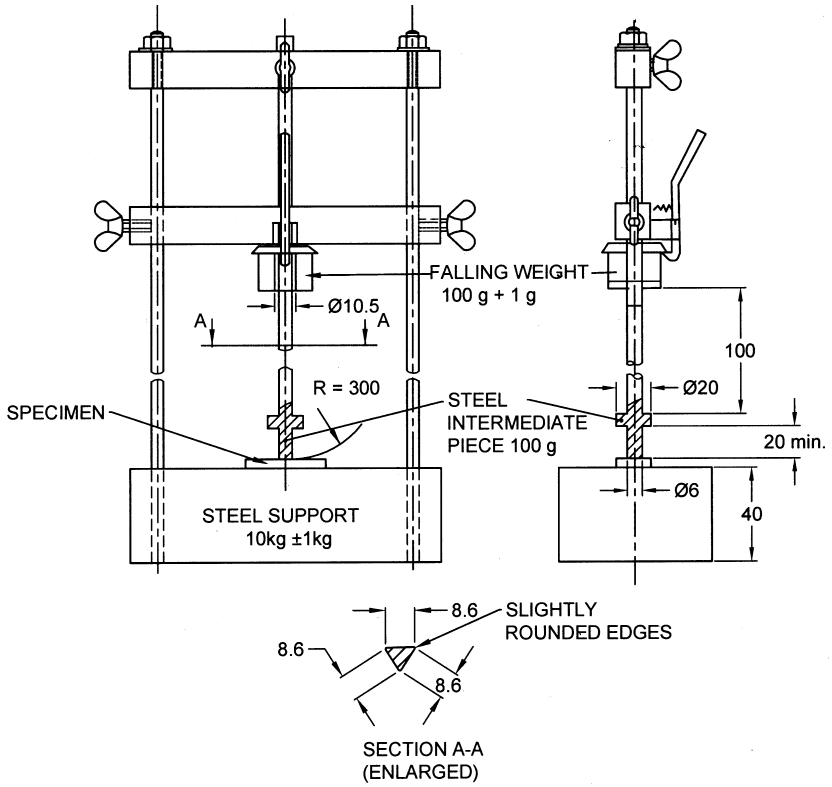


FIG. 40 APPARATUS FOR PRESSURE TEST AT HIGH TEMPERATURE



All dimensions in millimetres.

FIG. 41 IMPACT TEST APPARATUS ON PINS PROVIDED WITH INSULATING SLEEVES

magnification.

NOTE — 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.

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 (s*ee* **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 (s*ee* **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 harmful ingress of water and to humidity (*see* **16.2** and **16.3**);
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 F.

31.3 Routine Tests

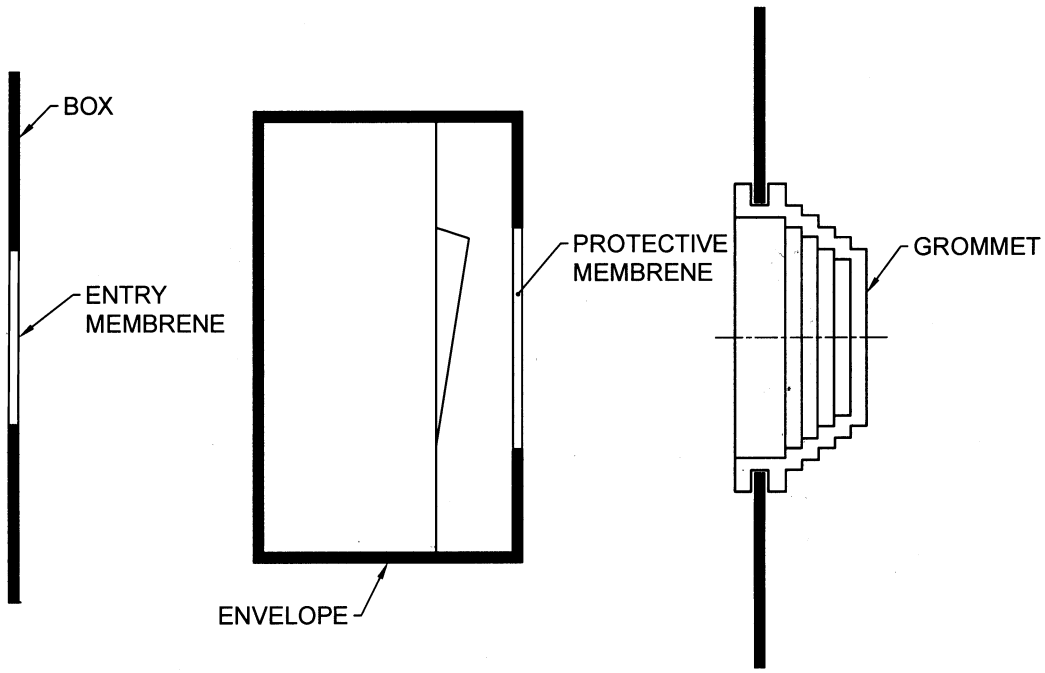
The following shall constitute routine tests:

