

इंटरनेट

मानक

Disclosure to Promote the Right To Information

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

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 14772 (2000): General Requirements for Enclosures for Accessories for Household and Similar Fixed Electrical Installations (Superseding IS 5133 (part 1 and 2) [ETD 14: Electrical Wiring Accessories]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक

घरेलू और ऐसे ही स्थायी विद्युत संस्थापन के लिए
उपसाधनों का आवष्टन हेतू सामान्य अपेक्षाएँ — विशिष्टि

Indian Standard

**GENERAL REQUIREMENTS FOR ENCLOSURES FOR
ACCESSORIES FOR HOUSEHOLD AND SIMILAR
FIXED ELECTRICAL INSTALLATIONS —
SPECIFICATION**

ICS 29.120.10

© BIS 2000

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

FOREWORD

This Indian Standard 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.

The requirements of boxes made of steel and cast iron for enclosures of electrical accessories were covered in IS 5133 (Part 1) : 1969. Similarly boxes made of insulating material for the enclosure of electrical accessories were covered in IS 5133 (Part 2). In order to align with International practice, the revision of IS 5133 (Part 1) and IS 5133 (Part 2) have been brought out.

Apart from the changes in the format of the standard, the other important feature of this standard are:

- a) Introduction of classification of boxes,
- b) Check on the durability of marking,
- c) Test for protection against electric shock,
- d) Tests to ensure provisions for earthing,
- e) Constructional details and tests based on degree of protection.
- f) Introduction of tests to ageing, effect due to humidity, ingress of water and solid objects,
- g) Mechanical strength of complete boxes, and
- h) Inclusion of test for resistance to heat, abnormal heat, rusting and tracking.

The primary intention to revise this standard is with a view to ensure adequate safety, mechanical strength and durability of the boxes used for the enclosure of electrical accessories for household and similar fixed electrical installation.

After the publication of this standard IS 5133 (Part 1) and IS 5133 (Part 2) shall be withdrawn.

The enclosure specified in the standard are intended to contain electrical accessories, such as, switches, socket outlets, etc, providing after assembling an appropriate degree of protection of the accessory and the cables and/or conductors against external influences, and a defined degree of protection against contact with enclosed live parts for any direction.

While preparing this standard, considerable assistance have been derived from IEC 60670 (1989) 'General requirements for enclosures for accessories for household and similar fixed electrical installations'.

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 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.

Indian Standard

GENERAL REQUIREMENTS FOR ENCLOSURES FOR ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS — SPECIFICATION

1 SCOPE

This standard applies to enclosures or parts of enclosures or parts for accessories with a rated voltage not exceeding 440 V intended for household or similar fixed electrical installations, either indoors or outdoors.

This standard may be used as a guide for enclosures having a rated voltage up to 1 100 V.

Enclosures complying with this standard are suitable for use, after installation, at ambient temperatures not normally exceeding 35°C, but occasionally reaching 45°C.

For the purpose of this standard the enclosures include surface, flush and semi-flush mounting boxes provided for electrical accessories, where the cover, or cover-plate may or may not be part of the accessory. This standard does not apply to enclosures for assemblies containing overcurrent protective devices, nor to enclosures of the busbar trunking type.

This standard also applies to boxes intended for the mounting or suspension of luminaires.

This standard is intended to apply to enclosures for electrical accessories but is also intended to serve as a reference document for other Indian Standards.

An enclosure which is an integral part of an electrical accessory and provides protection for that accessory against external influences (for example mechanical impact, ingress of solid objects or water, etc) is covered by the relevant standard for such an accessory.

2 REFERENCES

2.1 Following Indian Standards are necessary adjuncts to this standard:

<i>IS/IEC No.</i>	<i>Title</i>
1586 : 1988	Method of Rockwell Hardness test for metallic materials (scales A-B-C-D-E-F-G-H-K) (<i>second revision</i>)
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*)

2824 : 1975	Method for determining the comparative tracking index of solid insulating material under moist condition (<i>first revision</i>)
11000 (Part 2/ Sec 1) : 1984	Fire hazard testing: Part 2 Test method, Section 1 Glow wire test and guidance
12063 : 1987	Classification of degree of protection provided by enclosures of electrical equipment
13588 : 1993/ IEC 817:1984	Spring operated impact test apparatus and calibration
14763 : 2000	Conduits for electrical purposes, inside diameters of conduits for electrical installations and thread for conduits and fittings

3 TERMINOLOGY

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

3.1 Enclosures — Parts, such as surface mounting boxes, covers, cover-plates, switches, socket-outlets, etc, providing, after assembling, and appropriate degree of protection of the accessory and the cables and/or conductors against external influences, and a defined degree of protection against contact with enclosed live parts from any direction.

3.2 Surface Mounting Box — A part of an enclosure which is intended for mounting on a surface.

3.3 Flush Mounting Box — A part of an enclosure which is intended for mounting flush with the surface.

3.4 Semi-flush Mounting Box — A part of an enclosure which is intended to fit within a mounting surface and partially projects from the mounting surface.

3.5 Box Extension Collar — A part of an enclosure which is intended to extend a mounting box.

3.6 Cover or Cover-plate — A part of an enclosure, not integral with accessory, which may either retain the accessories in position or enclose it.

NOTE — Examples of enclosures and parts thereof are shown in Annex A.

3.7 Routine Test — Test carried out on each item to check the essential requirement which are likely to vary during production.

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

3.9 Type Test — Tests carried out to prove conformity with the requirement of the standard. These are intended to prove the general qualities and design of a given type of product.

4 GENERAL REQUIREMENTS

4.1 Enclosures shall be so designed and constructed that, when mounted as for normal use, they ensure adequate electrical and mechanical protection to the parts so enclosed and prevent danger to the user or surroundings.

Compliance is checked by carrying out all the relevant tests specified.

5 GENERAL NOTES ON TESTS

5.1 Tests according to this standard are type tests.

Tests on enclosures of insulating material shall be performed after a preconditioning period of 10 days at ambient temperature and relative humidity of air between 50 percent and 85 percent.

5.2 Unless otherwise specified the tests shall be carried out in the order of clauses at an ambient temperature of $27 \pm 5^\circ\text{C}$ on a set of three new samples.

5.3 Enclosures shall be deemed not to comply with this standard if there is more than one failure in any 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, shall be repeated on another similar set of samples, all of which shall then comply with the repeated tests.

NOTE — The manufacturer, when submitting the first set of samples, may also submit the additional set of samples, which may be necessary should one sample fail. The testing station will then, without further request test the additional set of samples and will only reject it if a further failure occurs.

If the additional set of samples is not submitted at the same time, the failure of one sample will entail a rejection.

6 CLASSIFICATION

Enclosures are classified according to:

6.1 The nature of their material

6.1.1 Insulating material

6.1.2 Metallic

6.1.3 Composite

6.2 The method of installation

6.2.1 Flush-type

6.2.2 Semi-flush type

6.2.3 Surface-type

6.3 The Nature of installation

6.3.1 Enclosures flush mounted in :

6.3.1.1 Solid non-combustible walls and ceilings:

- a) Suitable to be placed before the building process (for example suitable for casting into concrete).
- b) Suitable to be placed after the building process (for example not suitable for casting into concrete).

6.3.1.2 Solid combustible walls and ceilings

6.3.1.3 Hollow walls, hollow ceilings, furniture, architraves

6.3.1.4 Trunking and ducting

6.3.2 Enclosures surface mounted on:

6.3.2.1 Non-combustible walls and ceilings

6.3.2.2 Combustible walls and/or ceilings and/or furniture

6.4 The temperature range during installation

6.4.1 from -5°C to $+60^\circ\text{C}$

6.4.2 from -15°C to $+60^\circ\text{C}$

6.4.3 from -25°C to $+60^\circ\text{C}$ (see Note)

NOTE — These types are intended for enclosures to be used outdoor conditions with a cold climate.

