IS 371 (1999): Ceiling Roses [ETD 14: Electrical Wiring Accessories]

BLANK PAGE

IS 371 : 1999

भारतीय मानक

सीलिंग रोज़िज़ – विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

CEILING ROSES — SPECIFICATION

(Third Revision)

ICS 29.140.10

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

November 1999

Price Group 8

FOREWORD

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

This standard was originally published in 1954 and was subsequently revised in 1966 and 1979. The third revision is contemplated to take cognizance of the developments at the international level. The experience gained through the implementation of this standard since its last revision has also been taken into account.

The important features of this revision are:

a) Replacement of resistance to abnormal heat and fire test by Glow-Wire Test keeping in view the developments in the area of plastics and also keeping in line with international practice.

b) Introduction of screwless terminals.

c) Introduction of additional terminology.

d) Provision of earthing terminals and four separate terminal ceiling roses.

e) Inclusion of test for resistance to excessive residual stress and to rusting.

f) Classification of the ceiling roses.

While using aluminium conductor cables for wiring, certain precautions have to be taken [*see* IS 732 : 1989 Code of practice for electrical wiring installations (*third revision*)]

While preparing this standard considerable assistance has been derived from BS 67 : 1987 'Specification for ceiling roses' issued by the British Standards Institution.

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, shall be rounded off in accordance with IS 2 : 1960 'Rules for 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.

AMENDMENT NO. 1 MAY 2002
TO
IS 371 : 1999 CEILING ROSES — SPECIFICATION

(Third Revision)

(*Page* 4, *clause* **12.1**) — Substitute the following for the existing:

'**12.1** All ceiling roses shall be provided with an earthing terminal as specified in **13**. The earthing terminals shall be visibly distinguishable.'

(ET 14)

Reprography Unit, BIS, New Delhi, India

(*Page* 7, *clause* **13.8.2**, *para* 5, *line* 2) — Substitute '10 N' *for* '10 h'.

(*Page* 7, *clause* **13.8.3**, *para* 1) — Substitute the following for the existing para:

'**13.8.3** For screwless terminals designed for use with both rigid and flexible conductors, compliance shall be checked with insulated conductors having cross-sectional area as specified is **13.1**.'

(*Page* 8, *clause* **14.1.1**, *line* 3) — Substitute ' 0.03' *for* '0.30'.

(*Page* 9, *clause* **16.2**, *para* 1, *line* 2) — Substitute '**8.1**' *for* '**7.1**'.

(*Page* 9, *clause* **16.2**, *para* 1, *line* 4) – Substitute '10 mm' *for* '10 mm^2'.

AMENDMENT NO. 2 NOVEMBER 2002
TO
IS 371 : 1999 CEILING ROSES — SPECIFICATION

(Third Revision)

(*Page* 1, *clause* **2.1**, *Reference to* IS 5133) — Delete.

(*Page* 1, *clause* **2.1**) — Insert the following reference at the end:

'IS 14772 : 2000 Enclosures for accessories for household and similar fixed electrical installation.'

(*Page* 1, *clause* **3.3**) — Substitute the following for the existing:

'**3.3 Semi-Recessed or Flush-Type Ceiling Rose**

A ceiling rose intended for mounting with its base partially or completely sunk into a small circular conduit box or other suitable enclosure complying with IS 14772.'

(*Page* 4, *clause* **9.6.1**, *line* 4) — Substitute the word 'licence' for the word 'license'.

(*Page* 4, *clause* **10.3**, *line* 2) — Delete the repeat word 'of '.

(*Page* 4, *clause* **11.1.1**, *line* 3) — Substitute ')' *for* ','.

(*Page* 5, *Table* 1, *col* 4, *row* 7) — Substitute '1.80' *for* '1,80'.

(*Page* 7, *clause* **13.8.2**, *para* 5, *line* 2) — Substitute '10 N' *for* '10 h'.

(*Page* 7, *clause* **13.8.3**, *para* 1) — Substitute the following for the existing para:

'**13.8.3** For screwless terminals designed for use with both rigid and flexible conductors, compliance shall be checked with insulated conductors having cross-sectional area as specified is **13.1**.'

(*Page* 8, *clause* **14.1.1**, *line* 3) — Substitute ' 0.03' *for* '0.30'.

(*Page* 9, *clause* **16.2**, *para* 1, *line* 2) — Substitute '**8.1**' *for* '**7.1**'.

(*Page* 9, *clause* **16.2**, *para* 1, *line* 4) – Substitute '10 mm' *for* '10 mm^2'.

(*Page* 9, *clause* **16.2**, *para* 3, *line* 2) – Substitute '0.75 mm^2' *for* '0.75 mm'.

(*Page* 9, *clause* **16.2**, *para* 4, *line* 1) — Substitute 'cables or cords' *for* 'cables of cords'.

(*Page* 10, *clause* **17.2**, *para* 3, *line* 2) — Substitute 'polyamide' *for* 'polymide'.

(*Page* 10, *clause* **17.2**, *para* 4) — Substitute the following for the existing matter:

'The design of the apparatus is such that a force of 1.9 N to 2 N is applied to the face of the striking elements to maintain the pendulum in a horizontal position.'

[*Page* 12, *clause* **17.2**(a), *line* 3] — Substitute 'axis' *for* 'exist'.

(*Page* 13, *clause* **18.3**, *para* 3) — Substitute the following for the existing para:

'The test shall be made in a heating cabinet at a temperature of 125 ± 2°C.'

(*Page* 13, *clause* **18.4**, *line* 4) — Substitute '**18.3**' *for* '**17.3**'.

[*Page* 13, *clause* **19.2**(a), *line* 4] — Substitute '850°C' *for* "85°C'.

[*Page* 13, *clause* **19.2**(b), *line* 5] — Substitute '850°C' for '85°C'.

(*Page* 13, *clause* **19.2**, *para* 2, *line* 2) — Substitute the word 'ceiling rose' *for* 'switch'.

(*Page* 13, *clause* **19.2**, *Note* 1, *line* 7) — Substitute the word 'pinewood' *for* 'painedwood'.

(*Page* 14, *clause* **19.3**, *para* 3, *line* 2) — Substitute the word 'ammonium' *for* 'aluminium'

(*Page* 14, *clause* **19.3**, *para* 3, *third sentence*) — Substitute the following for the existing sentence:

'The drops shall have a volume of 20 ± 3 mm^3 and shall fall from a height of 35 ± 5 mm.'

[*Page* 15, *clause* **20.1.1**(b)]— Substitute the following for the existing matter:

'five times for nuts and other screws.'

[*Page* 16, *Table* 3, *col* 2, *Sl No.* (iii), *line* 6] — Substitute 'hygroscopic' *for* 'hydroscopic'.

(*Page* 17, *clause* **22.2.1**, *para* 2, *line* 3) — Substitute the word 'degreasing' *for* 'decreasing'.

(*Page* 17, *clause* **22.2.1**, *para* 2, *line* 5) — Substitute the word 'ammonium' *for* 'aluminium'.

(*Page* 17, *clause* **23.1.2**, *line* 2) — Substitute '**6.3**' *for* '**6.4**'.

(ET 14)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 JUNE 2003
TO
IS 371 : 1999 CEILING ROSES — SPECIFICATION

(Third Revision)

(*Page* 17, *clause* **23.1**, *lines* 1 *and* 2) — Substitute 'nine samples' for 'three samples'.

(ET 14)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 MARCH 2007
TO
IS 371 : 1999 CEILING ROSES — SPECIFICATION

(Third Revision)

(*Page* 3, *clause* 1.1, *line* 5) — Substitute 'current of 6A only' *for* 'current does not exceed 6A'

(*Page* 5, *clause* 7.2) — Substitute the following for the existing clause:

'7.2 Ceiling roses shall have a rated current of 6A only'.

(ET 14)

Reprography Unit, BIS, New Delhi, India

Indian Standard

CEILING ROSES — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard covers ceiling roses of surface and semi-recessed types for use with simple or multiple pendant lighting fitting and for the use in circuits in which the nominal voltage does not exceed 250V and the current does not exceed 6A and intended to be used in final circuits with rated current 16A maximum for ceiling roses with screw-type supply terminals or 10 A maximum for ceiling roses with screwless supply terminals. The requirements specified in this standard have particular reference to safety in use.

The ceiling roses are intended for use with cables complying with IS 694 : 1990 'PVC insulated cables for working voltage up to and including 1 100 V (*third revision*)'.

Ceiling roses incorporating means other than rewirable terminals, to facilitate the connection and disconnection of lampholders or luminaires, are not covered by this standard.

NOTE — Accessories complying with this standard may be regarded as lighting outlets.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
302-1 : 1979	Safety of household and similar electrical appliances: Part 1 General requirements (*fifth revision*)
694 : 1990	PVC insulated cables for working voltage up to and including 1 100 V (*third revision*)
732 : 1989	Code of practice for electrical wiring installations
1401 : 1970	Accessibility test probes (*first revision*)
2500 (Part 1) : 1992	Sampling inspection procedures: Part 1 Attribute sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection (*second revision*)
2667 : 1988	Fittings for rigid steel conduits for electrical wiring (*first revision*)
3419 : 1988	Fittings for rigid non-metallic conduits (*second revision*)
5133	Boxes for enclosures of electrical accessories:
(Part 1) : 1969	Steel and cost iron boxes
(Part 2) : 1969	Boxes made of insulating material
9968 (Part 1) : 1988	Elastomers insulated cables : Part 1 For working voltages up to and including 1 100 V (*first revision*)
11000(Part 2/ Sec 1) : 1984	Fire hazard testing: Part 2 Tests methods, Section 1 Glow-wire test and guidance

3 TERMINOLOGY

For the purpose of this Indian Standard, the following definitions shall apply.

3.1 Ceiling Rose

An accessory for connection to the fixed wiring of an installation to pass current to a lampholder or a luminaire by means of the conductors of a flexible cable or cord.