a) Marking (*see* **8**); and
b) Electric strength (Flash test) (*see* **17.3**).

ANNEX A

(*Clauses* 3.35 *and* 3.36)

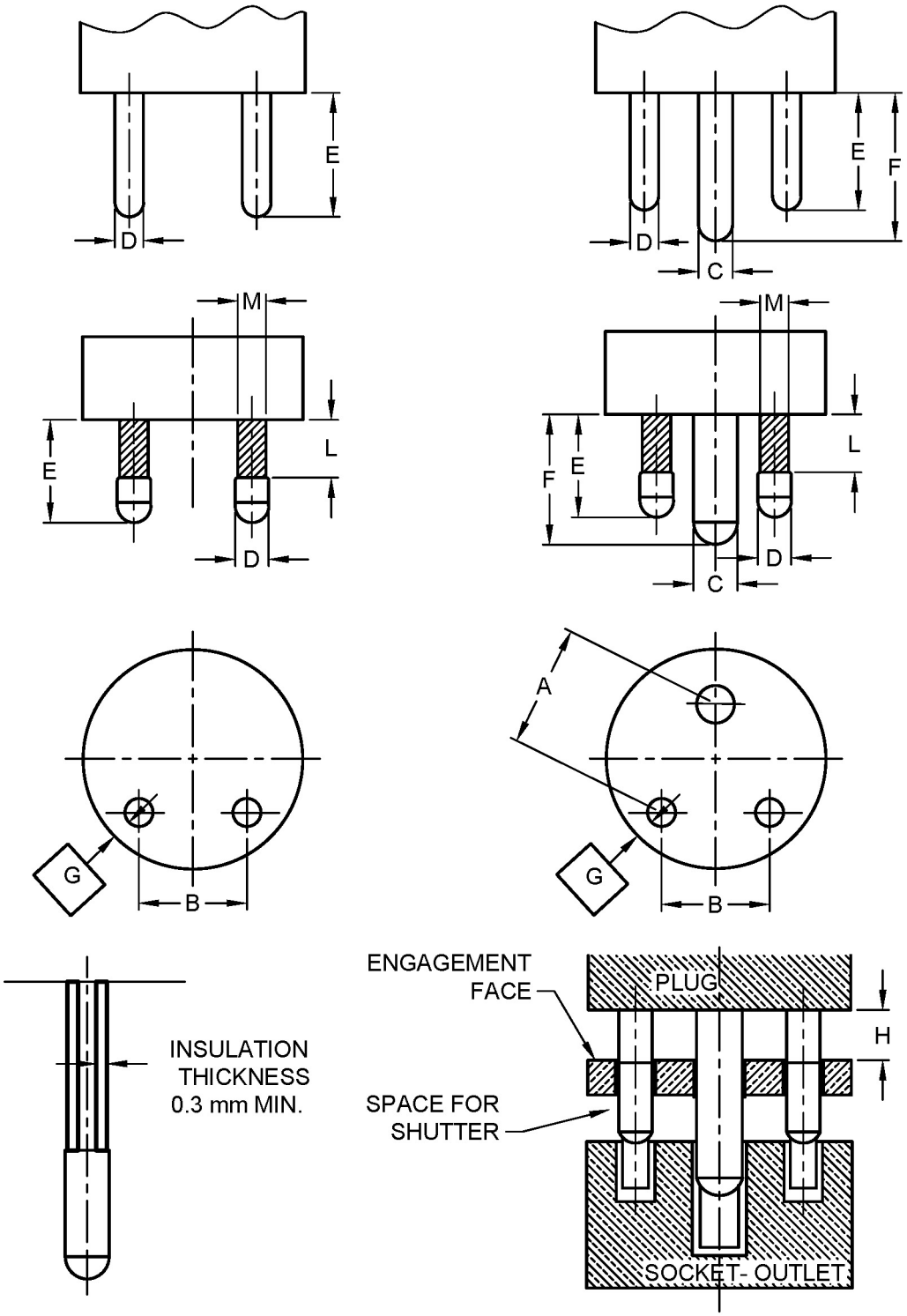
EXAMPLES OF MEMBRANES AND GROMMETS



ANNEX B

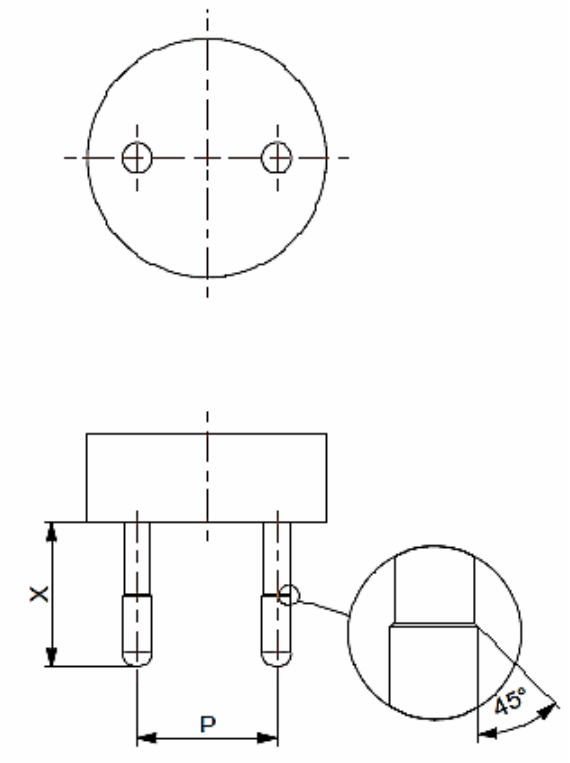
(*Clauses* 9.1)

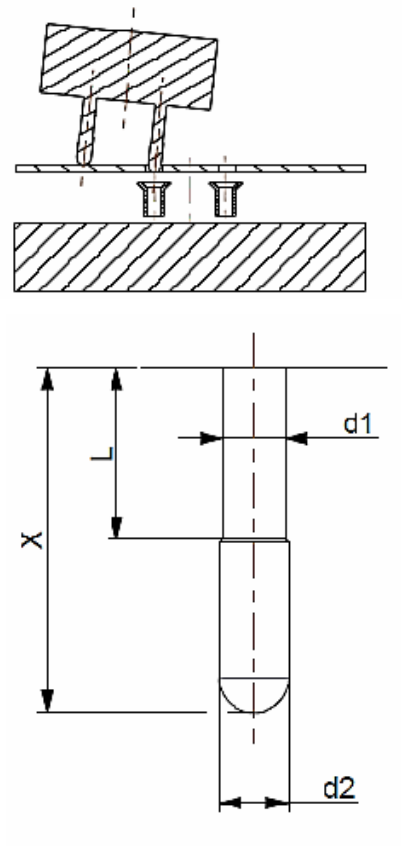
DIMENSIONS OF PLUGS AND SOCKET-OUTLETS



	Rating					
	2.5 A mm		6A mm		16A mm	
(1)	(2)		(3)		(4)	
A	–		22.2 ± 0.15		28.6 ± 0.15	
B	19.10 ± 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	7.06	+ 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[1)], *Min*	7.94		7.94		9.52	
H	5.16 to 7.54		5.16 to 7.54		6.76 to 9.12	
L	7.5				9	
M	4.58 *Max*				6.56 *Max*	

NOTES
H = distance between the base of plug and socket outlets at position of first contact of live pins.
[1)] 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.
L = Insulation length of current–carrying plug pins.
M = Diameter of current –carrying plug pin with insulation.