6.5 The maximum temperature during the building process

6.5.1 $+60^\circ\text{C}$

6.5.2 $+60^\circ\text{C}$ (see Note)

NOTE — These types are for use in prefabricated concrete and will temporarily withstand temperatures up to $+90^\circ\text{C}$.

6.6 The degree of protection against direct contact and harmful ingress of solid objects and harmful ingress of water.

According to IP given in IS 12063.

6.7 The provision for suspension means

6.7.1 Without suspension means

6.7.2 With suspension means

Enclosures intended to provide double or reinforced insulation are under consideration.

7 MARKINGS

Enclosures shall be marked with:

- name, trade-mark or identification mark of the manufacturer or the responsible vendor;
- type reference, which may be a catalogue number;
- symbol for degree of protection against ingress of solid objects if higher than IP2X;
- symbol for degree of protection against harmful ingress of water if higher than IPXO and a box is supplied together with cover-plates;
- where the degree of protection IPXX is reduced during its normal use (for example due to insertion of a plug into a socket-outlet) the relevant IP symbol shall be additionally marked; and
- “15°C” or “-25°C”, if applicable.

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

Other markings shall be visible after installation which may include removal of the cover, cover-plate, accessories, etc, the type reference may be marked on the package only.

Markings shall be durable and easily legible.

Details of the applicable classification according to 6.3, 6.4 and 6.5 shall be given in the manufacturer's catalogue.

Compliance is checked by inspection and by the following test:

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

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

Unless self-evident, further information for the correct use of the enclosure shall be given in the manufacturer's catalogue or in an instruction sheet.

NOTE — Petroleum spirit is defined as a solvent hexane with a content of aromatics of maximum 0.1 volume percentage, a kauributanol value of 29, an initial boiling point of approximately 65°C, a dry point of approximately 69°C and a density of approximately 0.68 g/cm³.

7.1 The enclosures for accessories may also be marked with Standard Mark.

7.1.1 The use of the Standard Mark is governed by

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

8 CHECKING OF DIMENSIONS

Under consideration.

9 PROTECTION AGAINST ELECTRIC SHOCK

9.1 Enclosures shall be so designed that, when they are mounted as for normal use, the live parts of any correctly installed accessories or any parts of these accessories which may become live due to a fault shall not be accessible.

This requirement does not apply to small screws or the like, insulated from live parts, for fixing covers or cover-plates to the mounting box.

All the enclosures having a cover or an accessory incorporated shall have a degree of protection of at least IP20, using the standard test finger only. Where boxes are supplied for use without cover, cover-plate or accessory they are tested with the appropriate parts fitted, according to the information given in the manufacturers catalogue.

Compliance is checked by inspection and by applying in every possible position on parts which are accessible after correct installation:

- For enclosures IP20, the unjoined test finger (according to IS 12063) with a force of 10 N;
- For enclosures IP30, the steel rod having a diameter of 2.5 mm with a force of 3 N;
- For enclosure IP40, the steel rod having a diameter of 1 mm with a force of 1 N;
- When in doubt, an electrical indicator with a voltage not less than 40V and not more than 50V is used to show contact with the relevant part.

9.2 Enclosures specifically intended to carry an accessible metal device for example a hook to suspend a load, shall be so designed that any contact between the accessible device and live parts or parts which may become live in the event of an insulation fault is prevented, unless the metal accessible device includes a means for reliably connecting it to the earthing circuit.

Compliance is checked by inspection.

9.3 Metal covers or cover-plates, which may become live in the event of an insulation fault, shall be automatically connected, through a low resistance

connection, to the earthing circuit during fixing of the cover or cover-plate itself.

The use of fixing screws, or other means, is allowed.

Compliance is checked by inspection and by the test of 10.2.

10 PROVISION FOR EARTHING

10.1 Metallic enclosures, which may become live in the event of an insulation fault, shall be provided with a facility for permanent and reliable connection to an earthing means.

Compliance is checked by inspection.

10.2 The correction between an 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 12V and equal to 25A is passed between the earthing terminal and each of the accessible metal parts in turn. The voltage drop between the earthing terminal and the accessible metal parts is measured, and the resistance calculated from the current and this voltage drop.

In no case shall the resistance exceed 0.05 Ω .

NOTES

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

2 In insulating enclosures with IP > XO provision may be made for the addition of means for the effective continuity of the earthing conductor, when more than one inlet is provided.

11 CONSTRUCTIONAL REQUIREMENTS

11.1 Enclosures shall have adequate mechanical strength.

Compliance is checked by inspection and by the tests of 13.

11.1 Covers or cover-plates which are intended to ensure safety against electric shock shall be reliably held in place by two or more independent means, at least one of which requires the use of a tool.

One means only, requiring the use of a tool, is allowed if it acts centrally, provided that it holds the covers or the cover-plate reliably in place.

Compliance is checked by inspection.

The tests for snap-on fixing means are under consideration.

11.3 Enclosures with IP>XO fitted with appropriate glands or membranes if any, shall provide the required degree of protection against harmful ingress of water

when fitted with conduit or with sheathed cable.

Compliance is checked by inspection and by the test of 12.4.

11.4 Surface and semi-flush mounting enclosures with IP X1 to IP X6 shall be designed to allow opening a drain-hole at least 5 mm in diameter or 20 mm² in area with a minimum width or length of 3 mm.

Drain-holes shall be so located and available in such a number that one of the holes can always become effective in any intended position of the enclosure.

Compliance is checked by inspection, measurement and the use of probes.

11.5 Enclosures suitable for mounting in hollow walls shall have at least IP20.

They shall be provided with suitable means for fixing accessories, covers or cover-plates.

Compliance is checked by inspection and by a test under consideration.

11.6 Enclosures shall have provisions for their attachment into or onto a wall or ceiling.

Enclosures of insulating material shall be constructed in such a way that, when mounted using the fixing means intended, any metal parts of an internal fixing means is surrounded by insulation which projects above the top of the fixing means by an amount of at least 10 percent of the maximum width of the fixing means recess.

Compliance is checked by inspection and by measurements.

11.7 Inlet openings, if any, shall allow either the introduction of the conduit or a suitable fitting terminating the conduit at the enclosure or the protective covering of the cable so as to provide mechanical protection.

Inlet opening for conduit entries, or at least two of them if there are more than one, shall be capable of accepting either conduits of sizes, or a combination of sizes in accordance with the requirements given in IS 14763.

Compliance is checked by inspection and by tests using the appropriate cables or conduits.

NOTES

1 Inlet openings for cable entries are under consideration.

2 Inlet openings of adequate size may also be obtained by the use of knock-outs or suitable insertion pieces or by means of an appropriate cutting tool.

11.8 Screw fixing means for covers, accessories, etc, shall be so designed that these means withstand the mechanical stress occurring during installations and normal use.

Compliance is checked by inspection, by the following test and, if relevant, by the test of 13.3.

The screw fixing means are tightened and loosened:

- 10 times for screws in engagement with a thread of insulating material and for screws of insulating material; and
- 5 times in all other cases.

Screws and nuts in engagement with a thread of insulating material and screws of insulating material are completely removed and re-inserted each time. The use of thread-forming tapping screws is allowed for screws which can be removed by the user.

The use of thread-cutting tapping screws is allowed for screws which are tightened once only.

The test is made by using a suitable screwdriver applying a torque as given in Table 1.