3.2 Surface-Type Ceiling Rose

A ceiling rose provided with a seating surface such that when mounted as intended it projects wholly outside the surface on which it is mounted.

3.3 Semi-Recessed or Flush-Type Ceiling Rose

A ceiling rose intended for mounting with its base partially or completely sunk into a small circular conduit box or other suitable enclosures. Box complying with IS 5133 (Part 1) and IS 5133 (Part 2).

3.4 Terminal Housing

That part of the ceiling rose which locates and separates the terminals.

3.5 Terminal

A means by which the user can make an electrical connection between the appropriate cable or flexible cable or cord and the conducting parts of the accessory without the use of special tools.

3.6 Screw-Type Terminal

A terminal in which the connection is made directly or indirectly by means of screws or nuts of any kind

3.7 Pillar Terminal

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

3.8 Screw Terminal

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

3.9 Stud Terminal

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

3.10 Screwless Terminal

A connecting terminal for the connection and subsequent disconnection of one conductor capable of being dismantled, the connection being made, directly or indirectly, by means of springs or wedges, eccentrics or cones, etc.

3.11 Load Terminals

Terminals intended to accommodate flexible conductors for the connection of a lamp load, via a lampholder or luminaire.

3.12 Supply Terminals

Terminals intended to accommodate conductors of the fixed wiring.

3.13 Loop Terminal

A supply terminal intended for the interconnection of live conductors without the provision for the connection of flexible cords.

3.14 Cover

That part of the external enclosure which is intended to be removed to gain access for installation purposes.

3.15 Live Parts

Current carrying parts, and those metal parts in contact with them during normal use.

NOTE — Earthing terminals are not considered to be current carrying parts.

3.16 Rated Current

The maximum load, in amperes, which may be connected to the load terminals.

3.17 Type Tests

Tests carried out to prove conformity with the requirements of the standard. These are intended to prove the general qualities and design of a given type of ceiling rose.

3.18 Acceptance Tests

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.19 Routine Tests

Tests carried out on each item to check the essential requirements which are likely to vary during production.

4 CONDITIONS OF USE

4.1 Ceiling roses shall be suitable for use under the following conditions:

a) An ambient temperature having a peak value not exceeding 45°C with an average value not exceeding 40°C in a period of 24 h, but not subject to exposure to direct radiation from the sun or any other source of heat likely to raise the temperature above the specified ambient temperature;

b) An ambient temperature having a value not less than –5°C; and

c) An atmosphere not subject to excessive pollution by smoke, chemical fumes, salt laden spray, prolonged periods of high humidity or other abnormal conditions.

5 GENERAL REQUIREMENTS

Ceiling roses shall be so designed and constructed that when installed in the proper manner and in normal use they function reliably and cause no danger to persons or surrounding.

Ceiling roses shall be capable of meeting all the relevant requirements and tests specified herein.

NOTE — Where tolerances are not specified in this standard the value are to be regarded as nominal.

6 GENERAL CONDITIONS FOR TYPE TESTING

6.1 Unless otherwise specified in this standard ceiling roses shall be tested as delivered and installed, as in normal use, at any ambient temperature between 15°C to 35°C.

6.2 A total sample of nine ceiling roses shall be submitted to inspection and tests in the following order of clauses:

a) *Three ceiling roses* — Clauses 5, 9 to 14 and 20 and 21;

b) *Three ceiling roses* — Clauses 11 to 14, 15.3 to 15.6 and 16, 17 and 20; and

c) *Three ceiling roses* — Clauses 15.1, 15.2 and 18, 19 and 22.

6.3 If no ceiling roses fails in the tests specified in 6.2 then ceiling roses of that type shall be deemed to comply with this standard.

If one ceiling roses fails in any individual test, or series of tests, specified in 6.2 and the ceiling roses can be shown to be not representative of normal design or production, then a separate set of three ceiling roses shall be submitted to the relevant test or series of tests specified in 6.2. If no ceiling rose fails in this re-test then ceiling roses of that type shall be deemed to comply with this standard.

If more than one ceiling rose fails in the tests specified in 6.2 then ceiling roses of that type shall be deemed not to comply with this standard.

7 RATINGS

7.1 Ceiling roses shall have a rated voltage of not exceeding 250 V.

7.2 Ceiling roses shall have a rated current not exceeding 6 A.

8 CLASSIFICATION

8.1 Ceiling roses shall be classified as follows:

a) According to the method of mounting:
   1) Surface-type (*see* 3.2), or
   2) Semi-recessed or flush-type (*see* 3.3).

b) According to load-support:
   1) Intended to support mechanical loads by means of a flexible cord complying with IS 694 (*see* 14.4), and
   2) Intended to support mechanical loads as nominated by the manufacturer in addition to those specified in 8(b)(1), by means other than a flexible cord.

c) According to the current-carrying terminal arrangement:
   1) having provision for the connection of switch wiring, or
   2) having no provision for the connection of switch wiring.

d) According to terminal type:
   1) having screw-type terminals, or
   2) having screwless terminals, or
   3) having a combination of both types of terminal.

9 MARKING

9.1 Ceiling roses shall be marked with the following information on their main part or one of the parts fixed to it in normal use:

a) rated voltage, specified by manufacturer;
b) rated current, specified by the manufacturer;
c) ceiling roses provided with screwless terminals for installation in wiring shall be marked 'Not to be used in circuits with ratings exceeding 10 A';
d) name or trade-mark of the manufacturer or responsible vendor; and
e) country of manufacturer.

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

amperes	A
volts	V
earth	⏚
live	L
neutral	N

NOTE — It is recommended that, wherever practicable, the symbols should preferably be used.

For the marking of the rated current and rated voltage, figures may be used alone. The figure for rated current shall be placed before or above that for the rated voltage and separated from the latter by a line, for example, 6 A 250 V, or 6/250.

9.3 Where any terminal is provided for particular connection purposes there shall be marking to indicate its intended use (for example, LOOP). Such marking shall not be placed on screws, washers or other easily removable parts.

9.4 Marking shall be easily legible and durable.

9.4.1 Compliance shall be checked by inspection and by rubbing the markings for 15 s with a cloth soaked in water and again for 15 s with a cloth soaked in petroleum spirit.

The marking shall remain legible.

Markings produced by an engraving or moulding process are deemed to comply without this test.

9.5 Ceiling roses classified in accordance with 8(b)(2) shall be provided with installation information regarding their safe working for mechanical loads and the method of fixing to mounting surfaces.

9.5.1 Compliance shall be checked by inspection.

9.6 The ceiling roses may also be marked with the Standard Mark.

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

10 DIMENSIONS

10.1 Semi-recesed or flush ceiling roses shall be so designed that they can be fitted to the relevant mounting boxes, as specified in IS 2667 and IS 3419.

10.2 Surface mounting ceiling roses shall be provided with at least two holes of at least 5 mm diameter, to accommodate mounting screws.

10.3 The two holes should preferably be on nominal centers of of 50.8 mm or 60.3 mm. This dimensions is applicable for semi-recessed type ceiling roses.

NOTE — This is for the guidance to the manufacturers.

11 ACCESSIBILITY OF LIVE PARTS

11.1 Ceiling roses shall be so designed and constructed that when properly assembled, correctly wired and fitted with flexible cord and cover as in normal use, live parts are not accessible.

11.1.1 Compliance shall be checked by using a standard test finger with a force of 5N (Test finger as given in IS 1401, to all accessible parts of the ceiling rose, when fitted with a circular twin 0.5 mm^2 flexible cord complying with IS 694 connected to the load terminals.

11.2 Ceiling roses shall be so designed and constructed that when properly assembled, correctly wired and fitted with cover, but not fitted with flexible cord, live parts are not accessible.

11.2.1 Compliance shall be checked by applying, with a force of 5N, using a standard test finger as given in IS 1401 to all accessible parts of the ceiling rose.

11.3 When an associated controlling switch is in the 'OFF' position and the ceiling rose is dismantled to the extent necessary to remove or replace a corresponding flexible cord, any conducting part which may remain electrified shall not be accessible to accidental contact.

11.3.1 Compliance shall be checked by applying, with a force of 5N, test finger 1 of IS 1401 in a manner most likely to make contact with such parts, with the ceiling rose fitted with 1.0 mm^2 insulated conductors from a cable complying with Table 5 or 6 of IS 694.

11.4 Ceiling roses shall be provided with an enclosures to prevent inadvertent contact with live parts.

11.4.1 Screw type covers of ceiling roses shall not be removable without the cover being turned through an angle of more than 270°C.

11.4.1.1 Compliance shall be checked by mounting the ceiling rose on a flat plain surface, wired as in normal use and with the cover tightened to a torque, in newton metres, equal to 0.02 times the effective thread diameter, in millimeters, of the securing thread. The cover shall not be removable without first being turned through an angle greater than 270°.

12 PROVISION FOR EARTHING

12.1 All ceiling roses shall be provided with an earthing terminal as specified in 13.

12.2 Provision shall be made for the effective earthing of all metal parts that may become live in the event of failure of the insulation of the ceiling rose or conductors and which are capable of being touched by test finger as given in IS 1401, when the ceiling rose is correctly wired and mounted as in normal use. This requirement does not apply to screws in or through non-conducting material and separated by such material from live parts in such a way that, in normal use, they cannot become live. Any connection between the earthing terminal or earthing contact and parts required to be connected thereto shall be of low resistance.

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

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

In no case shall the resistance exceed 0.1 ohms.

The resistance of the flexible cable or cord is not included in the resistance measurement.

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

13 TERMINALS

13.1 Terminals shall be provided for the connection of live, neutral and protective earthing conductors. Terminal intended for the connection of fixed wiring shall permit the connection, without special preparation, of one, two or three 1.0 mm^2 or 1.5 mm^2 solid conductors, except in the case of the terminal for the connection of switch wiring, which shall permit

the connection of one or two such conductors. There shall be separate means to permit the connection of live and neutral conductors of a flexible cord from 0.5 mm^2 to 1.0 mm^2.