Gauge for checking impossibility of single-pole insertion of plugs into two-pole socket-outlets 2.5A, 6A, 250 V

	Rating		
	2.5 A mm	6 A mm	16A mm
(1)	(2)	(3)	(4)
X	19.1	19.1	25.4
d 1	4.58	4.58	6.56
d 2	5.08	5.08	7.06
P	19.1 ± 0.15	19.1 ± 0.15	25.4 ± 0.15

The total mass of the gauge is 200 ± 5 g. It is made of hard corrosion resistant metal providing sufficient rigidity (e.g. stainless steel).

The test is made with the engagement face of the socket-outlet being horizontal. The gauge is applied under its own mass in any conceivable position.

It shall not be possible to touch a socket-contact assembly with one gauge pin only.

An electric indicator with a voltage not less than 40 V and not exceeding 50 V is applied to show contact.

The tolerances of the gauge shall be specified in **9.1**.

ANNEX C

(*Clauses* 9.1 *and* 9.2)

GAUGES FOR PLUGS AND SOCKET-OUTLETS

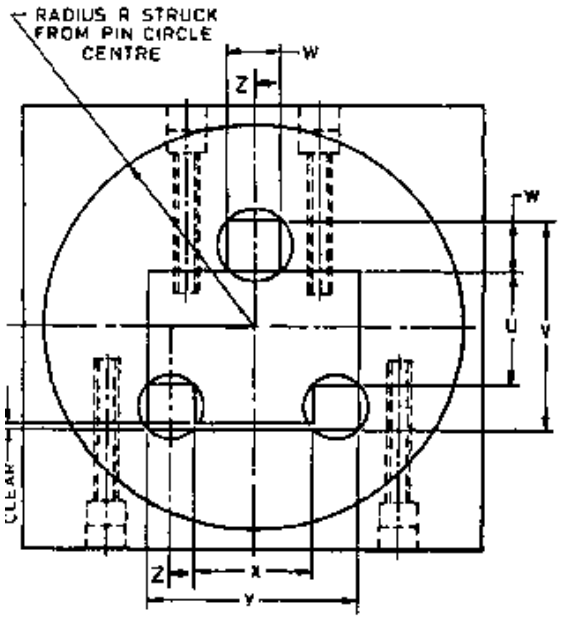
C-1 'GO' GAUGES FOR PLUGS

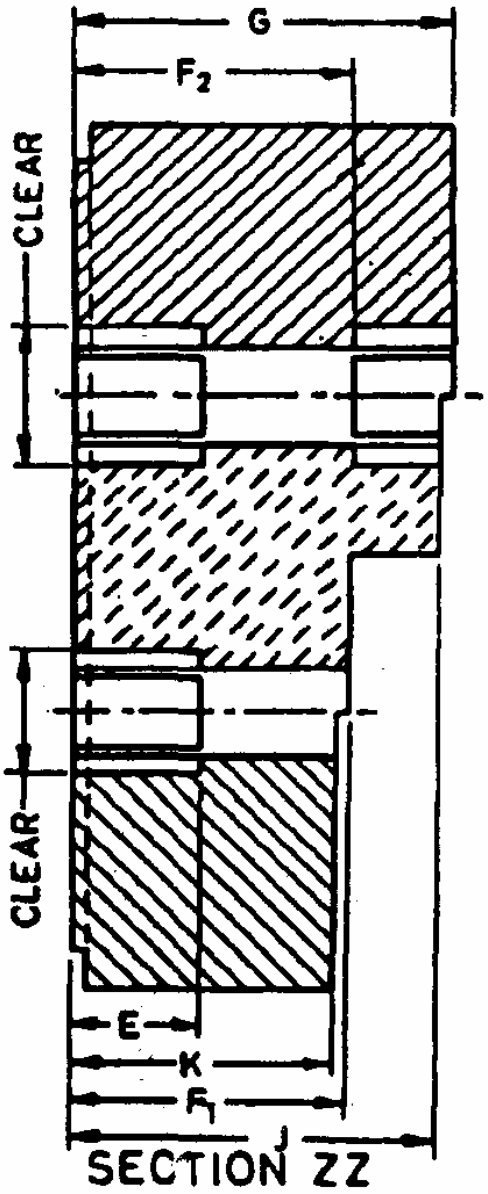
C-1.1 The gauge (*see* Fig. 42) is to prove correct spacing of plug pins. It accepts the plugs with plug pins at any centres that can be accepted without interference in socket outlets gauged by the maximum and minimum socket gauges.

