IEC 60670-21

Edition 2.0 2024-12
EXTENDED VERSION

INTERNATIONAL STANDARD

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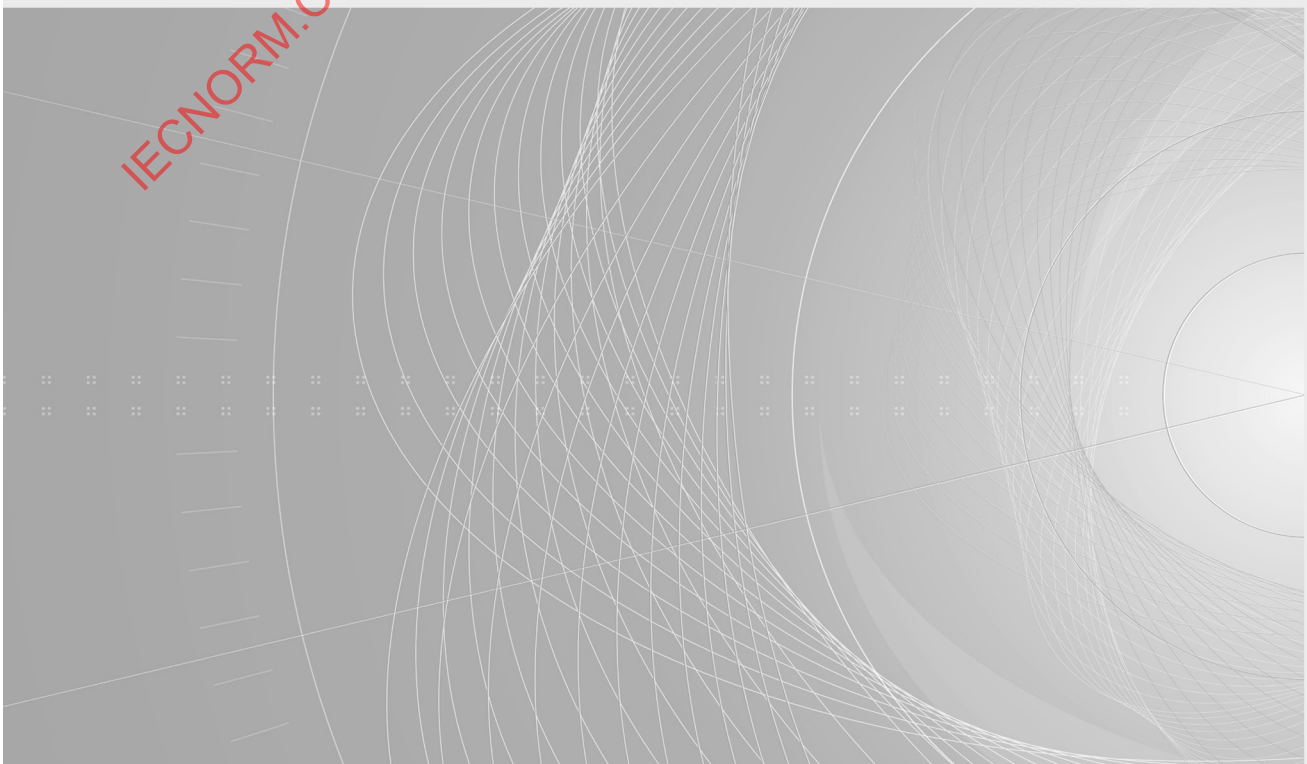
Boxes and enclosures for electrical accessories for household and similar fixed electrical installations –
Part 21: Particular requirements for boxes and enclosures with provision for suspension means



IEC 60670-21:2024-12 EXV(en)

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ISBN 978-2-8327-0112-6

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BOXES AND ENCLOSURES FOR ELECTRICAL ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

Part 21: Particular requirements for boxes and enclosures with provision for suspension means

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IEC 60670-21:2024 EXV includes the content of IEC 60670-21:2024, and the references made to IEC 60670-1:2024.

The specific content of IEC 60670-21:2024 is displayed on a blue background.

IEC 60670-21 has been prepared by subcommittee 23B: Plugs, socket-outlets and switches, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This second edition cancels and replaces the first edition published in 2004 and Amendment 1:2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Complete revision of the tests and requirements of the suspension means.

The text of this International Standard is based on the following documents:

Draft	Report on voting
23B/1534/FDIS	23B/1552/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60670 series, published under the general title *Boxes and enclosures for electrical accessories for household and similar fixed installations*, can be found on the IEC website.

This document is to be used in conjunction with IEC 60670-1:2024. It lists the changes necessary to convert that standard into a specific standard for housing protective devices and other power dissipating electrical equipment.

Where this document states "addition", "modification" or "replacement", the relevant requirement, test specifications or explanatory matter in IEC 60670-1:2024 shall be adapted accordingly.

Clauses and subclauses, notes, figures or tables which are additional to those in IEC 60670-1:2024 are numbered starting from 101.

Additional annexes to IEC 60670-1:2024 are numbered AA, BB, etc.

In this publication the following print types are used:

- requirements proper: in roman type.
- *test specifications: in italic type.*
- notes: in smaller roman type.

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The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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BOXES AND ENCLOSURES FOR ELECTRICAL ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

Part 21: Particular requirements for boxes and enclosures with provision for suspension means

1 Scope

This part of IEC 60670 applies to boxes, enclosures and parts of enclosures (hereafter called "boxes" and "enclosures") for electrical accessories with a rated voltage not exceeding 1 000 V AC and 1 500 V DC intended for household or similar fixed electrical installations, either indoors or outdoors.

Boxes and enclosures complying with this document are suitable for use at ambient temperatures not normally exceeding +40 °C, but their average over a period of 24 h does not exceed +35 °C, with a lower limit of the ambient air temperature of −5 °C.

Other temperatures outside the above range can apply according to the classification of the boxes and the enclosures.

This document applies to boxes and enclosures for ceiling and wall mounting with provision for suspension means.

This document is intended to apply to boxes and enclosures for electrical accessories within the scope of IEC technical committee 23.

A box or 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.

This document gives test requirements for boxes and enclosures declared with IK code, see Annex B (normative).

This document also applies to types of boxes and enclosures as modified in IEC 60670-21, IEC 60670-22, IEC 60670-23, and IEC 60670-24.

This document does not apply to:

– ceiling roses;
– luminaire supporting couplers;
– boxes, enclosures and parts of enclosures specifically designed to be used for cable trunking and ducting systems complying with IEC 61084 and which are not intended to be installed outside of these systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-75:2014, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

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IEC 60112:2020, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60417, *Graphical symbols for use on equipment,* available at http://www.graphical-symbols.info/equipment

IEC 60423:2007, *Conduit systems for cable management – Outside diameters of conduits for electrical installations and threads for conduits and fittings*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 60695-2-11:2021, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60695-10-2:2014, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test*

IEC 60981:2019, *Extra-heavy duty rigid steel conduits*

IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*
IEC 62262:2002/AMD1:2021

ISO/IEC Guide 51, *Safety aspects – Guidelines for their inclusion in standards*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
enclosure
combination of parts, such as boxes, backplates, covers, cover-plates, lids, box extensions, accessories, etc., providing after assembly and installation as in normal use, an appropriate protection against external influences, and a defined protection against contact with enclosed live parts from any accessible direction

Note 1 to entry: See Annex A.