Terminal shall be of a type in which each conductor is gripped firmly and they shall be so designed as to prevent the strands of the conductor from slipping out.

NOTES

1 A screw type terminal may clamp rigid conductors individually or collectively.

2 Terminals provided for earthing may have one terminal screw only.

13.1.1 Compliance shall be checked by inspection.

13.2 Screw type terminals shall be so located that they are prevented from rotating when the terminal screws are turned.

When pillar type terminals are used they shall meet the following requirements:

a) minimum nominal diameter of terminal screw: 2.5 mm;

b) minimum length of the thread in pillar through which the terminal screw passes shall be 2.5 mm;

c) the diameter of the conductor hole shall not permit a clearance greater than 0.4 mm on either side of the terminal screw. The screw shall be long enough under the head to extend to the far side of the conductor hole. In case of grub screw the length should be such that the top of the screw is flushed with the face of the terminal when tightened fully. The screw shall have a slightly rounded end, and the wall of the hole against which the screw clamps the conductor shall be unbroken.

13.2.1 Compliance shall be checked by inspection, measurement and the following test.

A rigid conductor of 1.0 mm^2 cross-sectional area shall be tightened and loosened five times by means of a suitable screwdriver or spanner applying a torque as shown in Table 1.

NOTE

It is essential that the shape of the blade of the test screwdriver suits the head of the screw being tested and that the screw is not tightened in jerks.

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

During the test, no change shall occur that impairs the further use of the terminal.

13.3 It is permissible for screwless terminals to be suitable for rigid and/or flexible conductors.

If the screwless terminal is suitable for both rigid and flexible conductors, tests shall carried out with rigid conductors first and then repeated with flexible conductors.

Screwless terminals shall be provided with clamping units which allow the proper connection of copper conductors having nominal cross-sectional areas complying with **13.1**.

NOTES

1 The screwless terminals are intended for the connection of copper conductors only without special preparation,when two

Table 1 Terminal Screw Torque Values

(*Clauses* 13.2.1 *and* 16.2)

Sl No.	Nominal Diameter of Screw	Mechanical Strength		Normal Use Test	
		For Screws Described Below[1]	For Other Screws and Nuts	For Screws Described Below[1]	For Other Screws and Nuts
	mm	Nm	Nm	Nm	Nm
(1)	(2)	(3)	(4)	(5)	(6)
i)	Up to and including 2.6	0.15	0.30	0.1	0.20
ii)	Over 2.6 up to and including 2.8	0.20	0.40	0.13	0.26
iii)	Over 2.8 up to and including 3.0	0.25	0.50	0.16	0.32
iv)	Over 3.0 up to and including 3.2	0.30	0.60	0.20	0.40
v)	Over 3.2 up to and including 3.6	0.40	0.80	0.30	0.60
vi)	Over 3.6 up to and including 4.1	0.70	1.20	0.40	0.80
vii)	Over 4.1 up to and including 4.7	0.80	1,80	0.60	1.20
viii)	Over 4.7 up to and including 5.3	0.80	2.00	0.60	1.40
ix)	Over 5.3 up to and including 6.0	0.80	2.50	0.60	1.60

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

conductors have to be connected, each conductor shall be introduced into a separate independent clamping unit.

2 This does not necessarily mean in separate holes. Parts of screwless terminals mainly intended for carrying current shall be of materials as specified in 20.3.

3 Springs, resilient units, clamping plates and the like are not considered as parts mainly intended for carrying current.

13.3.1 Compliance shall be checked by inspection.

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

Conductors shall be deemed to be unduly damaged if they show deep or sharp indentations.

The conductor shall be clamped between metal surfaces.

It shall be clear how the insertion and disconnection of the conductors is intended to be effected: this may be with or without the aid of a tool.

The intended disconnection of a conductor shall require an operation other than a pull not exceeding 30 N on the conductor.

If openings are provided for the use of a tool intended to assist the insertion or disconnection, they shall be clearly distinguishable from the opening intended for the conductor.

13.4.1 Compliance shall be checked by inspection and by the tests described in 13.8.

13.5 Screwless terminals which are intended to be used for the interconnection of more than one conductor shall be so designed that:

a) during the insertion, the operation of the clamping means of one of the conductors is independent of the operation of that of the other conductor, and
b) during the disconnection, the conductors can be disconnected either at the same time or separately.

It shall be possible to clamp securely any number of conductors up to the maximum as designed.

13.5.1 Compliance shall be checked by inspection and manual tests using the appropriate conductors (number and size).

13.6 Screwless terminals shall be so designed that undue insertion of the conductor is prevented and adequate insertion is obvious.

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

13.6.1 Compliance shall be checked by inspection and by the tests of 13.8.

13.7 Screwless terminals shall be properly fixed to the ceiling rose. They shall not work loose when the conductors are inserted or disconnected during installation and in normal use.

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

13.7.1 Compliance shall be checked by inspection and by the tests of 13.8.

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

13.8.1 For screwless terminals designed for use with rigid conductors, compliance shall be checked with insulated conductors on one screwless terminals of each ceiling rose.

The test is carried out with solid copper conductors, first with conductors having the largest cross-sectional area, and then as specified in 13.1.

Conductors are inserted and disconnected five times, new conductors being used each time, except for the fifth time when 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 a pull of 10 N, 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 terminals.

The test is then repeated with rigid stranded copper conductors having the largest and smallest cross-sectional areas specified in 13.1. These conductors, are, however, inserted and is connected only once.

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

13.8.2 For screwless terminals designed for use with flexible conductors, compliance shall be checked with insulated conductors on one screwless terminal on each ceiling rose.

The test is carried out with flexible copper conductors, first with conductors having the smallest cross-sectional area as specified in 13.1.

Conductors are inserted and disconnected five times, new conductors being used each time, except for the fifth time when 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 a pull of 10 h, 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.

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

13.8.3 For screwless terminals designed for use with both rigid and flexible conductors, compliance shall be checked with insulated conductors on one screwless cross-sectional area as specified in **13.1**.

Conductors are inserted and disconnected five times, new conductors being used each time, except for the fifth time when 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 a pull of 10 N, 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 cross-sectional areas specified in **13.1**. These conductors are, however, inserted and disconnected only once.

The test is then repeated with flexible copper conductors having the largest and smallest cross-sectional areas specified in **13.1**. These conductors are however, inserted and disconnected only once and the pull is reduced to 10 N.

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

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

13.9.1 Compliance shall be checked by the tests described in **13.9.2** and **13.9.3** which are carried out on five screwless terminals of ceiling roses which have not been used for any other test. Both tests shall be carried out with unused copper conductors.

13.9.2 The test is carried out loading the screwless terminals for 1 h with an alternating current, as specified in Table 2, when connected to 1 m long conductors having the cross-sectional area as specified in the same table and using the type of conductor, that is, rigid or flexible, applicable to the terminal. The test is carried out on each clamping unit.

During the test the current is not passed through the ceiling rose but only through the terminals.

Immediately after this period the voltage drop across each clamping unit is measured with rated current following. In no case shall the voltage drop exceed 15 mV. The measurements shall be made across each clamping unit and as near as possible to the place of contact.

NOTES

1 If the back connection of the terminal is not accessible the ceiling roses may be suitably prepared by the manufacturer. Care should be taken not to affect the behaviour of the terminals.

2 It is essential that care is taken to ensure that, during the period of the test, including the measurements, the conductors and the measurements taps cannot move noticeably in the terminals.

13.9.3 The connections already subjected to the determination of the voltage drop specified in **13.9.2** are tested as follows.

During the test, a current equal to the test current value given in Table 2 is passed.

Table 2 Test Current

(*Clauses* 13.9.2 *and* 13.9.3)

Sl No.	Test Currents for Test on Screwless Terminals	
	Cross-Sectional Area of the Conductor mm²	Test Current A
(1)	(2)	(3)
i)	1.0	10
ii)	1.5	15

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

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

a) with the current flowing, for approximately 30 min;

b) for a further 30 min approximately, with no current flowing.

The voltage drop in each clamping unit is determined as described in 13.9.2 after each 24 cycles and after the 192 cycles have been completed. In no case shall the voltage drop exceed 22.5 mV. After this test an inspection by normal or corrected vision without additional magnification shall show no changes evidently impairing further use such as cracks, deformations or the like.

Furthermore the appropriate mechanical strength test described in 13.8 is repeated and all five terminals shall withstand this test.

14 CONSTRUCTION

14.1 Where protection against electric shock is provided by a cover screwing on to a base, or by similar attachment, such parts shall withstand the forces likely to be applied in normal use.

14.1.1 Compliance shall be checked by removing and replacing such parts by hand 10 times, tightening each time with a torque, in newton metres, equal to 0.30 times the outside diameter, in millimetres, of the part under test.

14.2 Provision shall be made for the entry and connection of a circular flexible cord having three conductors of 1.0 mm^2 and complying with IS 694.

The means of entry shall be smooth and shall not cause abrasion or other damage to the sheath of the cord.

14.2.1 Compliance shall be checked by connection of the 3 core, 1.00 mm^2, flexible cord followed by inspection.

14.3 A device or means of insulating material, referred to herein as a strain relief, shall be provided, to prevent strain upon flexible conductors, connected to the ceiling rose, being transmitted to the terminals.

14.3.1 Compliance shall be checked by the following test. The ceiling rose shall be fitted with 2-core, 0.5 mm^2, circular sheathed flexible cord complying with IS 694 the terminal screws shall be tightened only sufficiently to stop the conductors slipping out of the terminals but not sufficiently to influence the effectiveness of the strain relief.