C-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.

C-2 'GO' GAUGES FOR SOCKET-OUTLETS

C-2.1 Two gauges (*see* Figs. 43 and 44) are required, each having pins of the maximum diameter specified in





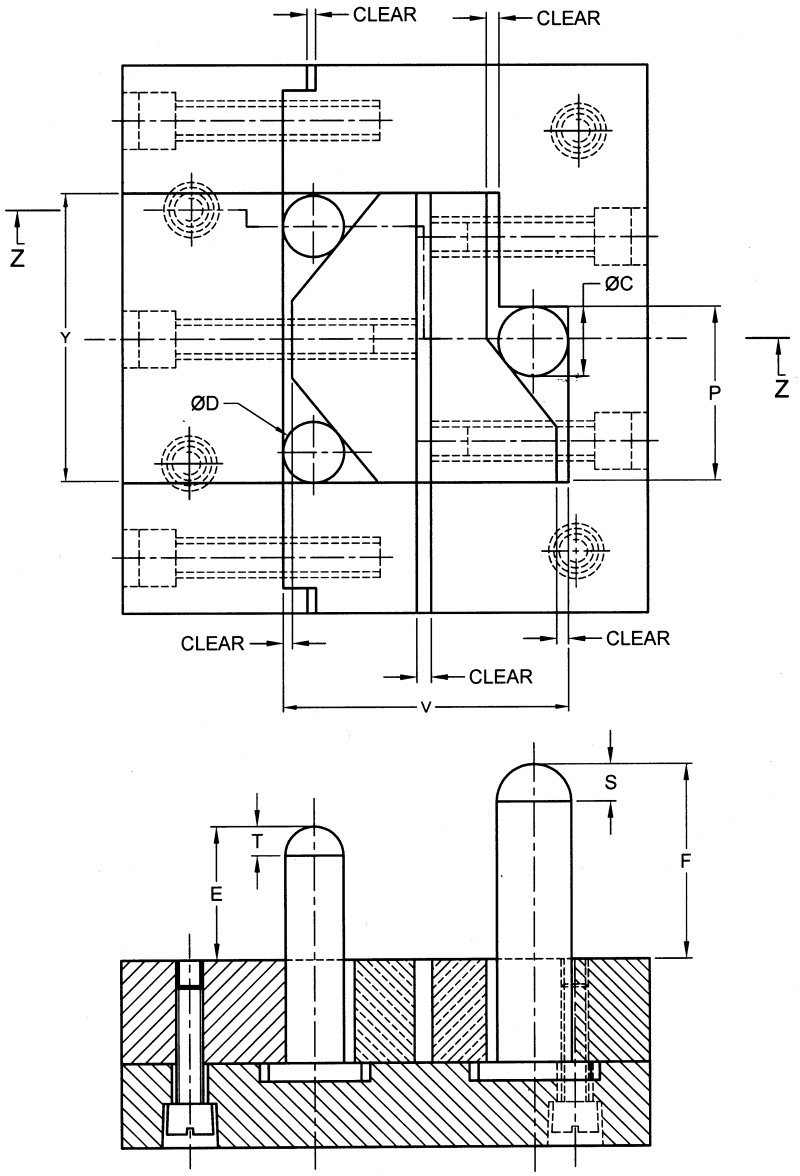
All dimensions in millimetres.