Table 1 Requirement of Torque for Screws
(Clause 11.8)

Nominal Diameter of Thread mm	Torque Nm	
	I	II
Up to and including 2.8	0.2	0.4
Over 2.8 up to and including 3.0	0.25	0.5
Over 3.0 up to and including 3.2	0.3	0.6
Over 3.2 up to and including 3.6	0.4	0.8
Over 3.6 up to and including 4.1	0.7	1.2
Over 4.1 up to and including 4.7	0.8	1.8
Over 4.7 up to and including 5.3	0.8	2.0
Over 5.3 up to and including 6.0	1.2	2.5
Over 6.0 up to and including 8.0	2.5	3.5
Over 8.0 up to and including 10.0	—	4.0
Over 10.0	Under consideration	

NOTES

1 Column I applies to screws which cannot be tightened by means of a screwdriver with a blade wider than the diameter of the screw.

2 Column II applies to other screws which are tightened by means of a screwdriver.

During the test, there shall be no damage, such as breakage of screw or damage to the head slot rendering the use of the appropriate screwdriver impossible or to threads or enclosures impairing the further use of the fixing means. The screws must not be tightened in jerks.

12 RESISTANCE TO AGEING, TO HUMID CONDITIONS, TO INGRESS OF SOLID OBJECTS AND TO HARMFUL INGRESS OF WATER

12.1 Resistance to Ageing and to Climatic Conditions of Insulating and Composite Enclosures

12.1.1 Insulating and composite enclosures shall be resistant to ageing. Parts intended for decorative purposes only, such as certain lids, are to be removed

before the tests.

Compliance is checked by the following test.

Enclosures, 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.

The temperature in the cabinet is $70 \pm 2^\circ\text{C}$.

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 ambient temperature and relative humidity between 45 percent and 55 percent for at least 4 days (96 h).

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

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

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

After the test, samples shall show no damage leading to non-compliance with this standard.

NOTE — The force of 5 N can be obtained in the following way: The sample is placed on one of the pans of a balance and the other pan is loaded with a mass equal to the mass of the sample plus 500 g. Equilibrium is then restored by pressing the sample with the forefinger wrapped in a dry piece of rough cloth.

12.1.2 Grommets (with membranes) 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.

Grommets are tested when fixed to enclosures.

First the enclosure is fitted with grommets which have been subjected to the treatment specified in 12.1.

The enclosures are then placed for 2 h in heating cabinet as described in 12.1, the temperature being maintained at $40 \pm 2^\circ\text{C}$.

Immediately after this period, a force of 30 N is applied for 5 s to various parts of the grommets by means of the tip of a straight unjointed test finger of the same dimensions as the standard test finger of Fig. 1 of IS 12063.

During these tests, the grommets shall not be deformed to such an extent that live parts of any included accessory become accessible.

For grommets 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 grommets shall not come out.

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

12.1.3 It is recommended that grommets (with 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 enclosure is fitted with grommets which have not been subjected to any ageing treatment, those without opening being suitably pierced.

The enclosure is then kept for 2 h in a refrigerator at a temperature of $-15 \pm 2^\circ\text{C}$ or at a temperature of $-25 \pm 2^\circ\text{C}$ for enclosures intended for installation at -25°C .

Immediately after this period, while the enclosure is still cold, it shall be possible to introduce cables of the maximum diameter intended through the grommet membranes.

After the tests of **12.1.2** and **12.1.3** the grommet membranes shall show no harmful deformation, cracks or similar damage leading to non-compliance with this standard.

12.2 Resistance to Humid Conditions

12.2.1 Insulation enclosures shall be resistant to humid conditions which may occur in normal use.

Compliance is checked as follows.

Enclosures are subjected to the following humidity treatment 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 $+1^\circ\text{C}$ of any convenient value between 15°C and 35°C .

Before being placed in the humidity cabinet, the samples are brought to a temperature between t and $t+4^\circ\text{C}$.

The samples are kept in the cabinet for:

- 2 days (48 h) for enclosures of IPXO degree; and
- 7 days (168 h) for other enclosures.

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

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

After this treatment the samples shall show no damage impairing their further use and in addition insulating enclosures shall be able to pass the following tests.

12.2.2 Insulation resistance by using a d.c., voltage of approximately 500 V, the measurement being made 1 min after application of the voltage.

The insulation resistance value shall be not less than 5 Mega ohm.

12.2.3 A voltage of substantially sine-wave form, having a r.m.s. value of 2 000 V and a frequency of 50 Hz is applied for 1 min between external and internal surfaces.

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

No flashover or breakdown shall occur.

NOTES

1 The high-voltage transformer used for the test is 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 of at least 200 mA. The overcurrent relay shall not trip when the output current is less than 100 mA.

2 Care is taken that the r.m.s. value of the test voltage applied is measured within ± 3 percent.

3 Glow discharges without drop in voltage are disregarded.

During the tests of **12.2.2** and **12.2.3** a metal foil is placed in contact with the inner surfaces and another metal foil, having a size not exceeding 200 mm \times 100 mm, is placed in contact with the external surfaces and, if necessary, moved so as to test all the parts.

Care shall be taken that during the test the distance between the inner and the outer metal foil shall be at least 4 mm except where this dimension is measured through insulating material.

12.3 Resistance Against Ingress of Solid Objects

Enclosures shall provide a degree of protection against the ingress of solid objects in accordance with their IP classification.

Compliance is checked by the following test.

12.3.1 Enclosures with screwed glands or grommets (with membranes) are fitted and connected with cables appropriate to the rating of the accessory fitted.

Fixing screws for enclosures are tightened with a torque equal to two-thirds of the values given in Table 1 of 11.8.

Cables and/or conduit entry means are made according to the manufacturers instructions.

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

Glands are not filled with sealing compound or the like.

12.3.2 Enclosures protected against solid objects greater than 12 mm in diameter are subjected to the test for degree of protection IP2X according to the relevant tests of IS 12063.

During this test the ball shall not pass through any opening of the enclosure.

12.3.3 Enclosures protected against solid objects greater than 2.0 diameter are subjected to the test for degree of protection IP3X according to the relevant tests of IS 12063.

12.3.4 Enclosures protected against solid objects greater than 1 mm diameter are subjected to the test for degree of protection IP4X according to the relevant tests of IS 12063.

During the tests of 12.3.3 and 12.3.4 the probes shall not enter the enclosure other than through drain-holes.

12.3.5 Dust-protected enclosures are subjected to the test for degree of protection IP5X according to the relevant tests of IS 12063 for enclosures without reduction below the surrounding atmospheric pressure.

During the tests of 12.3.5, drainage apertures, if any, shall not be open.

12.3.6 Dust-tight enclosures are subjected to the test for degree of protection IP6X according to the relevant tests of IS 12063 for enclosures without reduction below the surrounding atmospheric pressure.

During the tests of 12.3.6 drainage apertures, if any, shall not be open.

12.4 Resistance to Harmful Ingress of Water

Enclosures with IP>XO shall provide a degree of protection against harmful ingress of water in accordance with their IP classification.

Compliance is checked by carrying out the tests specified in IS 12063 for the degree of protection IPX1, IPX2, IPX3, IPX4, IPX5, IPX6, IPX7 and IPX8 with samples mounted as in 12.3.1.

Immediately after the test, inspection shall show that water has not entered the sample to any appreciable extent and has not reached live parts, following which the samples shall withstand an electric strength test as specified in 12.2.3.

If the enclosure has drain-holes, 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.

During the tests of enclosures with a degree of protection higher than IPX4, drainage apertures, if any, shall not be open.

NOTE — If the enclosures is not provided with drain-holes consideration should be given to the dispersal of any build-up of water which may occur.