The device shall then be tightened in a manner appropriate to its design, as in normal use. If the strain relief incorporates one or more screws, then these shall be tightened with a torque equal to two-thirds of the appropriate value given in Table 1. If the strain relief relies upon the screwing together of related threaded parts, then such parts shall be tightened with a torque equal to two-thirds of the value specified in 14.1. The cord shall be subjected to a pull of 25 N for 1 min steadily applied in the direction of the axis of the cord in normal use. The test shall be applied three times, the force being removed after each test.

At the conclusion of the tests, the conductors shall not have moved noticeably in the terminals and there shall be no damage to the conductor insulation such as to expose the conductor. At the end of the test the cord shall not have moved more than 2 mm.

14.4 The ceiling rose shall be capable of carrying a load as follows:

a) Ceiling roses classified in accordance with 8.1(b) (1): 2.5 kg;

b) Ceiling roses classified in accordance with 8.1(b) (2): 2.5 kg or higher as nominated by the manufacturer.

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

The ceiling rose shall be secured as in normal use to the underside of a horizontal surface and fitted with a 1.0 mm^2 circular twin flexible cord complying with Table 6 of IS 694. The terminal screws shall be tightened with the torque values for normal use specified in Table 1 and the strain relief device or means shall be tightened as specified in 14.3. A test loaded of 5 kg shall be suspended from the ceiling rose via the flexible cord and the equipment placed in an oven at a temperature of 40 ± 5°C for a period of 24 h.

At the conclusion of the test the load shall still be supported, the ceiling rose shall remain in a usable condition and shall comply with 11 and, where appropriate, 14.1 and/or 14.2.

For ceiling roses classified in accordance with 8.1 (b)(2) the above test is carried out and then repeated with twice the load nominated by the manufacturer with no load being transmitted through the flexible cord.

At the conclusion of the test the load shall still be supported the ceiling rose shall remain in a usable condition and shall comply with 10, and where appropriate, 14.1 and/or 14.2.

15 RESISTANCE TO MOISTURE AND HUMIDITY, INSULATION RESISTANCE AND ELECTRIC STRENGTH

15.1 Ceramic parts of ceiling roses shall be sufficiently non-hygroscopic. The resistance to moisture shall not depend on glaze or varnish or similar surface treatment.

15.1.1 Compliance shall be checked by the following test. Ceramic parts shall be conditioned for 24 h at any temperature between 15°C to 35°C and 45 percent relative humidity to 75 percent relative humidity and then immersed in distilled water for 24 h at any

ambient temperature between of 15°C to 35°C. At the end of this period the parts shall be removed and, after all visible water has been wiped from the surface, the mass of the parts shall not have increased by more than 1.0 percent.

15.2 Plastics parts of ceiling roses shall be sufficiently non-hygroscopic. The resistance to moisture shall not depend on glaze or varnish or similar surface treatment.

15.2.1 Compliance shall be checked by the following test. Plastics parts shall be conditioned for 24 h at any ambient temperature between 15°C to 35°C and 45 percent relative humidity to 74 percent relative humidity and then immersed in distilled water for 48 h at any ambient temperature between 15°C to 35°C. At the end of this period the parts shall be removed and, after all visible water has been wiped from the surface, there shall be no distortion, swelling, delamination or other deformation which would impair the function of the ceiling rose.

15.3 Complete ceiling roses shall be proof against humid conditions that may occur in normal use.

15.3.1 Compliance shall be checked by the humidity treatment described in this subclause followed immediately by the measurement of the insulation resistance and by the electric strength tests described in **15.5** and **15.6**.

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

The humidity treatment shall be carried out in a humidity cabinet containing air with a relative humidity maintained between 91 percent and 95 percent. The temperature of the air, at all places where samples can be located, shall be maintained within 1K of any convenient value between 15°C and 35°C.

Before being placed in the humidity cabinet, the ceiling roses shall be brought to a temperature between t°C and t+4°C. Ceiling roses shall be kept in the cabinet for 48 h. After this treatment, the ceiling roses shall show no damage that affects compliance with this standard.

NOTES

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

2 Relative humidity between 91 percent and 95 percent can be obtained by placing in the humidity cabinet a saturated solution of sodium sulphate (Na_2SO_4) or potassium nitrate (KNO_3) in water, having a sufficiently large contact surface with the air. 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 that is thermally insulated.

15.4 Insulation shall be effective between:

a) live parts of opposite polarity;

b) live parts of opposite polarity connected together, and other metal parts insulated therefrom, including earthed metal parts.

15.4.1 Compliance shall be checked by the tests described in **15.5** and **15.6**.

15.5 The insulation resistance shall be measured with a dc voltage of approximately 500 V, the measurement being made 1 min after the application of the voltage consecutively between the points defined in **15.4**. The insulation resistance shall be not less than 5 MΩ.

15.6 Immediately after the test specified in **15.5** an ac voltage of substantially sine-wave form with a frequency of 50 Hz and with an rms value of 2 000 V shall be applied for 1 min between the points defined in **15.4** Initially not more than half the prescribed voltage shall be applied, then it shall be raised rapidly to the required value.

No breakdown or flashover shall occur. Glow discharges without drop in voltage are ignored.

15.7 Flash Test

As a routine test, the high voltage, may be carried out in the form of flash test an ac voltage of 2 000 V rms being applied for a period of 1 s between the parts specified in **15.4** without arcing.

16 TEMPERATURE RISE

16.1 Ceiling roses shall be so designed and constructed that, when installed and used as in normal use, the temperature rise of current-carrying parts is not excessive.

16.1.1 Compliance shall be checked by the tests described in **16.2** and **16.3**.

16.2 Ceiling roses shall be mounted, in the manner indicated by the classification of **7.1**, on the underside of a horizontal surface comprising a piece of plywood approximately 10 mm² thick and 500 mm × 500 mm square, painted mate white. Any necessary mounting box or device shall be used in a manner typical of normal installation practice and the ceiling rose shall be located in the center of the mounting surface.

All terminals, other than those intended for the exclusive connection of flexible cords, shall be wired with 1.5 mm² flat twin complying with IS 694 with circuit protective conductor.

Terminals intended for the connection of flexible cords shall be wired with 0.75 mm circular twin flexible cord complying with Table 6 of IS 694.

The length of the specified cables of cords, outside the ceiling rose, shall be at least 1.0 m for cables and

0.5 m for cords.

The following circuit connections shall be made:

a) incoming supply : 1.5 mm² cables:
b) outgoing supply : 1.5 mm² cables;
c) switch connection : 1.5 mm² cables (*see* Note); and
d) load connection : 0.75 mm² flexible cord.

Terminal screws shall be tightened with the torque values for normal use given in Table 1.

NOTE — Except that, in a ceiling rose not intended for the connection of a switching circuit, item (c) is omitted.

16.3 Loads shall then be connected to the cables after the test of **16.2** to provide two test conditions as follows:

Test 1

a) Connect to supply source;
b) Connect to a resistive load as follows:
   1) For screw-type terminals connect to a 16 A resistive load;
   2) For screwless terminals connect to a 10 A resistive load;
c) Open-circuit (*see* Note); and
d) Open circuit.

Test 2

a) Connect to supply source;
b) Connect to a resistive load as follows:
   1) For screw-type terminals connect to a 10 A resistive load;
   2) For screwless terminals connect to a 4 A resistive load;
c) Closed circuit (*see* Note); and
d) Connect to a 6 A resistive load.

NOTE — Except that, in a ceiling rose not intended for the connection of a switching circuit, item (c) of Test 1 and Test 2 is omitted and where separate outgoing terminals are not provided item (b) of Test 1 and Test 2 is omitted.

16.4 When separate outgoing supply terminals are not provided test 1 is not applicable.

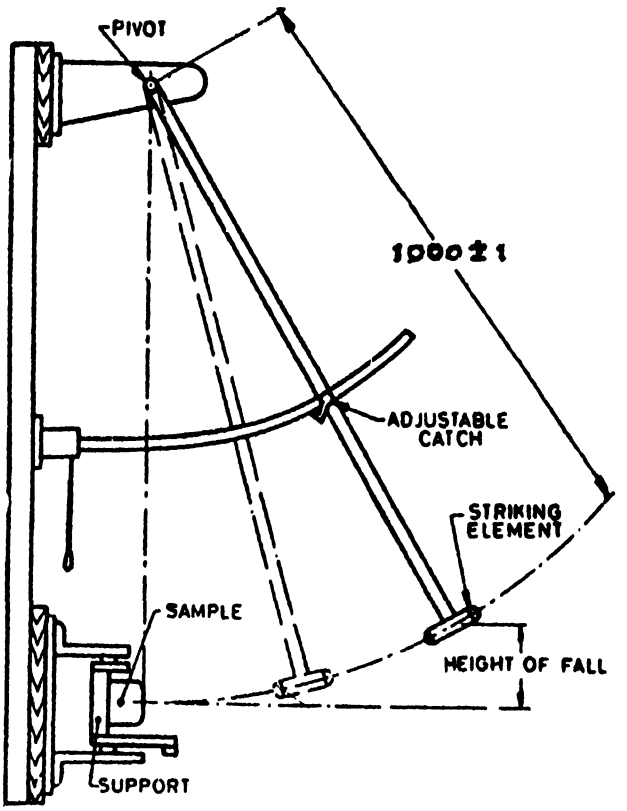
The temperature rise of any current-carrying terminal, on load, shall not exceed 45°C in either test. The test shall continue until stability is reached, stability being taken as not more than 1°C rise within 1 h.

17 MECHANICAL STRENGTH

17.1 Ceiling roses shall have adequate mechanical strength to withstand the stresses imposed during installation and use.

17.1.1 Compliance shall be checked by the tests described in **17.3** using the apparatus in **17.2**.

17.2 Ceiling roses are tested with the impact apparatus shown in Fig. 1.



NOTE — This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.

All dimensions in millimetres.