Annex B, 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.

Rating A	*u*	*v*	*w*	*X*	*y*	*E*	F_1	*G*		*J* F_2	*K*	*R*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
6	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 –0.01	+ 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.

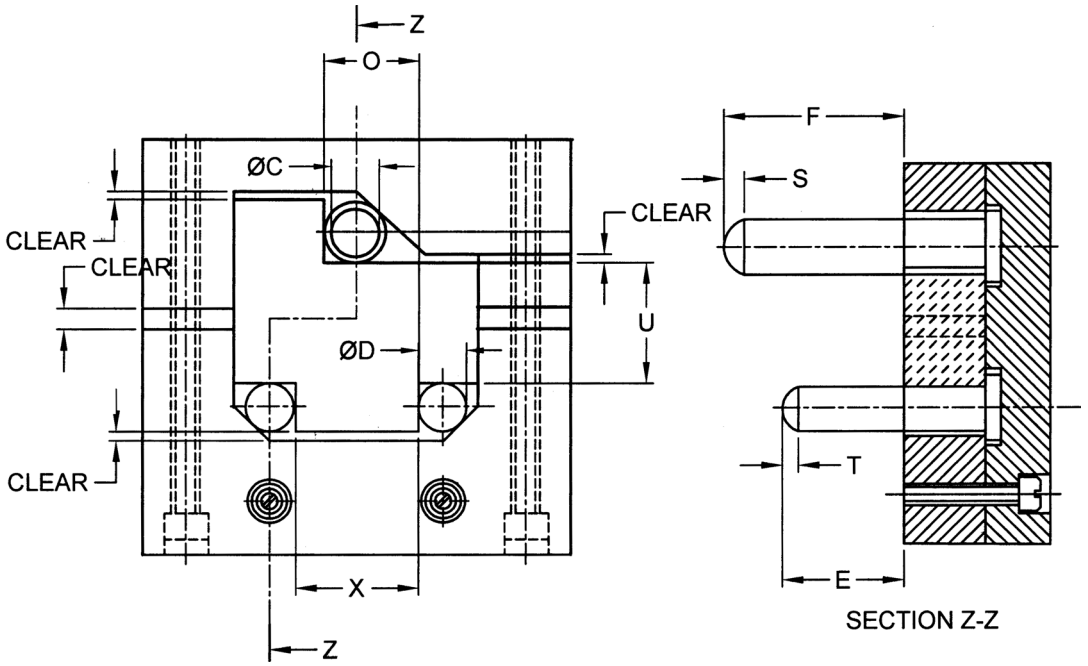
FIG. 42 'GO' GAUGE FOR PLUG



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	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	+0.01	+0.00	+0.00	+0.00	+0.00	+0.005	+0.25	+0.25
	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01	-0.000	-0.00	-0.00

FIG. 43 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	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	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.25	+0.25
	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.005	-0.00	-0.00

FIG. 44 MINIMUM 'GO' GAUGE FOR SOCKET-OUTLET

ANNEX D

(*Normative*)

(*Clause* 14.22)

SWITCHES INCORPORATED IN PORTABLE SOCKET-OUTLETS

D-1 Switches incorporated in portable socket-outlets shall comply with the relevant part of IS 3854 or IS/IEC 61058.

The rating of the switch shall not be lower than the lowest rating of the socket-outlet or the incorporated overcurrent protective device.

Switches marked with 'OFF' state shall be of normal gap construction and shall disconnect all the live poles.

Switches complying with IEC 61058-1 shall have the following minimum classification:

a) Pollution degree : 2
b) Rated impulse withstand voltage : 2 500 V
c) Level of resistance to fire with test according to glow wire temperature : 750 °C
d) Number of operating cycles : 10 000

ANNEX E

(*Informative*)

(*Clause* 14.24)

ALTERNATIVE GRIPPING TESTS

E-1 GRIPPING TEST E1

Prior to testing, the reference plugs shown in Fig. 45 shall be cleaned with a metal cleaner.