The tests of this 12.4 are performed before the tests of 12.2 and 12.3.

13 MECHANICAL STRENGTH

Enclosures shall have adequate strength to withstand the mechanical stresses occurring during installation and use.

Compliance is checked by the tests of 13.1 and 13.2.

When an enclosure is too large to fit the test apparatus shown in Fig. 3 or Fig. 4 the tests are carried out under the same conditions as those specified in 13.1.1 or 13.1.2 respectively, but using the spring hammer according to IS 13588/IEC 817 (1984) calibrated to the impact energy corresponding to the impact required by the relevant 13.1.1 or 13.1.2.

13.1 For Enclosures Intended for Casting into Concrete

13.1.1 Impact Test

The sample shall be subjected to an impact test with a vertical hammer test apparatus (*see* Fig. 4) placed on a pad of closed cell expanded sponge rubber 40 mm thick when uncompressed and having a density of 538 kg/m³.

The whole arrangement together with the samples shall be placed in a refrigerator, the temperature within being maintained for 3 h at:

- 5 ± 1°C for types according to 6.4.1;
- 15 ± 1°C for types according to 6.4.2; and
- 25 ± 1°C for types according to 6.4.3.

At the end of this period, each sample is submitted to an impact by means of a mass of 1 kg falling vertically from a height of 10 cm.

One blow is applied on the back and four equally spaced on the side walls.

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

NOTE — Damage to the finish, small dents which do not reduce creepage distances or clearance below the values specified in the standards relevant to the accessories intended to be mounted and small chips which do not adversely affect the protection against electric shock or harmful ingress of water are disregarded.

Cracks not visible to normal or corrected vision without magnification, surface cracks in fibre reinforced mouldings and small indentations are disregarded.

13.1.2 Compression test for enclosures according to 6.5.2.

The enclosure shall be suitable for mounting in heated moulds or in heated concrete and shall withstand the mechanical stresses during concrete work.

Compliance is checked by the following tests:

- The enclosure is placed for 1 h at a temperature of $90 \pm 5^\circ\text{C}$.
The enclosure is then allowed to cool down to ambient temperature.
After the test, the enclosure shall show neither deformation nor damage leading to non-compliance with the standard.
- The enclosure is then placed between two hardwood plates and is loaded with a force of 500 N for 1 min.

Care shall be taken that the pressure produced by the hardwood plates used in this test is distributed uniformly on the external surfaces and in no way strengthens the enclosure.

NOTES

1 During these two tests the enclosures are equipped according to the manufacturer's instruction with the special part (if any) intended to improve the mechanical behaviour of the enclosures when embedding.

2 For the test, this special part is delivered together with the enclosure.

13.2 For Enclosures Other Than Those Intended for Casting into Concrete

The samples are subjected to blows by means of an impact test apparatus as shown in Fig. 1, 2, 3A and 3B.

The striking element has hemispherical face of 10 mm radius, made of polyamide having a Rockwell hardness of HR 100, and a mass of $150 \pm 1\text{g}$.

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

The axis of the pivot is $1\,000 \pm 1\text{ mm}$ above the axis of the striking element.

The Rockwell hardness of the polyamide striking element is determined by using a ball having a diameter of $12.700 \pm 0.025\text{ mm}$, the initial load being $100 \pm 2\text{ N}$, the initial load being $100 \pm 2\text{ N}$ and the extra load $500 \pm 2\text{ N}$.

NOTE — Additional information concerning the determination of the Rockwell hardness of plastics is given in IS 1586.

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

The samples are mounted on a sheet of plywood 8 mm thick and $175\text{ mm} \times 175\text{ mm}$, secured at its top and bottom edges to a rigid bracket.

The mounting support shall have a mass of $10 \pm 1\text{ kg}$ and shall be mounted on a rigid frame.

The design of the mounting support is such that:

- sample can be so placed that the point of impact lies in the vertical plane through the axis of the pivot;
- sample can be moved horizontally and turned about an axis perpendicular to the surface of the plywood; and
- plywood can be turned about a vertical axis.

Surface type enclosures 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 these is open.

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

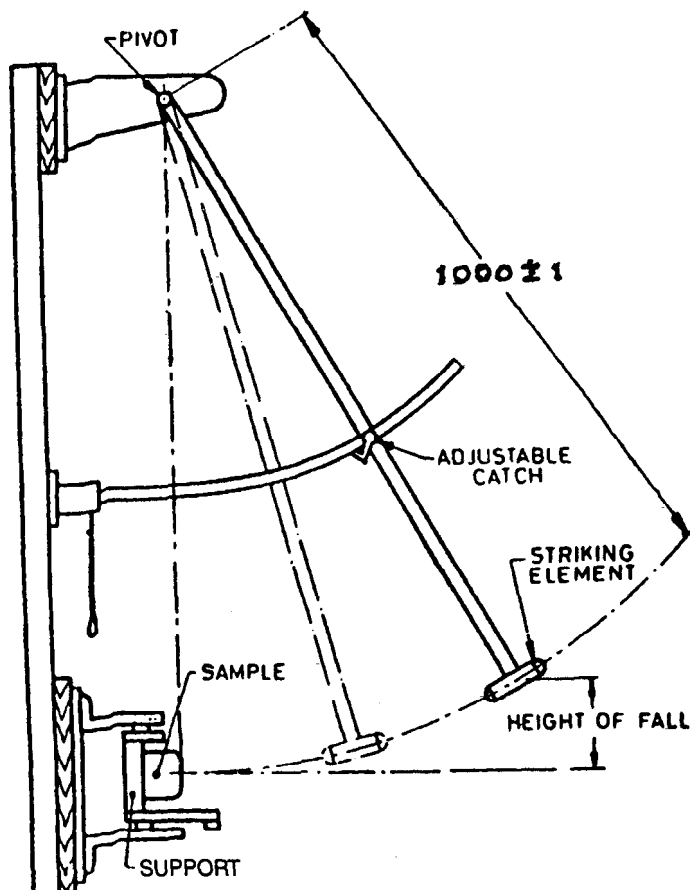
The striking element is allowed to fall from a height which is specified in Table 2.

The samples are subjected to blows, which are evenly distributed over the sample. The blows are not applied to 'knock-out' areas.

The following blows are applied:

- for Part A five blows: one blow in the centre, after the sample has been moved horizontally, one each on the unfavourable points between the centre and the edges, and then, after the sample has been turned 90° about its axis perpendicular to the plywood, one each on similar points;
- for Parts B (as far as applicable), C and D four blows:

One blow on one side of the sample after the plywood sheet has been turned 60° and one blow on another side of the sample after it



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

All dimensions in millimetres.