FIG. 1 PENDULUM IMPACT TEST APPARATUS

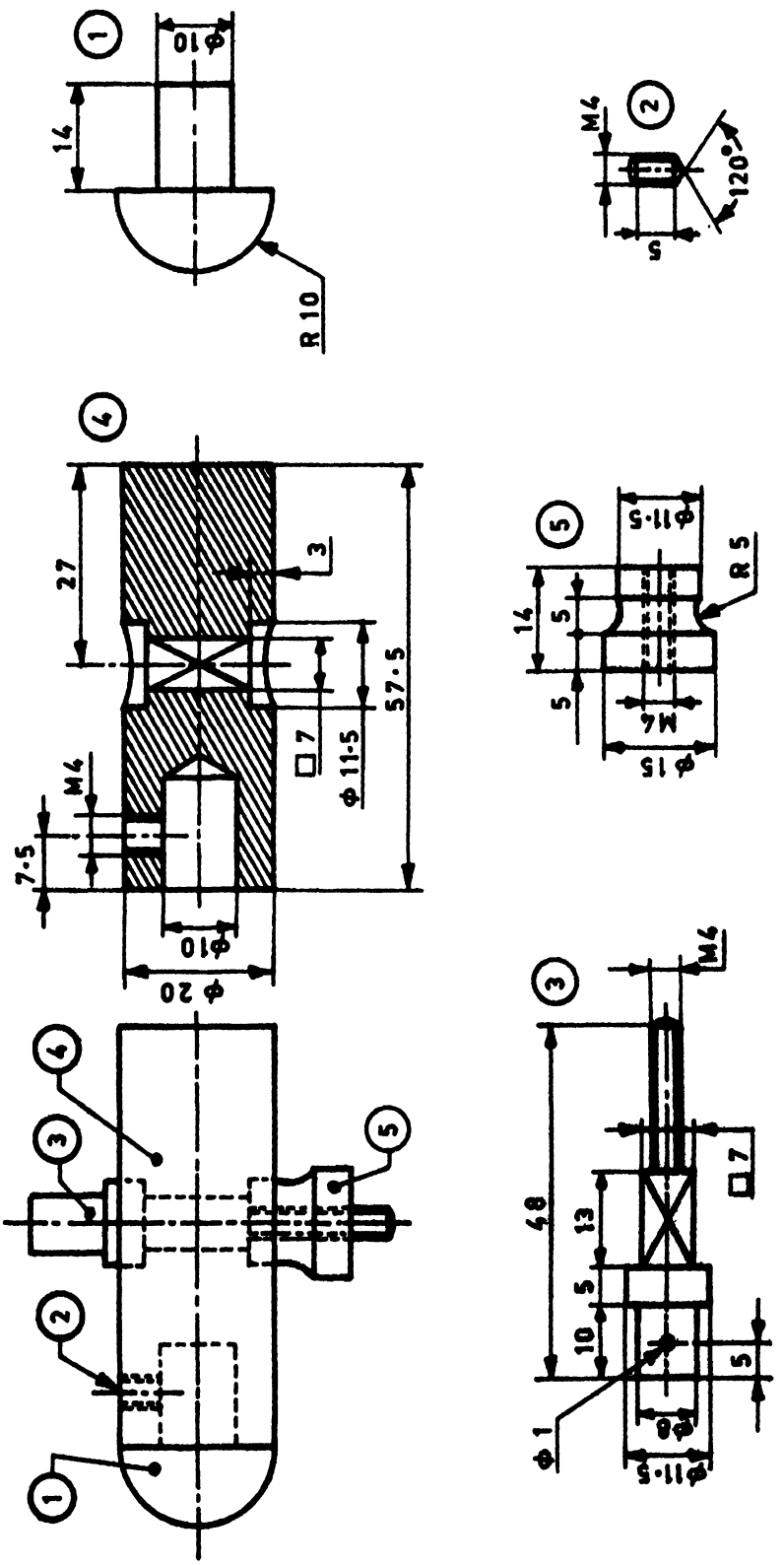
The pendulum consists of a steel tube suspended in such a way that it swings only in a vertical plane. A striking element of 0.15 kg is rigidly fixed to the lower end with its axis 1m from the axis of suspension.

The striking element has a hemispherical face made of polymide having a Rockwell hardens of R 100, or hornbeam, and a radius of 10 mm (*see* Fig. 2).

The design of the apparatus is such that a force of between 1.9 N and 2 N has to be applied to the face of the striking element to maintain the pendulum in a horizontal position.

Ceiling roses are mounted in the center of a sheet of plywood, 8 mm thick and 175 mm square, secured at its top and bottom edges to a mounting support shown in Fig. 3.

The mounting support shown (*see* Fig. 3) having a mass of 10 ± 1 kg is mounted on a rigid brackets by

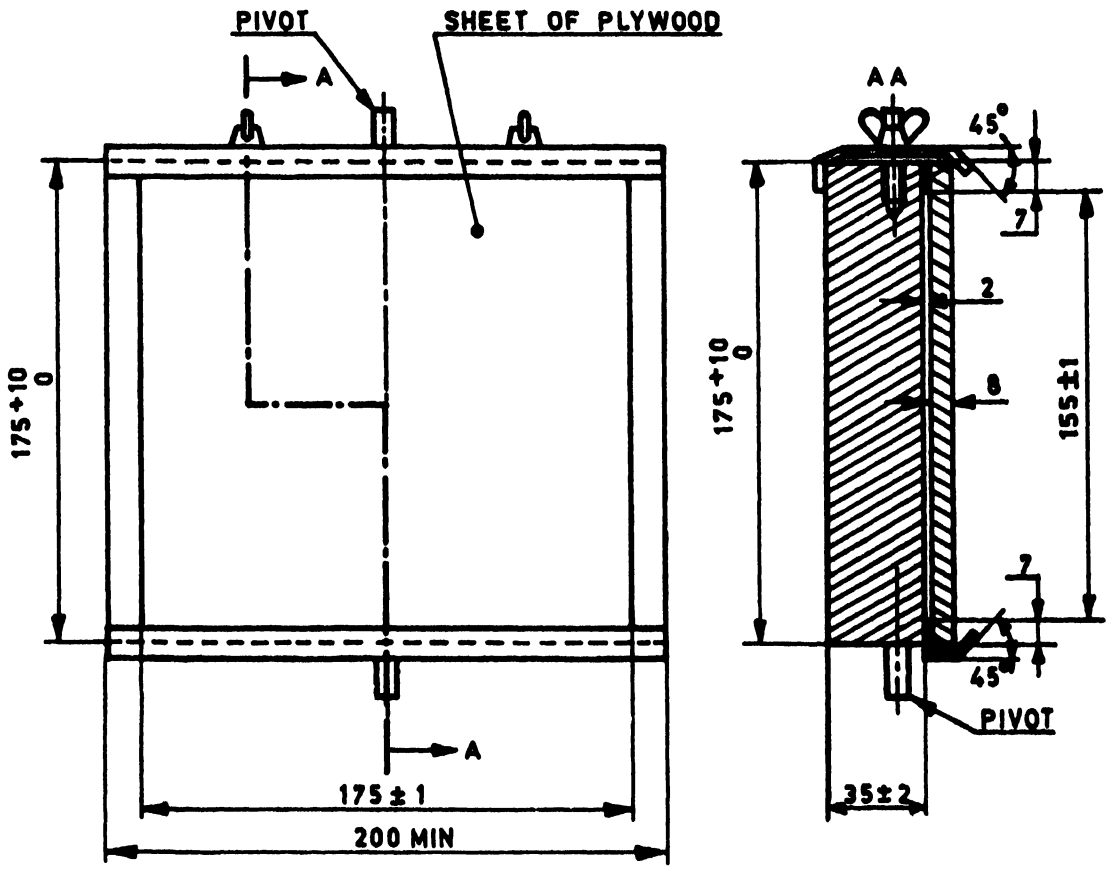


Materials
1 : polyamide or hornbeam
2, 3, 4 and 5 . steel

NOTE — This drawing is not intended to govern design except as regards the dimensions and specific requirements shown.

All dimensions in millimetres.

FIG. 2 CONSTRUCTIONAL DETAILS OF STRIKING ELEMENT



NOTE — This drawing is not intended to govern design except as regards the dimensions and specific requirements shown

All dimensions in millimetres.

FIG. 3 CONSTRUCTIONAL DETAILS OF MOUNTING SUPPORT FOR TEST SPECIMENS

means of pivots. The bracket is mounted on a frame which is fixed to a solid wall. The design of the rigid mounting is such that:

a) the ceiling rose can be so placed that the point of impact lies in the vertical plane through the exist of the pivot;
b) the ceiling rose can be moved horizontally and turned about an axis perpendicular to the surface of the plywood; and
c) the plywood can be turned about a vertical axis.

17.3 Surface type ceiling roses shall be mounted on the plywood.

Flush or semi-recessed type ceiling roses and their boxes, if any, shall be placed in a block of hardwood which is itself fixed to the sheet of plywood. In the wood used for the block the direction of the wood fibres shall be perpendicular to the direction of impact. To simulate the condition of normal use the rear of the plate is flush with the surface of the block. The front edge of the box shall be between 2.5 mm and 5 mm behind the face of the block.

For all tests the striking element shall be between 2.5 mm and 5 mm behind the face of the block.

For all tests the striking element shall fall from a height of 150 mm measured vertically between the point of impact on the ceiling rose and the face of the striking element at the point of release.

A total of 10 blows shall be applied to points distributed over the accessible external surface of the ceiling rose, excluding knock-outs.

During the test, cracks may appear and small pieces may become detached, but provided the ceiling rose cover can be removed and replaced and still complies with **11**, **15.5** and **15.6**.