3.2
box
part of an enclosure provided with means for fixing a cover, cover-plate, accessory, etc., and intended to receive accessories (such as socket-outlets, switches, etc.)

Note 1 to entry: The accessory can be entirely or partly inside the enclosure.

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3.3
box extension
part of an enclosure which is intended to extend a box for the purpose of either increasing the internal volume of the box or enclosure or to adjust for mounting the box flush or semi-flush with the finished surface of a wall or the like

3.4
backplate
part of a surface mounting enclosure provided with means for fixing a cover, cover-plate, accessory (such as socket-outlets, switches, etc)

3.5
lid
cover
cover-plate
part of an enclosure, not integral with or part of an accessory, which may either retain an accessory in position or enclose it

3.6
raised cover
cover intended for mounting directly onto a box to provide for the attachment of accessories and to increase the internal volume of the enclosure

Note 1 to entry: The centre portion of the cover is raised to accommodate a specific wall or ceiling thickness and to permit the mounting of the accessory on it, flush with the surface of the wall or ceiling.

3.7
exposed conductive part
conductive part of electrical equipment, which can be touched, and which is not normally live, but which can become live when basic insulation fails

3.8
surface mounting enclosure
surface mounting box
box or enclosure which is intended for mounting on a surface

Note 1 to entry: See Annex A.

3.9
flush-mounting box
flush-mounting enclosure
box or enclosure which is intended for mounting flush with the surface

Note 1 to entry: See Annex A.

3.10
semi-flush mounting box
semi-flush mounting enclosure
box or enclosure which is intended to fit within a mounting surface and partially projects from the mounting surface

3.11
cable gland
device designed to permit the entry of a cable, flexible cable or insulated conductor into an enclosure, and which provides sealing and retention and eventually may also provide other functions such as earthing, bonding, insulation, cable guarding, strain relief or a combination of these

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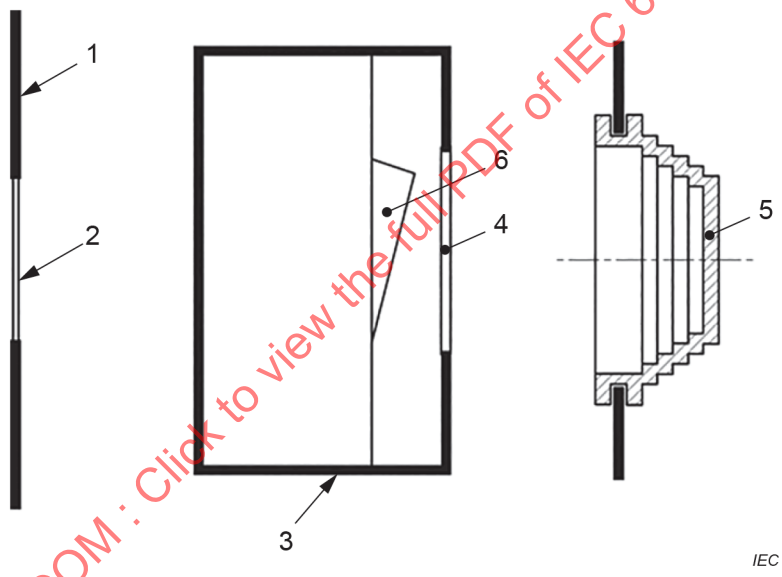
3.12
seal
material used to fill up the space between the inside of a gland and the cable passing through, usually compressed by the gland and thereby forming a joint

3.13
gasket
material introduced between mating surfaces of an enclosure which when under compression forms a joint

3.14
grommet
component used to support and protect the cable or conduit at the point of entry; it may also prevent the ingress of moisture or contaminants

Note 1 to entry: See Figure 1.

[SOURCE: IEC 60050-581:2008, 581-27-19, modified – The words "part of", "or an accessory" and "wires or" have been omitted from the definition and "or conduit" added; Note 1 to entry added.]



Key

1 box
2 entry membrane
3 enclosure
4 protective membrane
5 grommet
6 electrical accessory

Figure 1 – Examples of membranes and grommets

3.15
entry membrane
component or an integral part of an enclosure used to protect the cable which may be used to support the cable or conduit at the point of entry

Note 1 to entry: An entry membrane may also prevent the ingress of moisture or contaminants and may be part of a grommet (see Figure 1).

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3.16
protective membrane
component or an integral part of an enclosure that is not intended to be penetrated in normal use and is intended to provide protection against ingress of water or solid objects and/or to allow the operation of an accessory

Note 1 to entry: See Figure 1.

3.17
composite material
combination of metal and insulating material

3.18
spout
hub
open entry of a box permitting the insertion and containment of a conduit

3.19
cable retention
ability to limit the displacement of a fitted cable against pull forces

3.20
cable anchorage
ability to limit the displacement of a fitted flexible cable against pull and push forces and torques

3.21
blanking-plug
component used to close an open inlet or an open knock-out

3.22
***U*$_n$**
rated voltage
voltage assigned by the manufacturer for a specific operating condition of the box or enclosure

[SOURCE: IEC 60050-442:1998, 442-01-03, modified – The symbol has been added as a term, the domain "(of accessories)" has been deleted; in the definition, "accessory" has been replaced with "box or enclosure".]

3.101
box with provision for suspension means
box intended to be used for suspending and supporting mechanical loads and which accepts the suspension means

3.102
suspension means
means comprising any necessary components (hooks, brackets, etc.) which may be delivered with the box and enclosure or supplied separately

Note 1 to entry: Examples of suspension means are shown in Figure 101.

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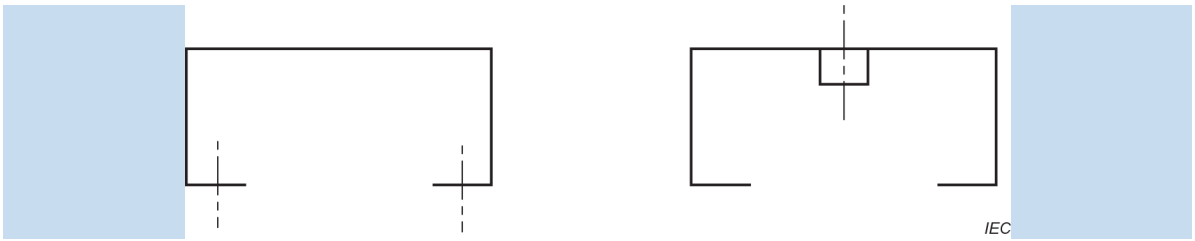
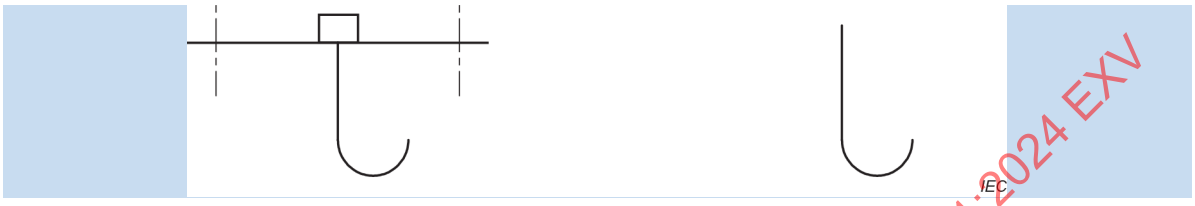
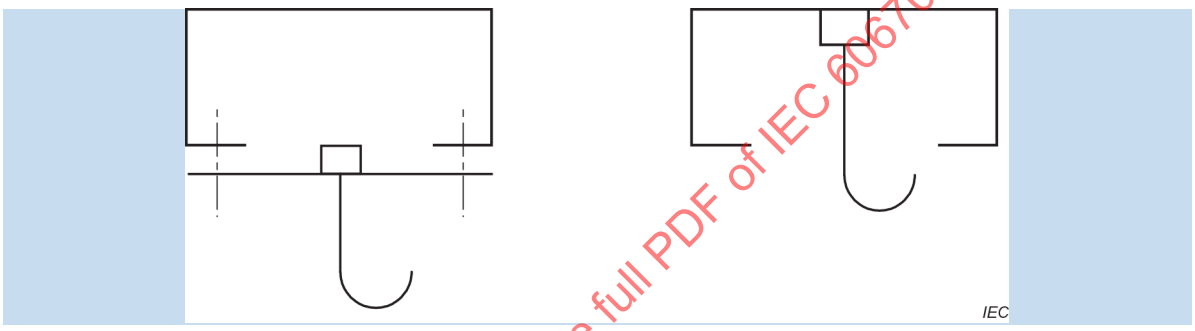