FIG. 1 PENDULUM IMPACT TEST APPARATUS

Table 2 Parts of Enclosures to be Subjected to the Impact

(Clause 13.2)

Sl No.	Height of Fall in cm	Ordinary Accessory IPXO	Other Accessory >IPXO
i)	10	A and B	—
ii)	15	C	A and B
iii)	20	D	C
iv)	25	—	D

where

- A = Parts on the front surface, including the parts which are recessed.
- B = Parts which do not project more than 15 mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exception of the above Part A.
- C = Parts which project more than 15 mm and not more than 25 mm from the mounting surface (distance from the wall) after mounting as in normal use, with the exception of the above Part A.
- D = Parts which project more than 25 mm from the mounting surface (distance from the wall) after

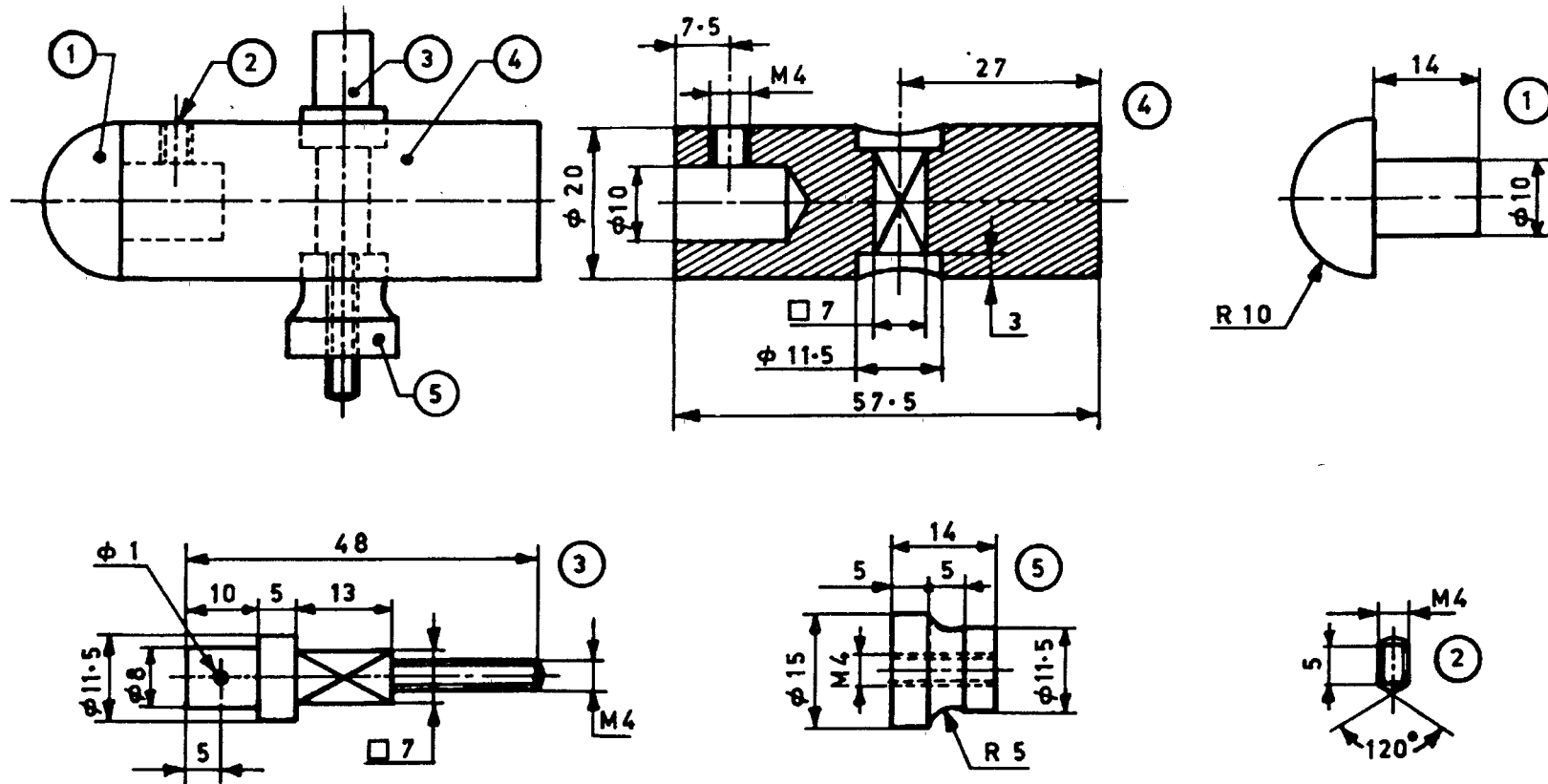
mounting as in normal use, with the exception of the above Part A.

NOTE

The impact energy determined by the sample which projects most from the mounting surface is applied on all parts of the sample with the exception of its Part 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, perpendicular to the plane through both axes, meets the surface.

Theoretically the centre of gravity of the striking element should be the checking point. As the centre of gravity in practice is difficult to determine, the checking point is chose as described above.

has been turned 90° about its axis perpendicular to the plywood sheet, keeping the position of the plywood sheet unchanged; One blow on each of the other two sides of the sample, with the plywood sheet turned 60° in the opposite direction.



Materials

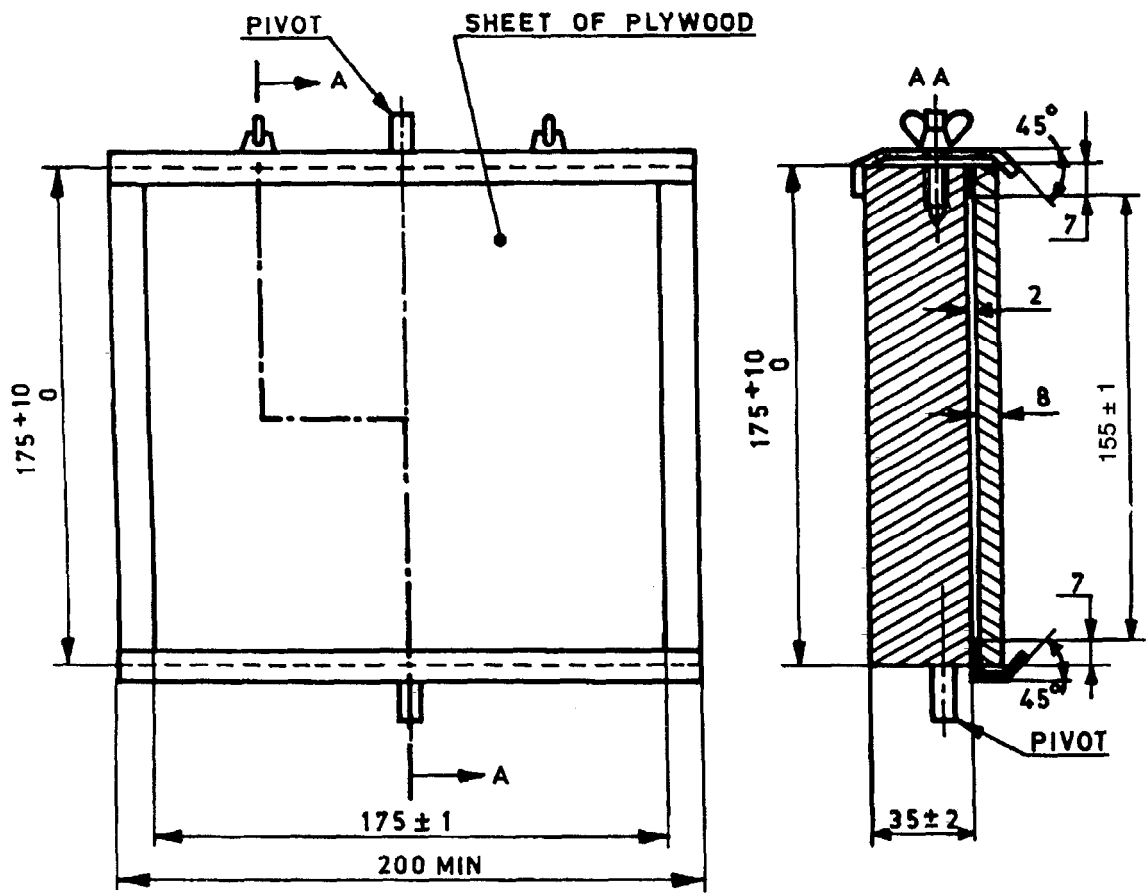
1: polyamide or hornbeam

2, 3, 4 and 5 : steel

NOTE — This drawing is not intended to govern design except as regard, the dimensions and specific requirement shown.