18 RESISTANCE TO HEAT

18.1 Ceiling roses shall be resistant to heat.

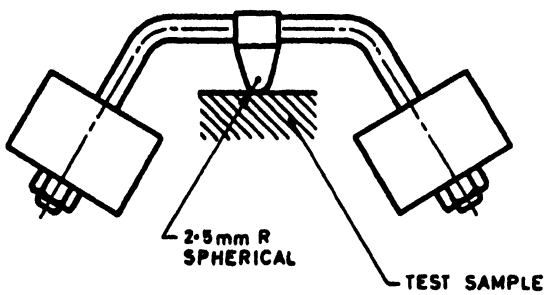
18.1.1 Compliance shall be checked by the tests described in **18.2**, **18.3** and **18.4**.

18.2 The ceiling roses shall be kept for 1 h in a heating cabinet at a temperature of 100 ± 2°C.

During the test, the ceiling roses shall not undergo any change impairing their further use. Any flow of sealing compound shall be disregarded.

After the test, the ceiling rose shall comply with **11**.

18.3 Parts of insulating material necessary to retain current carrying parts shall be subjected to a ball pressure test by means of the apparatus shown in Fig. 4. The surface of the part to be tested shall be placed in a horizontal position and a steel ball of 5 mm diameter shall be pressed against this surface with a force of 20 N.



NOTE — This drawing is not intended to govern design except as regards the dimension and specific requirements shown

All dimension in millimetres

FIG. 4 BALL PRESSURE TEST APPARATUS

When it is possible to carry out the test on the ceiling rose itself the tests shall be carried out on a specimen of the same material not less than 2 mm thick.

The tests shall be made in a heating cabinet at any ambient temperature between 15°C to 35°C.

The underside of the supporting means shall be placed within the heating cabinet for a sufficient time to ensure they have attained the stabilized testing temperature before the test commences.

The part to be tested shall be placed in heating cabinet for a period of 10 min before the test load is applied.

After 1 h, the ball shall be removed from the specimen which shall then be cooled down by immersion for at least 10 s in water at approximately room temperature. The diameter of the impression caused by the ball shall be measured and shall not exceed 2 mm.

18,4 Parts of insulating material not necessary to retain current carrying parts in position, even though they are in contact with them, shall be subjected to a ball pressure test as described in **17.3** but the test shall be made at a temperature at 75 ± 2°C.

19 RESISTANCE TO ABNORMAL HEAT, FIRE AND TRACKING

19.1 Accessories shall be proof against abnormal heat, fire and tracking.

19.1.1 Compliance shall be checked by the tests described in **19.2** and **19.3**.

The tests shall not be made on parts of ceramic material or metal.

19.2 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, in position, by the test made at a temperature of 85°C, and

b) for parts of insulating material not necessary to retain current-carrying parts and parts of the earthing circuit in position, even they are in contact with them, by the test made at a temperature of 85°C.

If the tests specified have to be made at more than one place on the same switch, care shall be taken to ensure that any deterioration caused by previous tests does not affect the result of the test to be made.

Small parts, such as washers, are not subjected to tests.

The tests are not made on parts of ceramic material

NOTES

1 The glow-wire test is applied to ensure that electrically heated test wire under defined test condition does not cause ignition of insulating parts or to ensure that a part of insulating material, which might be ignited by the heated test wire under defined conditions, has a limited time to burn without spreading fire by flame or burning parts or droplets from the tested part falling down on to the painedwood board covered with tissue paper

If possible, the specimen should be a complete ceiling rose

2 If the test cannot be made on a complete ceiling rose a suitable part may be cut from it for the purpose of the test

The test is made on one specimen In case of doubt, the test shall be repeated on two further specimens

The specimens shall be stored for 24 h at standard ambient atmospheric condition before the test

The test is made applying the glow-wire once

The specimen shall be positioned during the test in the most unfavourable position of its intended use (with the surface tested in a vertical position) The tip of the glow-wire shall be applied to the specified surface of the specimen taking into account the conditions of the intended use under which a heated or glowing element may come into contact with the switch

During the application time of the glow-wire and during a period of 30 s from the end of the application time, the sample and the surrounding parts, including the layer under the sample, shall be observed

The time when the ignition of the sample occurs and/or the time when the flames extinguish during or after the application time shall be measured and recorded

The switch is regarded as having passed the glow-wire test if:

— there is no visible flame and sustained glowing.

— flames and glowing at the switch extinguish within 30 s after the removal of the glow-wire.

There shall be no ignition of the wrapping tissue or scorching of the board.

3 The test may be carried out by the alternative method given in Annex J of IS 302-1. However the method shall not be applicable after 3 years from the date of publication of this standard.

4 A typical diagram of glow-wire test apparatus and glow-wire with thermocouple has been shown in Fig. 5 and Fig. 6.

19.3 Tracking Test

A flat surface of the part to be tested, if possible at least 15 mm × 15 mm and 3 mm thick, is placed in a horizontal position. Two electrodes of platinum with dimensions shown in Fig. 7, are placed on surface of the specimen as shown in figure, so that the rounded edges are in contact with the specimen over the whole length. The force exerted on the surface by each electrode is 1 ± 0.05 N.

The electrodes are connected to a 50 Hz supply of substantially sinusoidal waveform with a no-load voltage of 175 V. The current is adjusted by means of a variable resistor to 1 ± 0.1A with cos ϕ = 0.95 ± 0.05. An over current relay which will trip when 0.5 A or more has persisted for 2 s is included in the circuit.

The surface of the specimen is wetted by allowing drops of a solution of aluminium chloride in distilled water to fall centrally between the electrodes. The solution shall have a resistivity of 395 ± 5Ω.cm any ambient temperature between 15°C to 35°C corresponding to a concentration of 0.1 percent. The drops shall have a volume of 20 ± 3 mm^3 and shall fall a distance of 35 ± 5 mm. The time interval between one drop and the next shall be 30 ± 5 s. No flashover or breakdown between the electrodes shall occur before 50 drops have fallen.

The test shall be made at three places on the specimen. In case of doubt the test is repeated, if necessary on a new specimen.

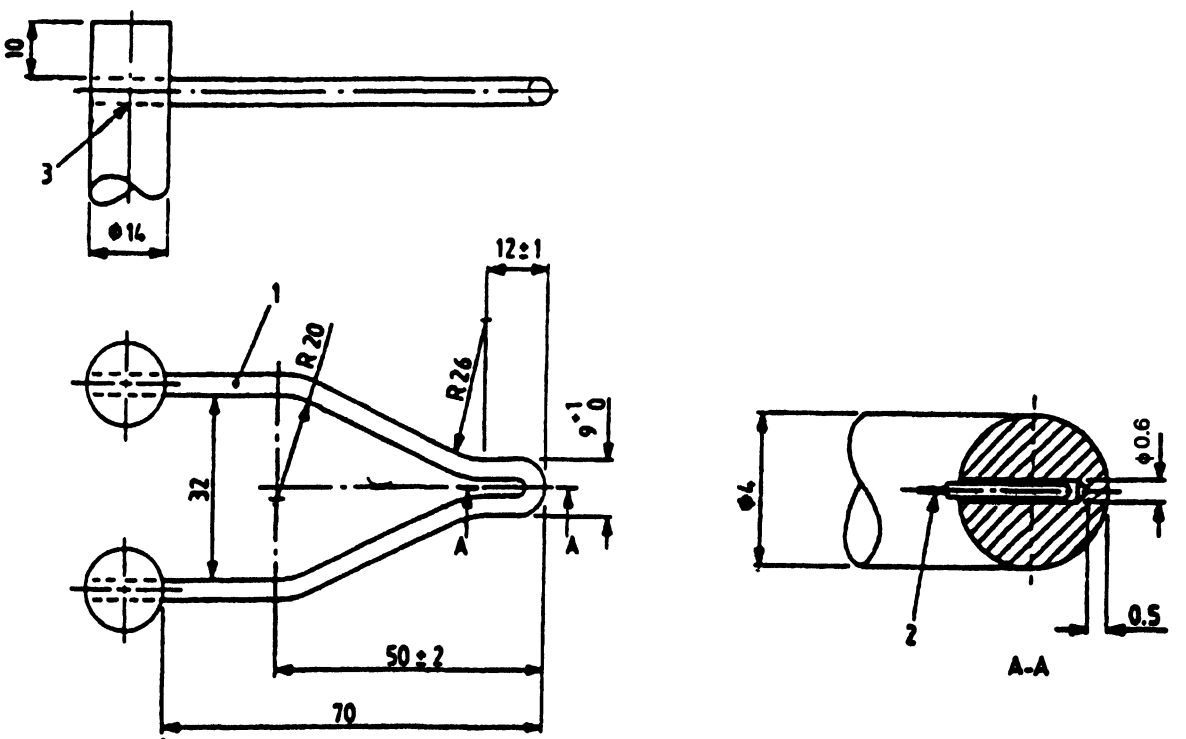
NOTES

1 It is essential that care is taken to ensure that the electrodes are clean, correctly shaped and correctly positioned before each test is started.