a) Box provided with provision for suspension means



b) Suspension means



c) Box and enclosure delivered with suspension means

Figure 101 – Examples of suspension means

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4 General requirements

Boxes and enclosures shall be so designed and constructed that, in normal use, their performance is reliable, and safety is achieved by reducing risk to a tolerable level, as defined in ISO/IEC Guide 51.

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

5 General remarks on tests

5.1 Test conditions and number of samples

Tests according to this document are type tests.

Unless otherwise specified in this document, boxes and enclosures are tested as delivered.

Accessories complying with other standards are not tested again.

Tests on boxes and enclosures of insulating material shall be performed after a preconditioning period of at least 48 h at ambient temperature between +15 °C and +35 °C and relative air humidity between 45 % and 85 %.

NOTE For some materials a longer preconditioning period can be requested by the manufacturer.

Unless otherwise specified, the tests are carried out in the order of the clauses, at an ambient temperature between +15 °C and +35 °C on a set of three specimens.

It is recommended that the tests are carried out at an ambient temperature of (20 ± 5) °C.

5.2 Compliance general requirement

The specimens are submitted to all the relevant tests and the requirements are satisfied if all the applicable tests are deemed to have been passed.

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

NOTE When submitting the first set of specimens, the applicant can also submit the additional set of specimens which can be necessary, if one specimen fails. The testing station will then, without further request, test the additional set of specimens and will only reject if a further failure occurs. If the additional set of specimens is not submitted at the same time, the failure of one specimen will entail rejection.

In this document the term "instructions" is understood to mean manufacturer's instructions.

6 Ratings

Void.

7 Classification

Boxes and enclosures are classified according to Table 1.

Table 1 – Classification of boxes and enclosures

Classification criteria		
7.1 The nature of their material	7.1.1 Insulating	
	7.1.2 Metallic	
	7.1.3 Composite	
	7.1.4 Natural or synthetic rubber or a mixture of both	
7.2 The type of installation	7.2.1 Flush, semi-flush in solid walls, ceilings or floors	7.2.1.1 Not suitable for installation into concrete
		7.2.1.2 Suitable for installation into concrete with a maximum temperature during the casting process of +60 °C
		7.2.1.3 Suitable for installation into concrete with a maximum temperature during the casting process of +90 °C
	7.2.2 Flush or semi-flush in hollow walls, hollow ceilings, hollow floors or furniture	7.2.2.1 Class Ha
		7.2.2.2 Class Hb for walls
		7.2.2.3 Class Hb for ceilings
	7.2.3 Surface mounting on walls, ceilings, floors or furniture	

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Classification criteria		
7.3 The type(s) of inlets [a]	7.3.1 With inlets for sheathed cables for fixed installations	
	7.3.2 With inlets for flexible cables	
	7.3.3 With inlets for plain or corrugated conduits	
	7.3.4 With inlets for threaded conduits	
	7.3.5 With inlets for other types of conductors/cables or conduits	
	7.3.6 With spouts (hubs)	
	7.3.7 Without inlets. Inlet openings will be made during installation	
7.4 The clamping means	7.4.1 With cable retention	
	7.4.2 With cable anchorage	
	7.4.3 With clamping means for flexible conduit	
	7.4.4 Without clamping means	
7.5 The minimum temperature during installation and use.	7.5.1 −5 °C	
	7.5.2 −15 °C	
	7.5.3 −25 °C	
	7.5.4 −25 °C during installation, −25 °C to −40 °C during use, as declared.	
7.6 The degree of protection against access to hazardous parts and against harmful effects due to the ingress of solid foreign objects according to IEC 60529		
7.7 The degree of protection against harmful effects due to the ingress of water according to IEC 60529		
7.8 The degree of protection of the part mounted inside the hollow walls of the boxes classified according to 7.2.2.1	7.8.1 IP2X	
	7.8.2 > IP2X	
7.9 The provision for fixing accessories to boxes	7.9.1 Boxes supplied with screws	
	7.9.2 Boxes intended to receive screws	
	7.9.3 Boxes intended to receive claws	
	7.9.4 Boxes intended to receive other means	
7.101 The provision for suspension means[b]	7.101.1 For supporting a luminaire. 7.101.2 For supporting a ceiling fan.	

[a] Boxes and enclosures may have more than one type of inlet.

Owing to installation rules, boxes class Hb for walls and class Hb for ceilings have some specific additional requirements and are tested according to 11.2, 12.13, 16.3.

NOTE In the following countries only class Ha boxes and enclosures are used: BE, BR, CH, DE, FR, IT, JP, NL, NO, PT, SE, UK.

[b] The suspension means may be provided with the box or not.

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8 Marking

8.1 General

Boxes and enclosures shall be marked with

a) the name, trade mark or identification mark of the manufacturer or the responsible vendor.

In addition, enclosures shall be marked with:

b) the first characteristic numeral for the degree of protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects, if declared to be higher than 4, in which case the second characteristic numeral shall also be marked;

c) the second characteristic numeral for the degree of protection against harmful effects due to ingress of water, if declared to be higher than 2, in which case the first characteristic numeral shall also be marked;

d) the following marking

(IEC 60417-6345:2015-07) on the cover of flush enclosures intended to be mounted on rough surfaces and where the IP is dependent on the surface (see Figure 20);

The IP code, 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.

e) the type reference, which may be a catalogue number;

NOTE 1 In the following country the marking of the type reference is not used: UK.

f) for boxes and enclosures classified as in 7.2.2.2 and 7.2.2.3, the minimum internal volume in cm^3 as determined by the test in 12.16. The internal volume shall be marked on the inside of the box or enclosure. The marking on a box or enclosure shall be such that the value can be read after installation of the box in the normal manner but before the installation of the wiring devices and wiring.

The following information shall be marked on the boxes and enclosures or provided by the manufacturer on the smallest package unit or in the instructions which are not required to be provided with the product:

g) +90 °C for boxes and enclosures classified according to 7.2.1.3;

h) the necessary information concerning the openings which can be made during installation in the case of boxes and enclosures classified according to 7.3.7;

i) symbol IEC 60417-6292:2015-11

for boxes and enclosures classified according to 7.5.2, 7.5.3 and 7.5.4.