The reference plug, the plug to be tested, and the hands of each person conducting the test shall be washed with soap and water, rinsed, and then dried.

The test apparatus consists of a measuring device equipped with a means to securely attach both the reference plug and the plug to be tested, in a manner that reduces the likelihood of rotational movement during the pulls. An engagement face simulating the use of a plug in a socket-outlet of the same system, having an opening for the plug pins, shall be secured to the movable member.

NOTE — Other methods for measuring force may be used.

The mounting arrangements for the plug being tested shall be such that the face of the plug is flush with the faceplate.

A typical apparatus is shown in Fig. 46.

The plug to be tested with the flexible cable cut off close to the plug shall be securely attached to the test apparatus.

The person performing the test shall grip the plug to be tested, with either hand in a manner intended to apply the maximum pull force.

A steady straight pull shall be applied until the plug pulls free from the person's hand.

The person applying the force shall not view the force indicator during the pull.

The maximum pull force applied during the pull shall be recorded.

Immediately following the pull test, the reference plug shall be attached to the test apparatus and a comparison pull made using the same hand.

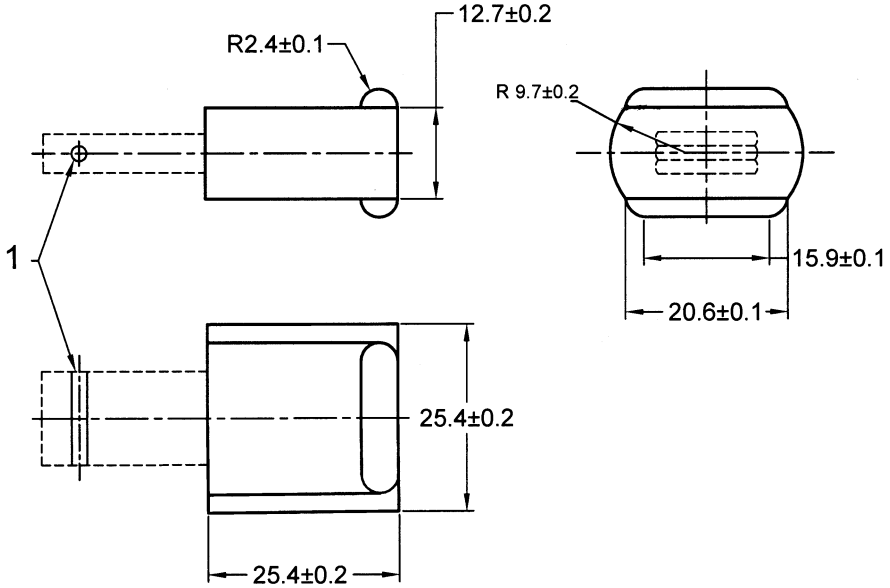
The maximum pull force shall be recorded.

The ratio of the force for the plug under test, to that for the reference plug shall be calculated and recorded.

The comparison pull procedure described above shall be repeated on the same plug an additional two times by the same person.

The ratio for each pair of pulls (test plug/reference plug) shall be calculated and recorded.

One person shall test three plugs (total nine comparison



All dimensions in milimetres.

Material: for example heat-treated steel.
Surface roughness of the gripping surface: between 0.6 ìm and 0.8 ìm.

1 Hole for retaining pins.
NOTE — The dimensions are to suit the test specimen and those of Fig. E-2.

FIG. 45 REFERENCE PLUG FOR GRIPPING TEST

pulls) as described above with the ratio for each pair of pulls being calculated and recorded for all three plugs. If the ratio of the pull force (plug under test/ reference plug) for each pair of pulls resulting from the tests carried out by this person is 0.8 or greater, the test shall be stopped and the results considered acceptable.

If the ratio is lower than 0.8, two additional people shall test three plugs each (for a total of nine comparison pulls per person), as described above.