2 This test is for the proper selection of the raw material as a guidance for the manufacturers.

20 SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS

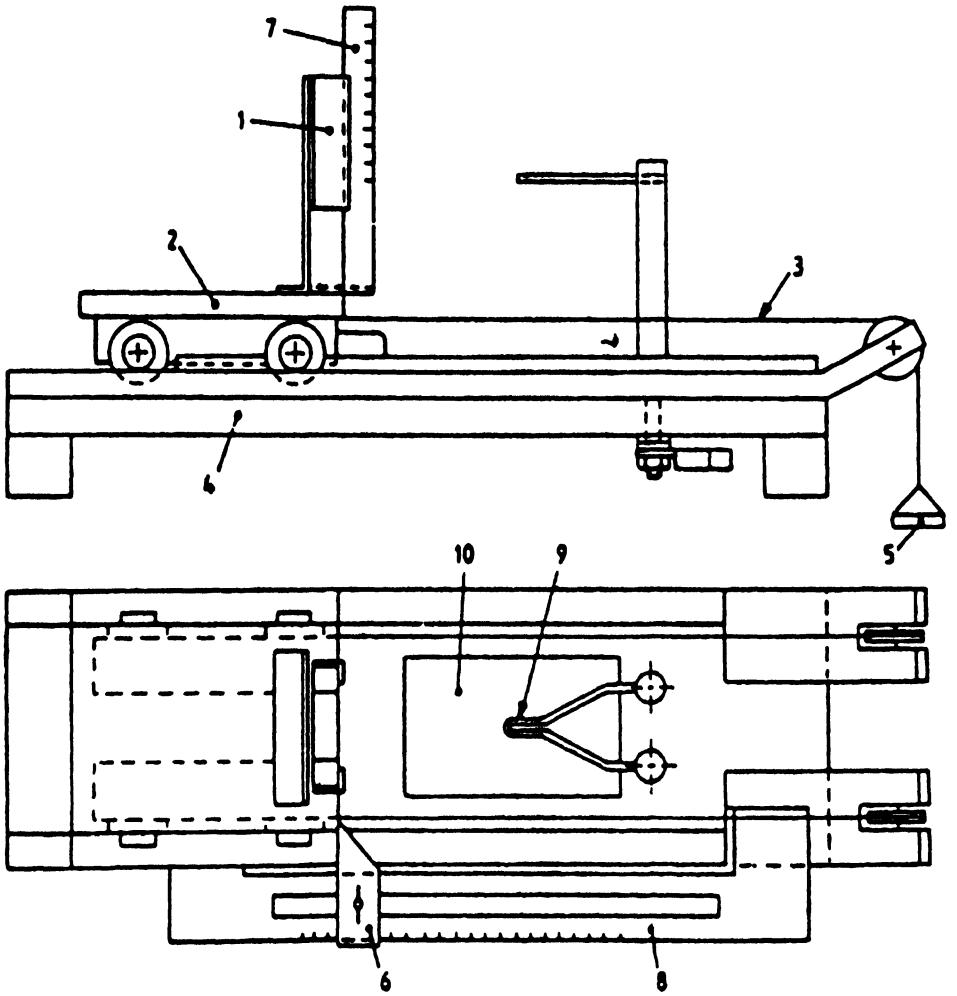
20.1 Screwed connection, electrical and otherwise,



All dimensions in millimetres.

Key: 1. Glow-wire, brazed to 3 2. Thermocouple 3. Brass studs (37 percent Cu)

FIG. 5 GLOW-WIRE WITH THERMOCOUPLE



Key:
1 — Support for sample
2 — Carriage
3 — Pulling string
4 — Base plate
5 — Weight

Key.
6 — Adjustable stop
7 — Scale for flame height
8 — Scale for depth of penetration
9 — Glow-wire with thermocouple
10 — Opening in base plate to pass molten or glowing particles

FIG. 6 GLOW-WIRE TEST APPARATUS

shall withstand the mechanical stresses occurring in normal use. Screw transmitting electrical contact pressure shall screw into metal. Screw shall not be of metal which is soft and liable to creep.

Screw shall not be of insulating material if their replacement by a metal screw would affect compliance of this clause.

Electrical connection shall be so designed that contact pressure is not transmitted through insulating material other than ceramic, unless there is sufficient resiliency in the metal parts to compensate for any possible shrinkage of the insulating material.

20.1.1 Compliance shall be checked by inspection and, for screws and nuts which are intended to be tightened during installation, or use, by the following test.

The screw shall be tightened and loosened:

a) 10 times for screws in engagement with a thread of insulating material, the screw being completely removed and replaced each time; and

b) five times for nuts other than screws.

NOTES

1 The requirements for the verification of terminals are given in 13

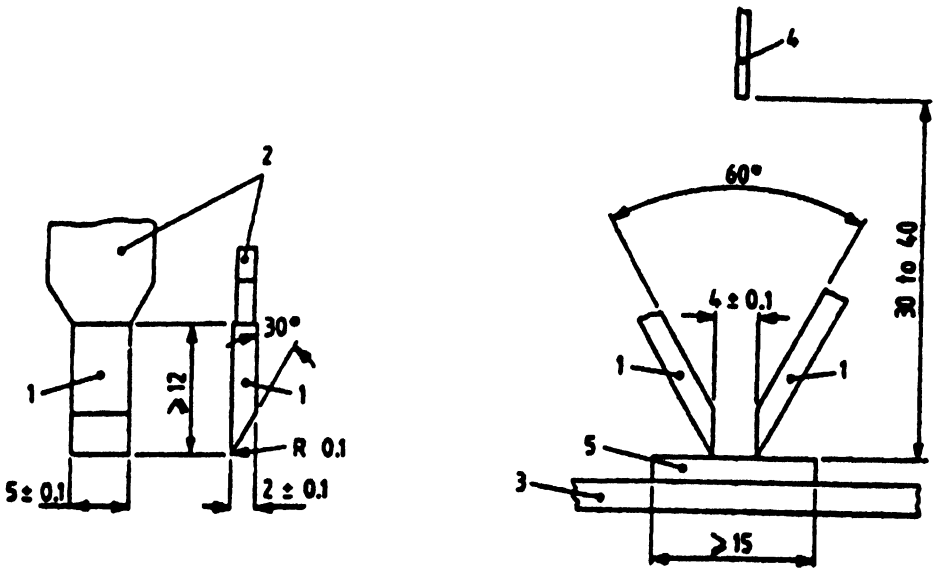
The test shall be made by means of a suitable test screwdriver, applying a torque as given in Table 1

During the test no damage impairing the further use of the screwed connection shall occur.

2 It is essential that the shape of the blade of the test screwdriver suits the head of the screw being tested, and that the screw is not tightened in jerks

20.2 Thread-forming screws shall not be used for the connection of current-carrying parts.

NOTE — Thread forming screws may be used to provide



(a) Electrode

(b) Electrode Arrangement

Key:
1 — Platinum electrode
2 — Brass extension
3 — Support

Key:
4 — Tip of dropping device
5 — Specimen

All dimensions in millimetres.

FIG. 7 ARRANGEMENT AND DIMENSIONS OF THE ELECTRODES FOR THE TRACKING TEST

earthing continuity, provided that it is not necessary to distrub the connection in normal use and at least two screws are used for each connection.

Screws which make a mechanical connection between different parts of the accessory shall be locked against loosening, if the connection carries current. Rivets used for curent-carrying connection shall be locked against loosening, if these connection are subject to torsion in normal use.

20.2.1 Compliance shall be checked by inspection and by manual test to check tightness.

NOTES

1 Spring washers and the like may provide satisfactory locking.

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

20.3 Current-carrying parts shall be of brass, copper, phosphorbronze or other metal at least equivalent with regard to its conductivity and resistance to corrosion.

NOTE — This requirement does not apply to screws, nuts, washers, clamping plates and similar parts of terminals nor to parts used for earth continuity purposes.

20.3.1 Compliance shall be checked by inspection and by the relevant tests of **16** and **22**.

21 CREEPAGE DISTANCE AND CLEARANCES

Creepage distance and clearances shall be not less than the values shown in Table 3.

21.1 Compliance shall be checked by inspection and measurement.

Table 3 Creepage Distances and Clearances
(*see Clause* 21, and *Annex* A)

Sl No.	Path Under Consideration	Clearance mm	Creepage mm
(1)	(2)	(3)	(4)
i)	Between live parts of different polarity	2.0	2.5
ii)	Between live parts and other metal parts	2.5	2.5
iii)	Between live metal parts and the enclosure or the surface on which the accessory is mounted, unless the holes containing such live parts are filled in with a non-hydroscopic insulation of at least 1 mm thickness	3.0	—

22 RESISTANCE TO EXCESSIVE RESIDUAL STRESS AND TO RUSTING

22.1 Contacts and other functional parts of copper or copper alloy shall be resistant to failure in use due to brittleness.

22.1.1 Parts made from copper or copper alloy containing not less than 80 percent copper shall be assumed to comply.

For copper alloys containing less than 80 percent copper, compliance shall be checked by the following test.

The part is de-greased in a suitable alkaline decreasing solution or organic solvent, then immersed in an aqueous solution of mercurous nitrate containing 10 g of $Hg_2 (NO_3)_2$ and 10 ml of HNO_3 (relative density 1.42) per litre of solution for 30 min at any ambient temperature between 15°C to 35°C.

NOTE — Attention is drawn to the fact that due precautions should be taken when using these liquids as they are toxic.

After the treatment the sample is washed in running water, any excess mercury wiped off and the sample is immediately visually examined. There shall be no cracks visible with normal or corrected vision without additional magnification.

22.2 Ferrous part shall be adequately protected against rusting.

22.2.1 Compliance shall be checked by the following test.

All grease is removed from the parts to be tested, by immersion in trichlorethane or an equivalent decreasing agent for 10 min. The parts are then immersed for 10 min in a 10 percent solution of aluminium chloride in water at any ambient temperature between 15°C to 35°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 any ambient temperature between 15°C to 35°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 should be ignored.

2 For small helical spring and the like, and for parts exposed to abrasion, a layer of grease may provide sufficient protection against rusting. Such parts are only subjected to the test if there is doubt about the effectiveness of the grease film and the test should then be made without previous removal of the grease.

23 TESTS

23.1 Type Tests

The following shall be carried out as type tests on three samples of ceiling roses, drawn preferably at random from a regular production lot:

Sl No.	*Type Test*	*See Clause*
i)	Markings	9
ii)	Dimensions	10
iii)	Accessibility of live parts	11
iv)	Provision of earthing	12
v)	Terminals	13
vi)	Construction	14
vii)	Resistance to moisture and humidity, insulation resistance and electric strength	15
viii)	Temperature rise	16
ix)	Mechanical strength	17
x)	Resistance to heat	18
xi)	Resistance to abnormal heat fire and tracking	19
xii)	Screws, current-carrying parts and connectors	20
xiii)	Creepage distances and clearances	21
xiv)	Resistance to excessive residual stresses and to rusting	22

23.1.1 The number of samples shall be nine and subjected to test specified in **6.2**.

23.1.2 *Criteria of Acceptance*

The criteria of acceptance shall be as per **6.4**.