The symbol shall indicate the declared minimum temperature of installation and use for boxes and enclosures classified according to 7.5.2 or 7.5.3 or the declared minimum temperature of use for boxes and enclosures classified according to 7.5.4.

For products according to 7.5.4 the instructions shall specify that the products are for installation down to −25 °C and for use down to the temperature value as declared by the manufacturer. The declared value shall be a multiple of 5 °C.

j) the symbol Ha for boxes classified according to 7.2.2.1 and the symbol Hb for boxes classified according to 7.2.2.2 and 7.2.2.3.

NOTE 2 In the following country, symbol for boxes classified according to 7.2.2.1 is not used: JP

k) IK code, if declared.

l) for boxes and enclosures classified according to 7.101.1, the maximum supported mass in kilograms declared by the manufacturer.

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NOTE 101 In the following countries boxes for luminaire support are marked "For luminaire support". Where boxes are intended to support a mass greater than 15,8 kg, the mass is to be marked: US.

NOTE 102 In the following country the marking in kilograms shall reflect a safety factor of 5 times: DK.

Unless self-evident, further information for the correct use of the enclosure shall be given in the instructions which are not required to be provided with the product.

In special cases, in order to achieve a higher degree of protection by the use of special parts, instructions should be provided and should indicate the higher degree of protection. In such a case, the marking covers the initial degree of protection.

8.2 Durability of the marking on the boxes and enclosures

Marking shall be easily legible, durable and indelible.

Laser marking directly on the product and marking made by moulding, pressing or engraving are not subjected to this test.

Compliance is checked by inspection, using normal or corrected vision, without additional magnification and, if necessary, by the following test.

The test is done by rubbing the marking for 15 s with a piece of cotton cloth soaked with water and again for 15 s with a piece of cotton cloth soaked with n-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3).

NOTE n-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3) is available from a variety of chemical suppliers as a high-pressure liquid chromatography (HPLC) solvent.

When using the liquid specified for the test, precautions as stated in the relative material safety datasheet provided by the chemical supplier shall be taken to safeguard the laboratory technicians.

The marking surface to be tested shall be dried after the test with water.

Rubbing shall commence immediately after soaking the piece of cotton, applying a compression force of (5 ± 1) N at a rate of about one cycle per second (a cycle comprising a forward and backward movement along the length of the marking). For markings longer than 20 mm, rubbing can be limited to a part of the marking, over a path of at least 20 mm length.

The compression force is applied by means of a test piston which is wrapped with cotton comprising cotton wool covered by a piece of cotton medical gauze.

The test piston shall have the dimensions specified in Figure 2 and shall be made of an elastic material which is inert against the test liquids and has a Shore-A hardness of 47 ± 5 (for example synthetic rubber).

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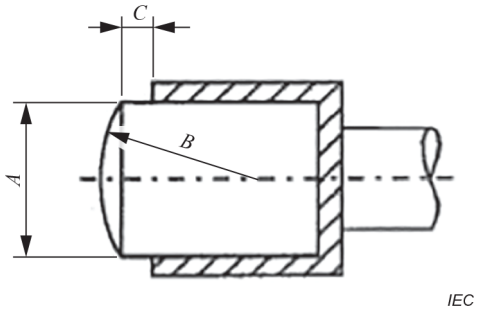

Dimensions mm			
°	*A*	*B*	*C*
Dimensions	20	20	2
Tolerance	+2, −0	±0,5	+1, −0

Figure 102 – Test piston dimensions

When it is not possible to carry out the test on the specimens due to the shape/size of the product or the marking is not accessible with the test piston:

– *a suitable piece having the same characteristics as the product can be submitted to the test*

or

– *another test piston with a different shape can be used on the condition that radius B is kept.*

9 Dimensions

Boxes and enclosures shall comply with the appropriate standard sheets, if any.

Compliance is checked by inspection and measurement.

10 Protection against electric shock

Boxes and enclosures shall be so designed that, when they are assembled, equipped and installed as for normal use in accordance with the instructions, live parts are not accessible.

Where enclosures are supplied without a cover, cover-plate or an accessory they are tested with the appropriate parts fitted according to the information given in the instructions.

Conductive parts of suspension means inside the box or enclosure shall be:

– protected by a layer of insulating material which complies with the tests for insulating linings, or
– located such that it will not come in contact with electrical conductors or live parts, or
– reliably connected to the earthing means complying with requirements of 11.1 when fitted as for normal use.

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

Enclosures shall be tested with test probe 11 according to IEC 61032 applied for 1 min with a force of 20 N, and the test probe shall not penetrate into the internal volume of the enclosure, as shown in Figure 3.

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Dimensions in millimetres

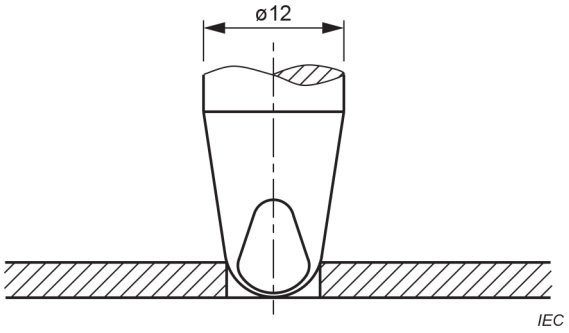

Figure 103 – Demonstration of the non-penetration of the internal volume

In addition, all enclosures according to 7.1.1, 7.1.3 and 7.1.4 with parts made of thermoplastic or elastomeric material shall be placed in a heating cabinet at + (35 ± 2) °C for 4 h and immediately afterwards be subjected for 1 min to a force applied through the tip of test probe 11 of IEC 61032.

The probe is applied to all places where yielding of insulating material could impair the safety with a force of 75 N except to membranes, grommets and knock-outs or the like.

Tests shall be carried out on parts which are accessible after installation.

The test probe shall not penetrate into the internal volume of the enclosure, as shown in Figure 3.

Knock-outs are tested according to 12.9.2.

11 Provision for earthing

11.1 Boxes and enclosures with exposed conductive parts

Boxes and enclosures with exposed conductive parts shall be provided with an earthing means of low resistance or have provision for the fitting of such an earthing means. For the purpose of this requirement, small screws and the like, for fixing bases, covers or cover-plates, etc. isolated from live parts, are not considered as exposed conductive parts.

Exposed conductive parts of covers or cover-plates shall be connected through a low resistance connection to the earthing means when fitted as for normal use.

Compliance is checked by the following test.

A current derived from an AC or DC source having a no-load voltage not exceeding 12 V and equal to (25 ± 1) A is passed between the earthing terminal and each exposed conductive part in turn. The voltage drop between the earthing terminal and each of the exposed conductive parts is measured, and the resistance is calculated from the current and this voltage drop.

In no case shall the resistance exceed 0,05 Ω.

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

In boxes and enclosures of insulating or composite material having an IP degree higher than IPX0, provisions can be made for the addition of means for the effective continuity of the earthing conductor, when more than one inlet is provided.