The ratio for each pair of pulls (plug under test/ reference plug) shall be calculated and recorded.

The results are considered acceptable if all of the following conditions are met:

a) the ratio for each pair of pulls (test/reference plug) is 0.55 or greater for at least two pulls (of the three pulls performed) on each plug;
b) at least two (of the three) plugs tested by each person comply with item a); and
c) at least two persons' test results comply with item b).

If only one person obtains results that comply with item b) then at the manufacturer's request, two persons not previously involved in the testing may test three plugs each as previously described.

The results are considered acceptable if both of the additional persons' test results comply with items a) and b).

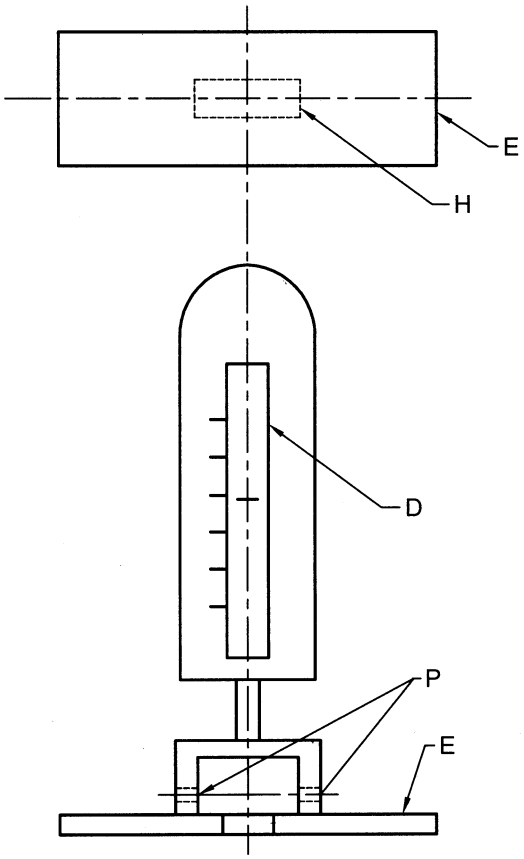
No result should be lower than the maximum withdrawal force for the relevant socket-outlet as specified in Table 19.

E-2 GRIPPING TEST E2

This test consists of a verification of one of the following characteristics of the plug under test:

a) the plug has a usable length for gripping of at least 55 mm in axial direction; or
b) the plug has such indent(s) that a ball with a diameter of (12 ± 0.1) mm can penetrate radially into the body at least 2 mm from two opposite directions or at least 4 mm from one direction; or
c) the plug has special means for withdrawal (for example hooks, rings).

The results are considered acceptable if at least one of the above conditions is fulfilled.



E Simulated engagement face
H Hole for introduction of fixing means
P Holes for pins for retention of fixing means
D Measuring device

NOTE — The figure is for guidance only and is not govern the design of the test apparatus.

FIG. 46 EXAMPLE OF THE TEST APPARATUS FOR PLUG GRIPPING TEST

ANNEX F

(*Clauses* 31.2.1)

SAMPLING PROCEDURE

F-1 LOT

F-1.1 In any consignment, all samples of the same type, designation, rating and manufactured under essentially similar conditions or procedures or production shall be grouped together to constitute a lot.

F-1.2 From each lot, a certain number of samples as specified in Table 24 shall be selected at random and subject to tests specified in **31.2**.

F-2 CRITERIA FOR CONFORMITY

F-2.1 In Table 24, N_1 is the size of first sample1. 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 failure is between C_1 and C_2, further sample of N_2 pieces shall be taken and subjected to all tests.

F-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* F-2.1)

Sl No.	Lot Size	N_1	N_2	(N_1+N_2)	C_1	C_2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	51 to 100	10	20	30	0	3
ii)	101 to 200	13	26	39	0 1	5
iii)	201 to 300	20	40	60	1	5
iv)	301 to 500	25	50	75	1	6
v)	501 to 800	35	70	105	2	7
vi)	800 to 1 300	50	100	150	3	10
vii)	1 300 and above	75	150	225		12

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