23.2 Acceptance Tests

The following shall constitute acceptance test:

Sl No.	*Acceptance Test*	*See Clause*
i)	Marking	9
ii)	Dimensions	10
iii)	Accessibility of live parts	11
iv)	Provision of earthing	12
v)	Terminals	13
vi)	Resistance to moisture and humidity insulation resistance and electric strength	15
vii)	Temperature rise	16
viii)	Mechanical strength	17
ix)	Screws, current-carrying parts and connections	20

23.2.1 For sampling plan IS 2500 (Part1) may be referred to.

23.3 Routine Tests

The following shall constitute routine tests:

i) Flash test (*see* **15.7**)

ii) Marking (*see* **9**)

NOTE — Marking shall be checked by inspection.

ANNEX A

(*Clause* 21, and *Table* 3)

MEASUREMENT OF CREEPAGE DISTANCES AND CLEARANCES

A-1 The methods of measuring creepage distances and clearances to be used in interpreting the requirements of 21 are indicated in Cases 1 to 10 of this Annex. These cases do not differentiate between gaps and grooves or between types of insulation.

A-2 The following assumptions are made.

a) A groove may have parallel, converging or diverging sides.

b) Any groove having diverging sides, a minimum width exceeding 0.25 mm, a depth exceeding 1.5 mm and width at a bottom equal to, or greater than, 1 mm, is regarded as an air gap (*see* Case 8).

c) Any corner including an angle less than 80° is assumed to be bridged with an insulating link of 1 mm width (0.25 mm for dirt-free situations) moved into the most unfavourable position (*see* Case 3).

d) Where the distances across the top of a groove is 1 mm (0.25 mm for dirt-free situations) or more, no creepage distance exists across the air space (*see* Case 2).

e) A creepage path is assumed not to exist if there is an air gap, as defined in item (b) above, exceeding 0.25 mm.

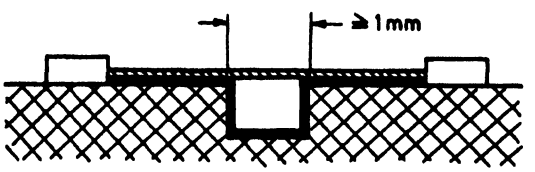
f) Creepage distances and clearances measured between parts moving relative to each other are measured when these parts are in their most unfavourable stationary positions.

g) A computed creepage distance is never less than a measured clearance.

h) Any air gap less than 1 mm wide (0.25 mm for dirt-free situations) is ignored in computing the total clearance.

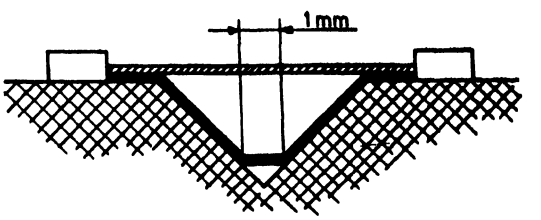
Condition: Path under consideration includes a parallel-or converging-sided groove of any depth with width less than 1 mm.
Rule: Creepage distance and clearance are measured directly across the groove as shown.

CASE 1



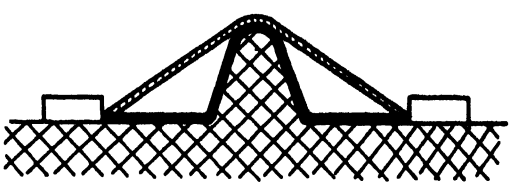
Condition: Path under consideration includes a parallel-sided groove of any depth, and equal to or more than 1 mm wide.
Rule: Clearance is a "line of sight" distance. Creepage path follows the contour of the groove.

CASE 2



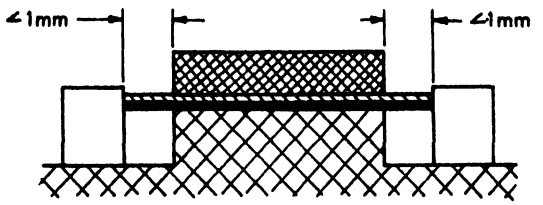
Condition: Path under consideration includes a V-shaped groove with internal angle of less than 80° and with a width greater than 1 mm.
Rule: Clearance is "line of sight" distance. Creepage path follows the contour of the groove but "short-circuits" the bottom of the groove by 1 mm (¼ mm for dirt-free situations) link.

CASE 3



Condition: Path under consideration includes a rib.
Rule: Clearance is the shortest direct air path over the top of the rib. Creepage path follows the contour of the rib.

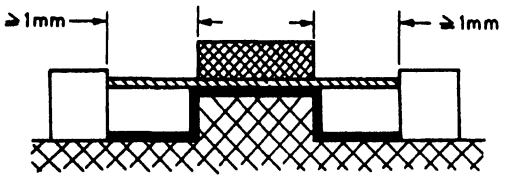
CASE 4



Condition Path under consideration includes an uncemented joint with grooves of less than 1 mm (0 25 mm) width on either side

Rule Creepage and clearance path is the "line of sight" distance shown

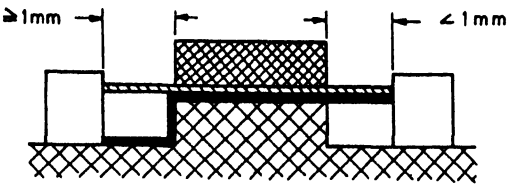
CASE 5



Condition Path under consideration includes an uncemented joint with grooves equal to or more than 1 mm wide each side

Rule Creepage is the "line of sight" distance Creepage path follows the contour of the grooves

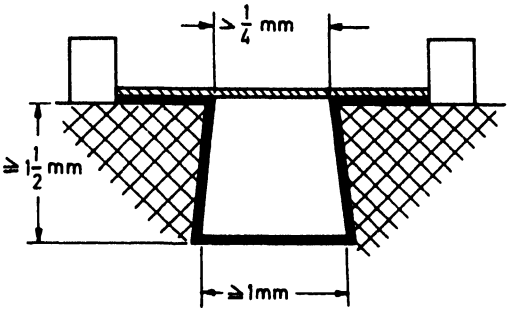
CASE 6



Condition Path under consideration includes an uncemented joint with a groove on one side of less than 1 mm wide, and the groove on the other of equal to or more than 1 mm wide

Rule Clearance and creepage paths are as shown

CASE 7

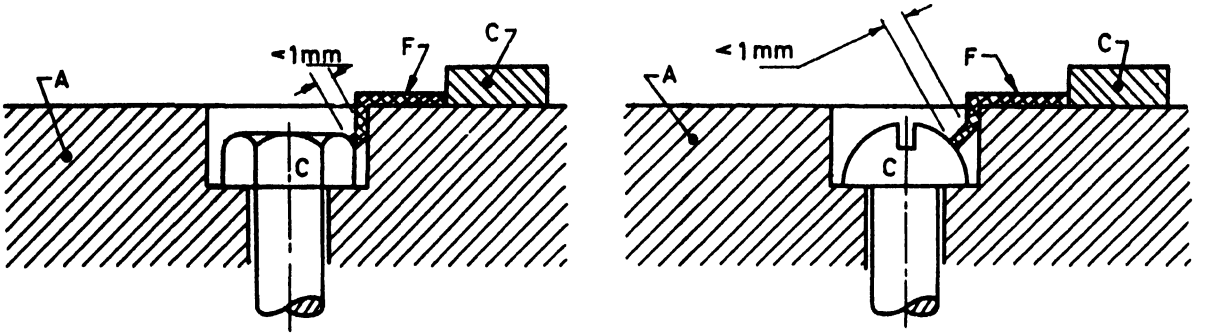


Condition Path under consideration includes a diverging-sided groove equal to or greater than 1½ mm deep and greater than ¼ mm wide at the narrowest part and equal to or greater than 1 mm at the bottom

Rule Clearance is "line of sight" distance Creepage path follows the contour of the groove

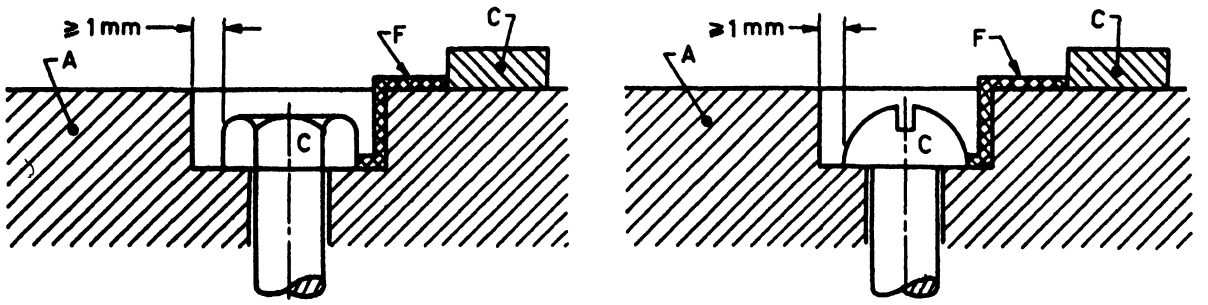
NOTE — Case 3 applies as well to the internal corners if they are less than 80°

CASE 8



Gap between head of screw and wall of recess too narrow to be taken into account

CASE 9



Gap between head of screw and wall of recess wide enough to be taken into account

CASE 10

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of stardardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc: No. ETD 14 (4033).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 3375, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi CALCUTTA 700054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	832 92 95, 832 78 58 832 78 91, 832 78 92
Branches	: AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.	

Printed at Simco Printing Press, Delhi