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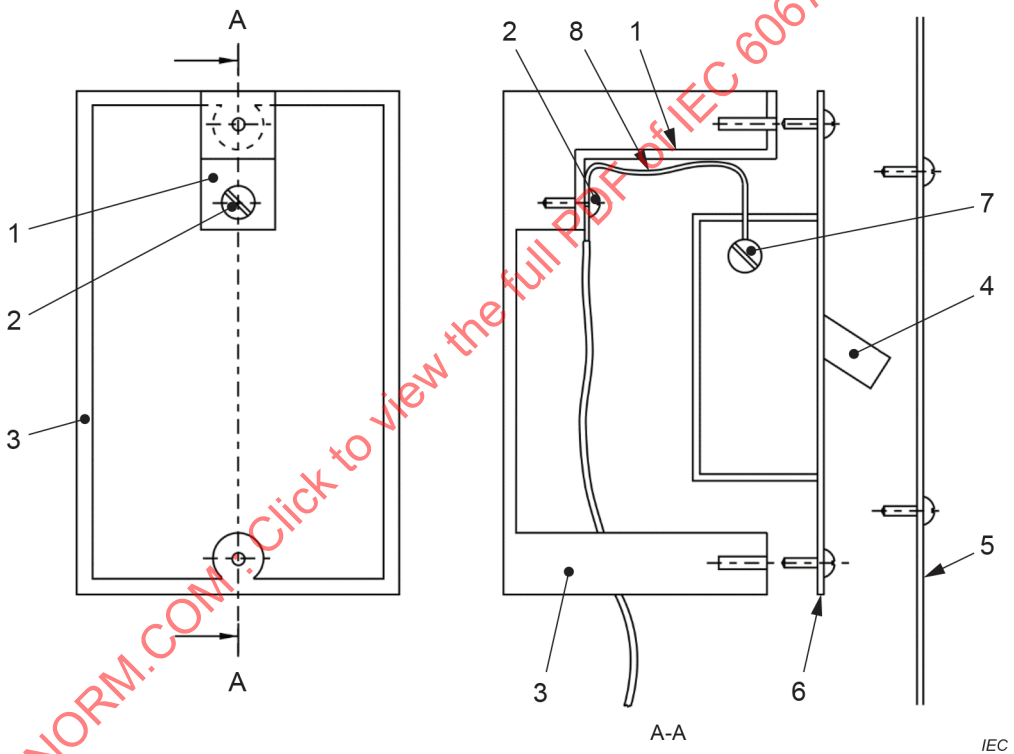
The earthing means or the provision for the fitting of such an earthing means shall be located so that:

– the means is readily accessible through the open face of the box, and
– the removal of an accessory mounted in the box does not disturb the continuity of the earthing circuit, and
– the means is not part of a removable cover, back, or side of the box or enclosure.

Compliance is checked by inspection.

11.2 Boxes and enclosures of insulating material classified according to 7.2.2.2 and 7.2.2.3

Boxes and enclosures of insulating material shall be provided with a minimum of one earthing strap having one screw terminal for earthing purposes with a connecting capacity of at least 4 mm^2. The design of the earthing strap shall ensure that the metal mounting yokes of accessories mounted inside the box and metallic covers mounted on the box are connected to the earthing conductors (see Figure 4 and Figure 5).



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Key

1 earthing strap
2 earthing terminal screw
3 plastic box
4 accessory
5 metal cover
6 accessory's metal mounting yoke
7 accessory earthing terminal
8 bonding jumper

Figure 104 – Earthing strap

Dimensions in millimetres

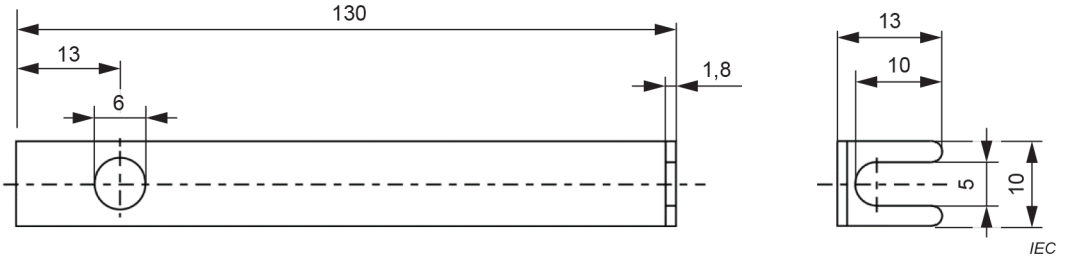

Figure 105 – Test strap

Compliance is checked by inspection.

The earthing strap shall be securely fastened to the box or enclosure.

Compliance is checked by the test in 16.3.2.

11.3 Boxes or enclosures with removable sides according to 7.1.2

A box or enclosure classified according to 7.1.2 that has removable sides shall be constructed so that the electrical bond between separable parts includes at least one threaded screw connection.

Compliance is checked by inspection.

11.4 Earthing terminal threads

The threads of the earthing terminal delivered with or integrated in boxes and enclosures shall not be stripped when the torque shown in the relevant column of Table 4 is applied.

Compliance is checked by inspection and by the following test.

The screws are tightened and loosened 5 times.

The test is carried out using a suitable screwdriver or an appropriate tool applying a torque as indicated in Table 4.

If a screw has a hexagonal head with a slot, only the test with the screwdriver is carried out, with the relevant torque given in column II of Table 4.

Greater values of torque may be used if so stated by the manufacturer, when the relevant information is provided.

Column I of Table 4 applies to screws which cannot be tightened by means of a screwdriver with a blade wider than the nominal diameter of the thread of the screw.

Column II of Table 4 applies to other screws which are tightened by means of a screwdriver.

Column III of Table 4 applies to screws and nuts which are tightened by means other than a screwdriver.

Column IV of Table 4 applies to screws which are tightened by means of a square blade screwdriver.

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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 the threads or to the enclosure impairing the further use of the fixing means. The screws shall be gradually tightened in one smooth and continuous movement.

12 Construction

12.1 General

Boxes and enclosures shall be constructed without sharp edges. Burrs shall be removed from mould lines of interior surfaces so that there are no sharp edges or undue obstructions to the passage of wiring or coupling of parts in the intended use of the product.

The inner and outer surfaces of a box or cover shall not be subject to peeling, scaling or flaking and shall be smooth and free from blisters, cracks, and other defects.

Compliance is checked by inspection.

12.2 Lids, covers or cover-plates or parts of them

12.2.1 General

Lids, covers, or cover-plates or parts of them, such as protective membranes, which are intended to ensure protection against electric shock, shall be held in place effectively.

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

12.2.2 Screw-type fixing

A box or enclosure intended to accept a lid, cover, or cover plate by means of screw fixing shall be provided with means to accommodate the intended screws.

For lids, covers or cover plates whose fixing is of the screw type, compliance is checked by inspection.

12.2.3 Non-screw-type fixing operable without the use of a tool or a key

12.2.3.1 General

A box or enclosure intended to accept a lid, cover, or cover plate with non-screw-type fixing operable without the use of a tool or a key shall be provided with means to fix the lid, cover, or cover plate.

For lids, covers or cover-plates whose removal is obtained by applying a force according to the requirements in Table 2 in a direction approximately perpendicular to the mounting/supporting surface when their removal may give access with test probe B of IEC 61032:

– *to live parts;*
– *to non-earthed conductive parts separated from live parts by basic insulation;*
– *only to*
  - *insulating parts, or,*
  - *earthed conductive parts, or*
  - *conductive parts separated from live parts by double or reinforced insulation, or*

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- *live parts of SELV circuits according to IEC 61140 having a voltage not greater than 25 V AC or 60 V DC.*

Compliance is checked by the tests of 12.2.3.2 and 12.2.3.3.