All dimensions in millimetres.

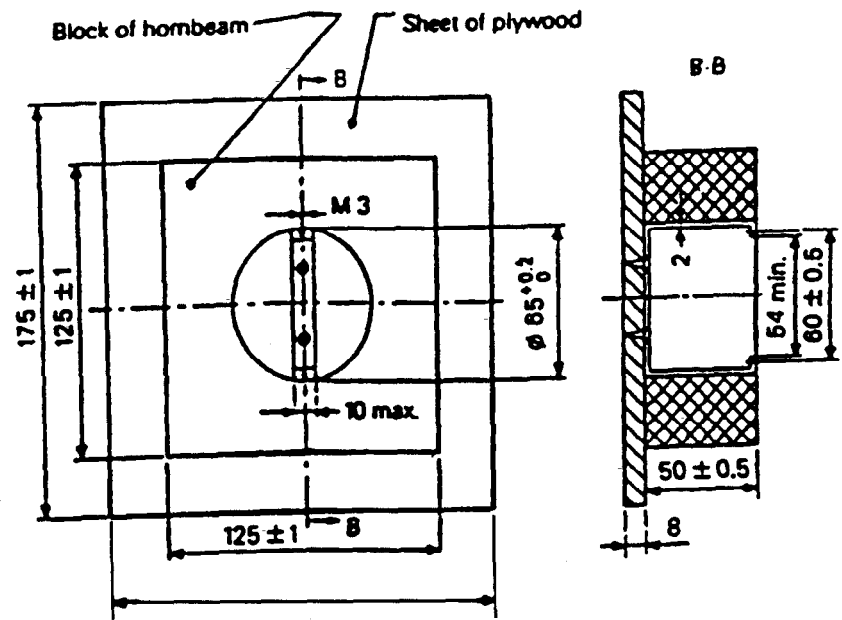
FIG. 2 CONSTRUCTIONAL DETAILS OF STRIKING ELEMENT



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

All dimensions in millimetres.

3A Constructional Details of Mounting Support for Test Specimens



All dimensions in millimetres.

3B Mounting Block for Flush Type Equipment

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

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

Damage to the finish, small dents which do not reduce creepage distances or clearances below the values specified in the relevant Indian Standard for accessories intended to be mounted and small chips which do not adversely affect the protection against electric shock or harmful ingress of water are ignored.

Cracks not visible to normal or corrected vision without magnification, surface cracks on fibre reinforced moulding and small indentations are ignored.

After the test on a lens (window for pilot lights), the lens may be cracked or dislodged, but it shall not be possible to touch live parts with the standard jointed

and unjointed test fingers, under the conditions stated in 9.1.

Additional requirements or flush-type boxes are under consideration.

13.3 For enclosures intended for the suspension of loads.

13.3.1 Enclosures which are intended for suspension of loads from a ceiling shall be so designed that the enclosure and the suspensions device withstand the force of 250 N or the force stated by the manufacturer, whichever is the higher.

Compliance is checked by the following test.

The sample is fitted with a suspension device and installed as for normal use according to the manufacturer's instructions and is placed in a heating cabinet, any screw being tightened to two-thirds of the torque given in Table 1.

The suspension device is then loaded with a weight of

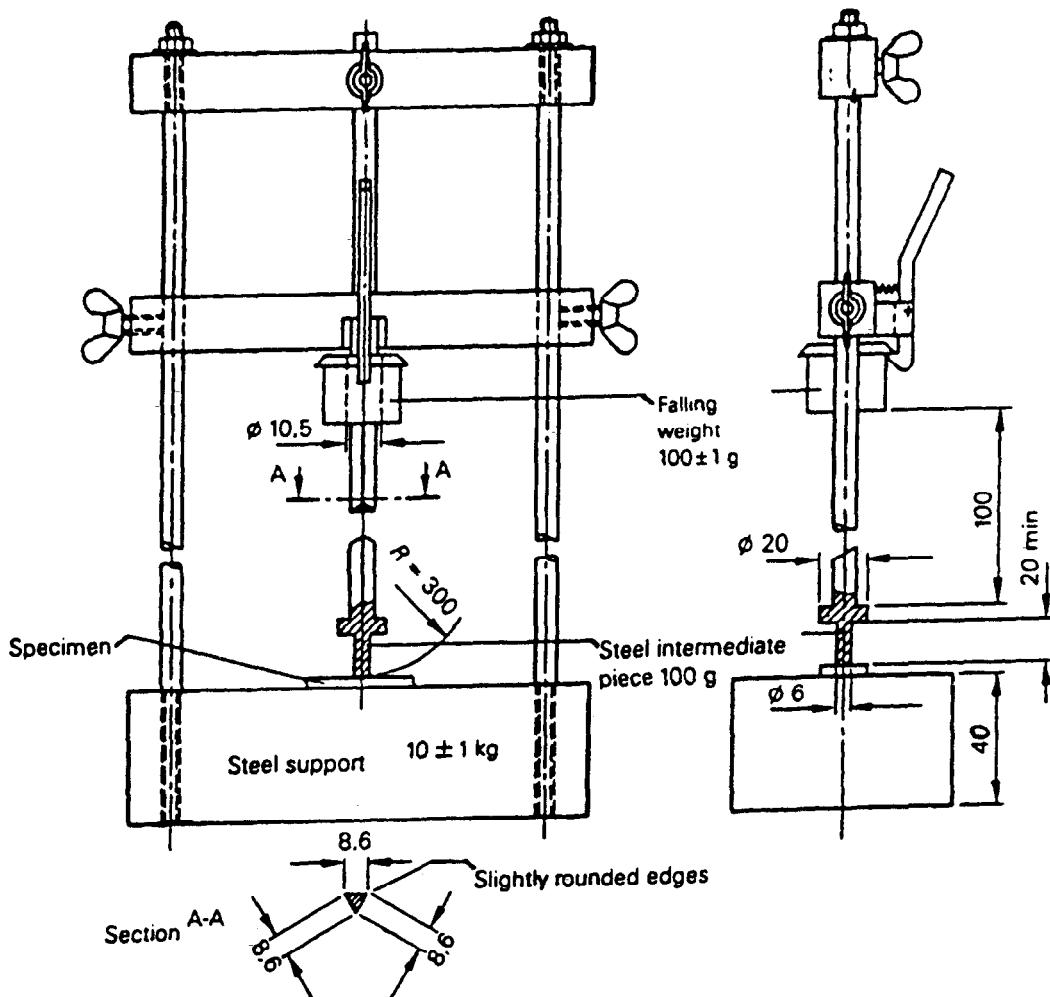


FIG. 4 IMPACT TEST APPARATUS ON PINS PROVIDED WITH INSULATING SLEEVES

250 N or with a weight stated by the manufacturer, whichever is the higher, for 24 h at $90\pm 2^\circ\text{C}$.

During the tests, the enclosure or the suspension device shall not come out of their suspension devices and the sample shall show no damage which leads to non-compliance with this standard.

13.3.2 Enclosures which are intended to be used in or on a wall and which are also intended for suspension of a load shall be provided with means which can be used for the fixing of a load.

This means may be the screws otherwise intended for fixing the accessory (socket-outlet, switch, etc) in the enclosure.

Enclosures with fixing means shall withstand the thermal and mechanical stress occurring in normal use.

Compliance is checked by inspection and by the following test.

The enclosures with cover and cover-plates (if any) is installed as for normal use according to the manufacturer's instructions and is placed in a heating cabinet, any screw being tightened to two-thirds of the torque given in Table 1.

A force, equally distributed between each fixing means if more than one, of 100 N is then applied for 24 h at $40\pm 2^\circ\text{C}$ perpendicularly to the wall.