Table 2 – Forces to be applied to lids, covers, cover-plates or actuating members whose fixing is not dependent on screws

Accessibility with the test probe B of IEC 61032 after removal of lids, covers or cover-plates or parts of them	Force to be applied N			
	Enclosures complying with 12.2.3.4 and 12.2.3.5		Enclosures not complying with 12.2.3.4 and 12.2.3.5	
	Shall not come off	Shall come off*	Shall not come off	Shall come off*
To live parts	40	120	80	120
To non-earthed conductive parts separated from live parts by basic insulation	10	120	20	120
To insulating parts or earthed conductive parts or conductive parts separated from live parts by double or reinforced insulation or live parts of SELV circuits according to IEC 61140 having a voltage not greater than 25 V AC or 60 V DC	10	120	10	120
* This column does not apply for 12.2.4.				

Boxes and enclosures are mounted as for normal use.

Flush-type boxes and enclosures are fixed and installed as for normal use. If they are provided with locking means which can be operated without the aid of a tool, these means are unlocked.

12.2.3.2 Verification of the non-removal of the lids, covers or cover-plates

Forces are gradually applied in one smooth and continuous movement in a direction perpendicular to the mounting surfaces, in such a way that the resulting force acting on the centre of the lids, covers or cover-plates, or parts of them, is as specified in the relevant column of Table 2.

The force is applied for 1 min.

The lids, covers or cover-plates, shall not come off or break.

For flush-mounting boxes or enclosures, the test is then repeated on new specimens, the lid, cover or cover-plate is mounted on the box, after a sheet of hard material (1 ± 0,1) mm thick, has been fitted on the wall F around the supporting frame, as shown in Figure 6.

The sheet of hard material is used to simulate wallpaper and may consist of a number of pieces.

In addition, for boxes and enclosures classified according to 7.5.2 or 7.5.3, the test shall be repeated at (−15 ± 2) °C and (−25 ± 2) °C respectively and at the declared temperature of use ± 2 °C for boxes and enclosures according to 7.5.4.

The boxes and enclosures are kept for 2 h in a freezer at the declared temperature.

Immediately afterwards, within 1 min, the test is initiated.

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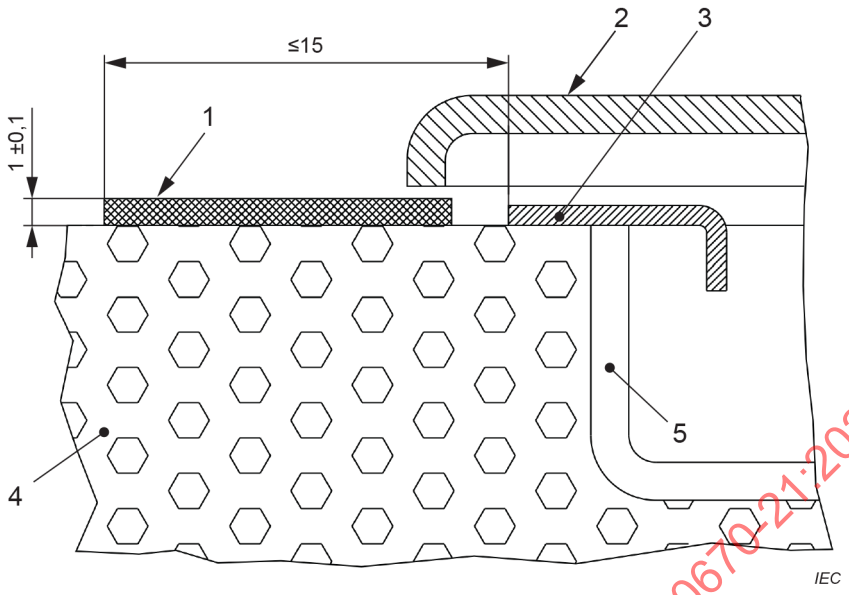
Dimensions in millimetres



Key

1 sheet of hard material
2 cover-plate
3 supporting frame
4 wall
5 mounting box

Figure 106 – Arrangement for test on covers or cover-plates (see 12.2.3.2 and 12.2.3.3)

12.2.3.3 Verification of the removal of the lids, covers or cover-plates

A force not exceeding that specified in the relevant column of *Table 2 is gradually applied in one smooth and continuous movement, in a direction perpendicular to the mounting/supporting surfaces, to lids, covers or cover-plates, or parts of them by means of a hook placed in turn in each of the grooves, holes, spaces or the like, provided for removing them.*

The lids, covers or cover-plates shall come off.

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

For flush-mounting boxes or enclosures the test is then repeated on new specimens.

The lid, cover or cover-plate is mounted on the box after a sheet of hard material (1 ± 0,1) mm thick has been fitted on the wall around the supporting frame, as shown in Figure 6.

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

12.2.3.4 Verification of the outline of lids, covers and cover-plates

The gauge shown in Figure 7 is pushed towards each side of each lid, cover or cover-plate which is fixed without screws on a mounting or supporting surface, as shown in Figure 8. The face B resting on the mounting/supporting surface, with the face A perpendicular to it, the gauge is applied at right angles to each side under test.

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In the case of a lid, cover or cover-plate fixed without screws to another lid, cover or cover-plate or to a mounting box, having the same outline dimensions, the face B of the gauge shall be placed at the same level as the junction; the outline of the lid, cover or cover-plate shall not exceed the outline of the supporting surface.

The distances between the face C of the gauge and the outline of the side under test, measured parallel to face B, shall not decrease (with the exception of grooves, holes, reverse tapers or the like, placed at a distance less than 7 mm from a plane including face B and complying with the test of 12.2.3.5) when measurements are repeated starting from point X in the direction of the arrow Y (see Figure 9).