During the test, the enclosures and fixing means shall not come out of their fixing devices and the sample shall show no damage which leads to non-compliance with this standard.

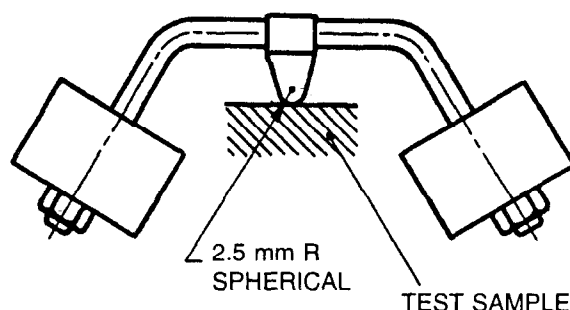
14 RESISTANCE TO HEAT

14.1 Parts of insulating material necessary to retain current-carrying parts and parts of the earthing circuit in position are subjected to a ball-pressure test by means of the apparatus shown in Fig. 5 except that insulating parts necessary to retain the earthing terminals in position shall be tested as specified in 14.2.

When it is not possible to carry out the test on the sample under test, the test shall be carried out on a specimen of the material at least 2 mm thick.

The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against the surface with a force of 20 N.

The test is made in a heating cabinet at a temperature of $125\pm 2^\circ\text{C}$. After 1 h, the ball is removed from the sample which is then cooled down within 10 s to approximately room temperature by immersion in cold water.



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

All dimensions in millimetres.

FIG. 5 BALL PRESSURE TEST APPARATUS

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

14.2 Parts of insulating materials 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 14.1 but the test is made at a temperature of $70\pm 2^\circ\text{C}$.

14.3 Parts of insulating material of flush mounted enclosures according to 6.6.2 are subjected to the test described in 14.2 but with a temperature of $90\pm 2^\circ\text{C}$.

15 RESISTANCE OF INSULATING MATERIAL TO ABNORMAL HEAT AND TO FIRE

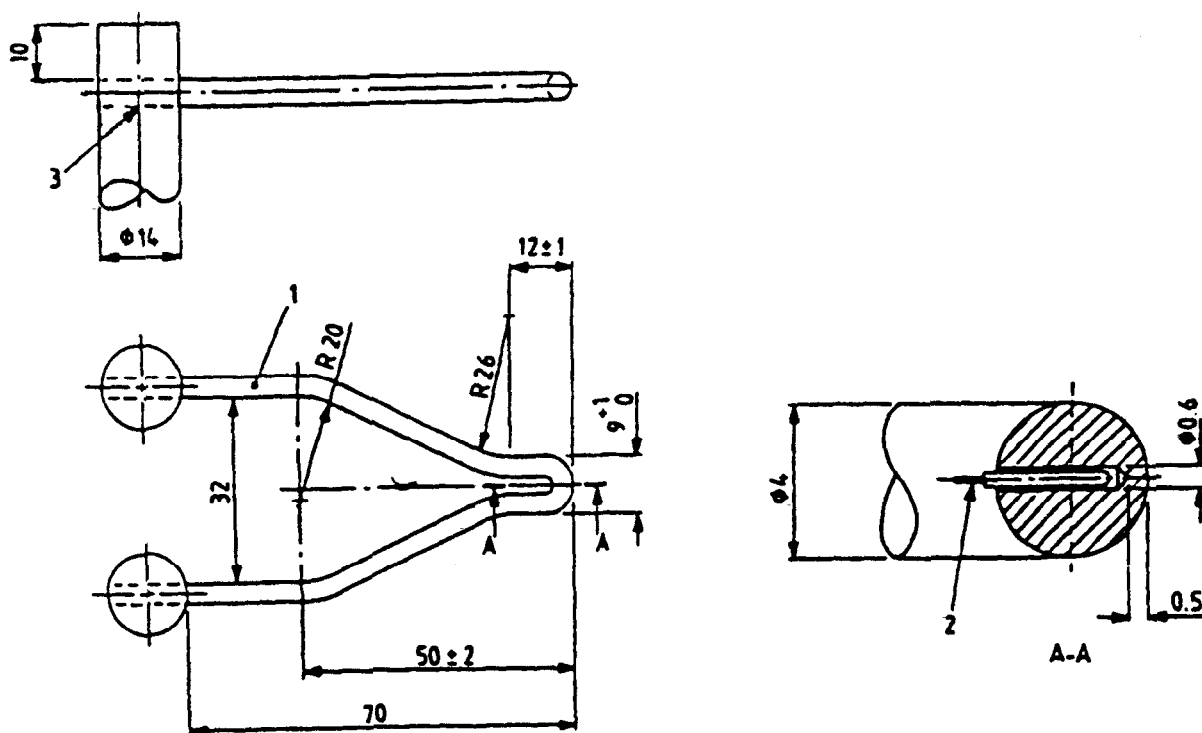
Parts of insulating material which might be exposed to thermal stresses due to electric effects, the deterioration of which might impair the safety, shall not be unduly affected by abnormal heat and by fire.

Compliance is checked by means of the glow-wire test performed according to IS 11000 (Part 2/Sec 1) under the following conditions (see Fig. 6).

For parts of insulating material necessary to retain current-carrying parts and for parts of insulating material of enclosures classified according to 6.3.1.3 by the test made at a temperature of 850°C :

- for parts of insulating material not necessary to retain current-carrying parts in position (even though they are in contact with them), for parts of insulating material retaining earthing terminals in position and for parts of insulating material for enclosures other than those classified according to 6.3.1.3 by the test made at a temperature of 650°C .

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



All dimensions in millimetres.

Key

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

FIG. 6 GLOW-WIRE WITH THERMOCOUPLE

Small parts, such as washers, are not subjected to the test of this clause.

The tests are not made on parts of ceramic material.

NOTE — The glow-wire test is applied to ensure that an electrically-heated test wire under defined test conditions does not cause ignition of insulating parts or to ensure that a part of insulating material, which can be ignited by the heated test wire under defined conditions, has a limited time to burn without fire by flame or burning parts or droplets falling down from the tested parts onto the pinewood board covered with a tissue paper.

If possible, the sample should be a complete enclosure.

If the test cannot be made on a complete enclosure, suitable part may be cut from it for the purpose of the test.

The test is made on one sample.

In case of doubt, the test shall be repeated on two further samples.

The test is made applying the glow-wire once.

The sample 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 sample taking into account the conditions of the intended use under which a heated or glowing element may come into contact with the sample.

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

- there is no visible flame and no sustained glowing, or if
- flames and glowing at the sample 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.

16 RESISTANCE TO RUSTING

Metal or composite enclosures shall be adequately protected against rusting.

Compliance is checked by the following test.

All grease is removed from the parts to be tested, by immersion in carbon-tetrachloride, trichloroethane or

an equivalent degreasing agent, for 10 min.

The parts are then immersed for 10 min in a 10 percent solution of ammonium chloride in water at a temperature of $27 \pm 5^\circ\text{C}$ 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 $27 \pm 5^\circ\text{C}$.

After the parts have been dried for 10 min in a heating cabinet at a temperature of $100 \pm 5^\circ\text{C}$, their surface shall show no sign of rust.

Traces of rust on sharp edges and any yellowish film removable by rubbing are ignored.

17 RESISTANCE TO TRACKING

For enclosures with $\text{IP} > \text{XO}$, parts of insulating material retaining live parts in position shall be made of a material resistant to tracking.

Compliance is checked by the following test, according to IS 2824.

A flat surface of the part to be tested, if possible at least $15 \text{ mm} \times 15 \text{ mm}$, is placed in the horizontal position.