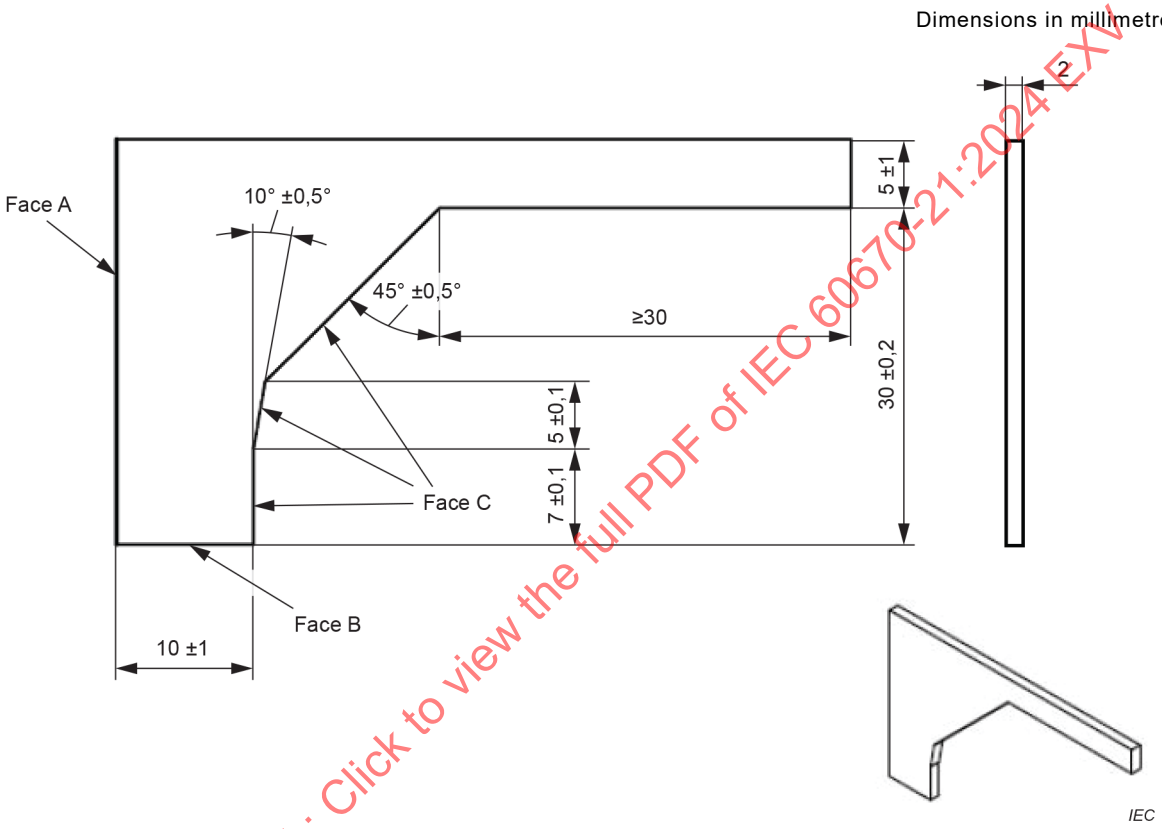

Figure 107 – Gauge for the verification of the outline of lids, covers or cover-plates

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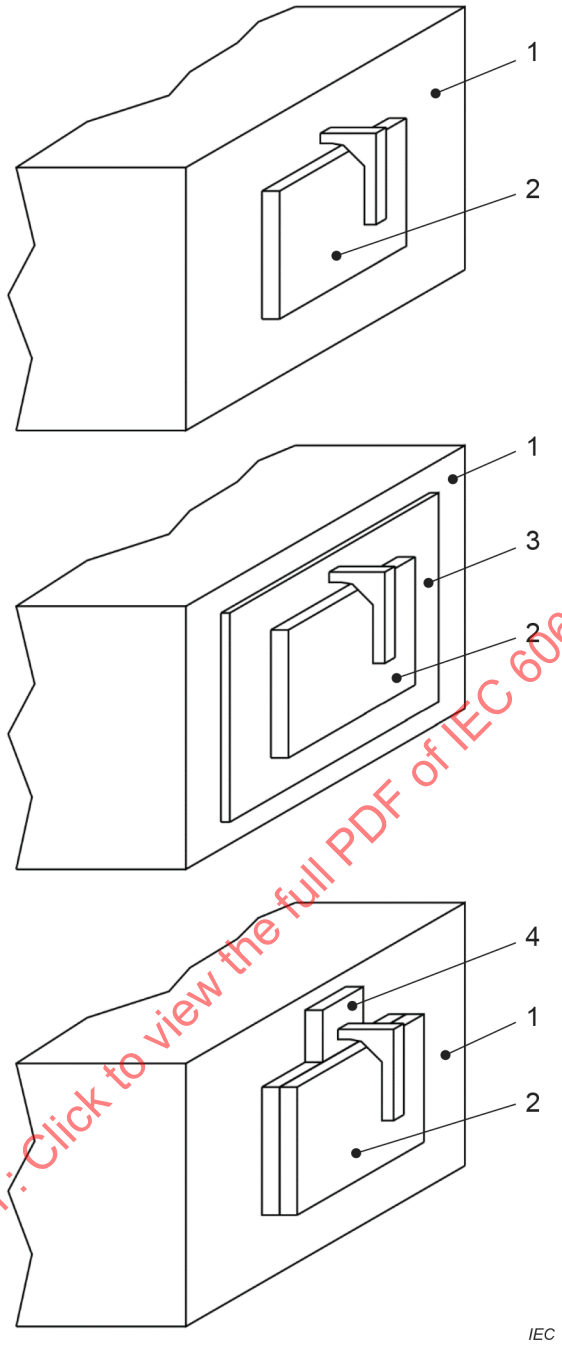