The two electrodes of platinum with the dimensions

shown in Fig. 7, are placed on the surface of the sample in the manner shown in this figure, so that the rounded edges are in contact with the sample over their whole length.

The force exerted on the surface by each electrode is approximately 1 N.

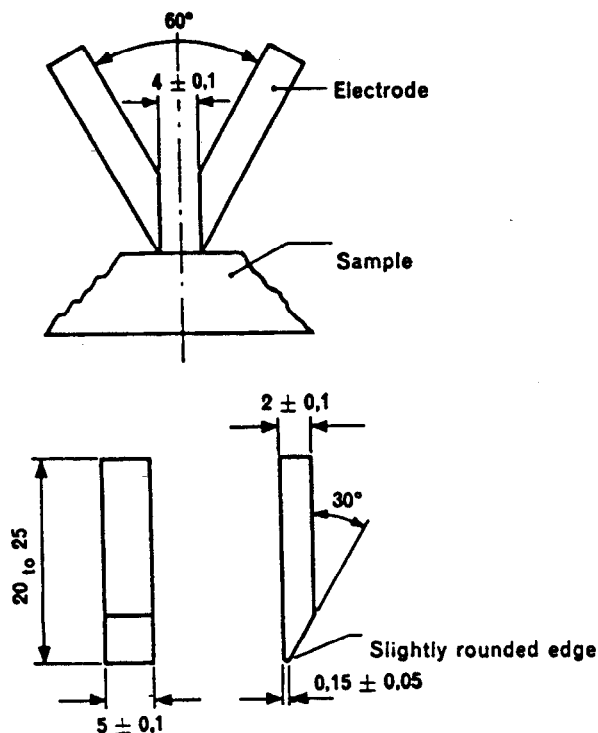
The electrodes are connected to a 50 Hz supply source having a voltage of 175 V, of substantially sine-wave form. The total impedance of the circuit when the electrodes are shortcircuited is adjusted by means of a variable resistor, so that the current is $1.0 \pm 0.1 \text{ A}$ with $\cos \phi$ 0.9 to 1.

An overcurrent relay with a tripping time of at least 0.5 s is included in the circuit.

The surface of the sample is wetted by allowing drops of a solution of ammonium chloride in distilled water to fall centrally between the electrodes.

The solution has a resistivity of 400 ohm-cm at 27°C , corresponding to a concentration of approximately 0.1 percent.

The drops have a volume of 20 mm and fall from a height of 30 to 40 mm.



All dimensions in millimetres.

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

The time interval between one drop and the next is 30 ± 5 s.

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

NOTES

1 Care is taken that the electrodes are clean, correctly shaped and correctly positioned before each test is started.

2 In case of doubt the test is repeated, if necessary, on a new set of samples.

18 TESTS

18.0 Category of Tests

Tests are classified as type, acceptance and routine test.

18.1 Type Test

The test specified in Table 3 shall constitute the type tests and shall be carried out on two sample of enclosure for accessories of the same type selected preferably at random from a regular production lot. Before commencement of the test, the sample shall be visually examined and inspected for obvious visual defects in respect of component, part and their assembly, construction, marking, mechanical hazards, earthings, etc. The external surface finish shall be even and free from finishing defects.

18.1.1 Criteria of Acceptance

Both samples shall successfully pass all the type tests for providing conformity with the requirements of the standard. If any of the sample fails in any of the type tests, the testing authority, at its discretion, may call for fresh sample not exceeding twice the original number and subject them again to all test or to the test(s) in which failure(s) had occurred. No failure should be permitted in the repeat test(s) (see also 4.3).

Table 3 Scheduled of Tests

(Clause 18.1)

Sl No.	Tests	Clause References
(1)	(2)	(3)
i)	Marking	7
ii)	Dimensions	8 (under consideration)
iii)	Protection against electric shock	9
iv)	Provision for earthing	10
v)	Construction	11
vi)	Resistance to ageing, to humid conditions, ingress of solid objects and to harmful ingress of water	12
vii)	Mechanical strength	13
viii)	Resistance to heat	14
ix)	Resistance of insulating material to abnormal heat and fire	15
x)	Resistance to rusting	16
xi)	Resistance of tracking	17

18.2 Acceptance Test

The following shall constitute the acceptance tests:

Tests	Clause References
Marking	7
Protection against electric shock	9
Provision for earthing	10
Construction	11
Resistance to ageing, to humid condition, to ingress of solid objects and to harmful ingress of water	12
Mechanical strength	13

18.2.1 For acceptance test the sampling procedure given in IS 2500 (Part1) shall be followed.

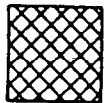
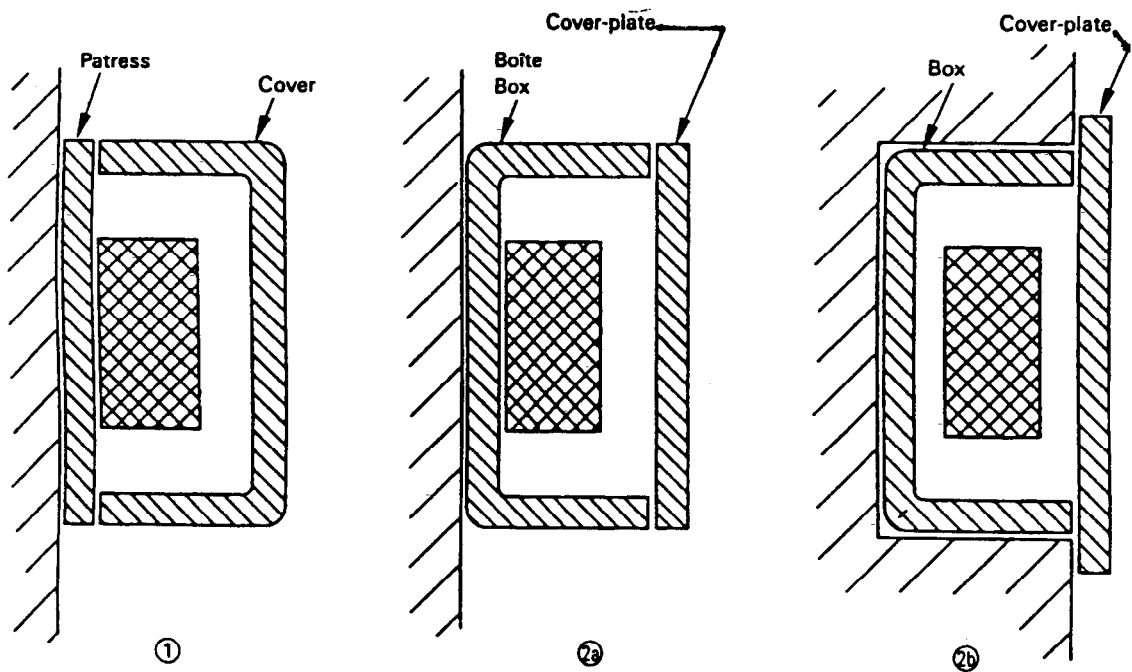
18.3 Routine Test

Tests	Clause References
Protection against electric shock	9
Provision for earthing	10

ANNEX A

(Clause 3.6)

EXAMPLES OF ENCLOSURES AND PARTS THEREOF



Accessory

Enclosures :

- 1 Patress + cover (only surface type)
- 2 Box + cover-plate
 - a) surface type
 - b) flush type

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 standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

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 Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. ETD 14 (4021).

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 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	{ 323 76 17 323 38 41
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi CALCUTTA 700 054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022	{ 60 38 43 60 20 25
Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600 113	{ 235 02 16, 235 04 42 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	{ 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.	