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Key

1 mounting surface

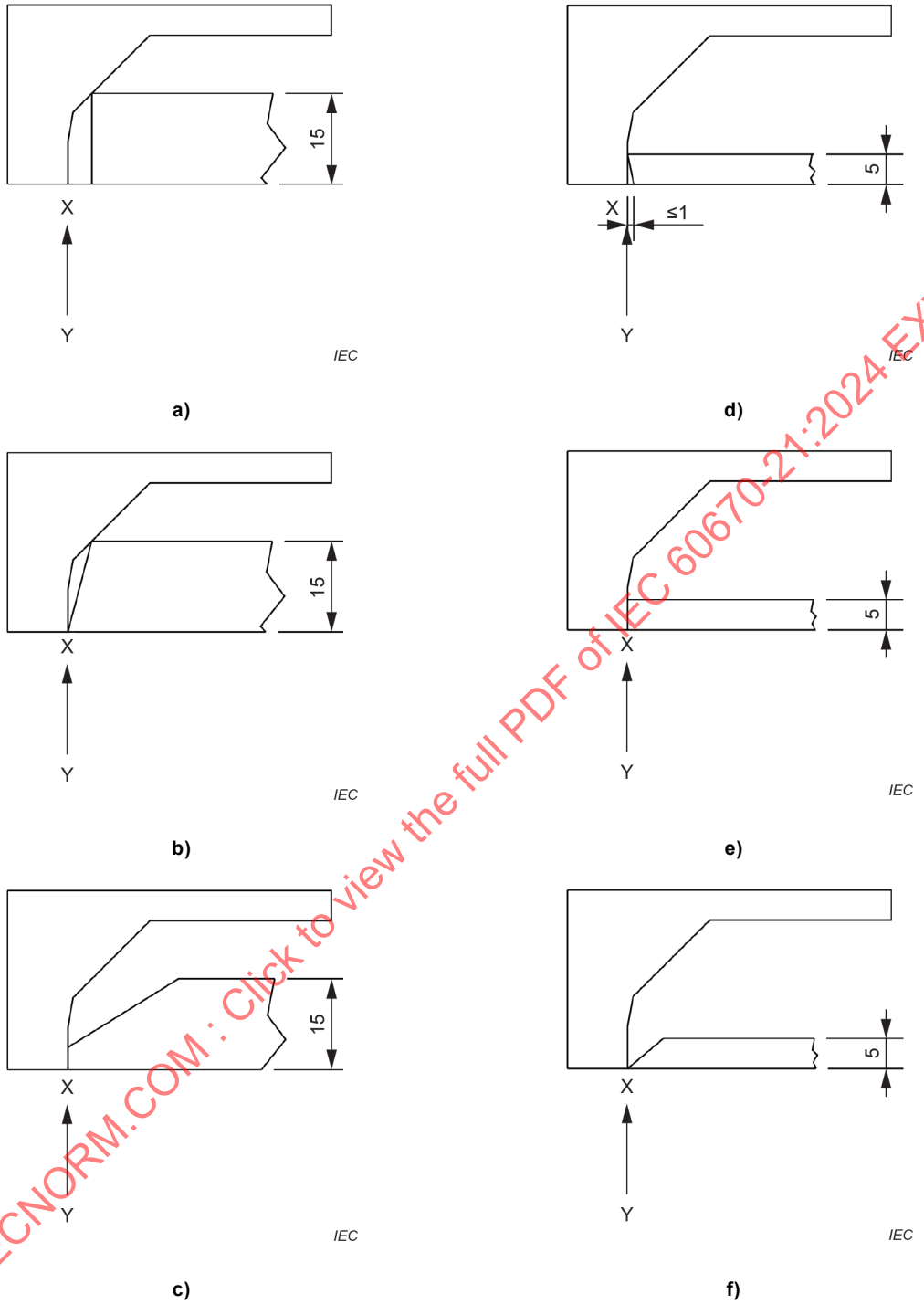
2 cover

3 surface support

4 spacing piece with the same thickness as that of the supporting part

Figure 108 – Examples of application of the gauge of Figure 7 on covers fixed without screws on a mounting surface or supporting surface

Dimensions in millimetres



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Cases a) and b) do not comply.

Cases c), d), e) and f) comply (compliance shall, however, also be checked with the requirements of 12.2.3.5 using the gauge shown in Figure 10).

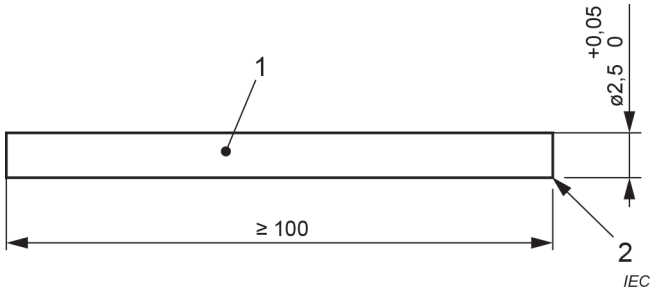
Figure 109 – Compliance criteria of application of the gauge of Figure 7

12.2.3.5 Verification of grooves, holes and reverse tapers

A gauge according to Figure 10, applied with a force of (1 ± 0,2) N, shall not enter more than 1,0 mm from the upper part of any groove, hole or reverse taper or the like when the gauge is applied parallel to the mounting/supporting surface and at right angles to the part under test, as shown in Figure 11.

NOTE Verification as to whether, according to Figure 11, the gauge has entered by more than 1,0 mm is made with reference to a surface perpendicular to face B and including the upper part of the outline of the grooves, holes, reverse tapers or the like.

Dimensions in millimetres

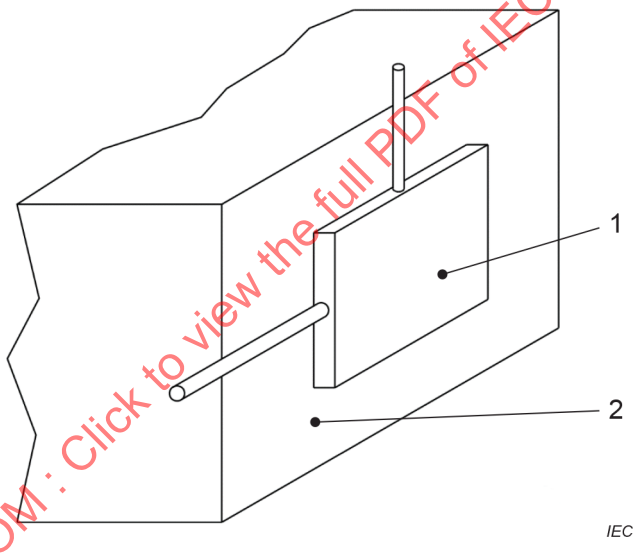


Key

1 test rod (metal)

2 right-angled sharp edges

Figure 110 – Gauge for verification of grooves, holes and reverse tapers



Key

1 cover

2 mounting support

Figure 111 – Sketch showing the direction of application of the gauge of Figure 10

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12.2.4 Non-screw-type fixing operable with the use of a tool or a key

For lids, covers or cover-plates whose fixing is not dependent on screws and whose removal is obtained by using a tool and/or a key, in accordance with the instructions, compliance is checked by the same tests of 12.2.3 except that the lids, covers or cover-plates or parts of them are not required to come off when applying a force not exceeding 120 N in directions perpendicular to the mounting/supporting surface.

12.3 Drain holes

Surface and semi-flush mounting enclosures with a degree of protection IPX1 to IPX6 shall be designed to allow the opening of a drain hole of at least 5 mm in diameter or 20 mm^2 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 mounting position of the enclosure.

Compliance is checked by inspection and measurement.

12.4 Mounting of enclosures

Enclosures shall have provisions for their suitable attachment according to the type of installation (see 7.2).

Enclosures of insulating material shall be constructed in such a way that any conductive parts of fixing means inside the box or enclosure intended to be used for mounting the enclosure are surrounded by insulation which projects above the top of the fixing means by an amount of not less than 10 % of the maximum width of the cavity for the fixing means.

Compliance is checked by inspection and by measurement.

If there is a cavity, the head of the screw can be protected by an additional cap of insulating material. In this case the instructions shall give information concerning the cap to be used.

If there is no cavity the head of the screw shall be protected with a cap of insulating material, and the cap shall be delivered with the box.

The cap shall stay in position during normal use.

Compliance is checked by the following test:

The caps are fixed to the boxes according to the instructions and subjected to the ageing test of 13.1.

After 1 h, the boxes are then turned to a position with the opening in the direction of the floor.

The cap shall not become detached.

12.5 Boxes and enclosures with inlets for flexible cables

Inlets provided in boxes and enclosures classified according to 7.3.2 shall be so designed and constructed that the flexible cables can be easily introduced and that the inlets will not damage the flexible cables where they enter the box or enclosure impairing their further use.

Compliance is checked by manual test.

12.6 Boxes and enclosures with inlets for applications other than flexible cables

Inlet openings classified according to 7.3 other than 7.3.2 shall allow the introduction of

– a conduit or suitable fitting connecting it to the box or enclosure, and/or
– the protective covering of the cable

so as to provide mechanical protection of the conductors where they enter the box or enclosure.

An inlet opening for conduit entries, or at least two of them if there is more than one, shall be capable of accepting either conduits of sizes, or a combination of sizes, in accordance with the requirements of IEC 60423, or for extra heavy-duty electrical rigid steel conduits, the requirements of IEC 60981.

Compliance is checked by inspection with the appropriate cables or conduits installed.

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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.

NOTE In the following countries, it is required that inlet openings in boxes intended to receive switches or socket outlets have spout(s) with inlets stops: NL.

12.7 Boxes and enclosures with a cable anchorage(s)

Clamping means of boxes and enclosures classified according to 7.4.2 shall be such that the connection of the conductors of the flexible cable are relieved from strain when this flexible cable is accessible and likely to be stressed after installation.

It shall be clear how the relief from strain and the prevention of twisting are intended to be effected.

Cable anchorages shall be:

– suitable for the different types of flexible cable for which the box is intended to be used;
– constructed in such a way that at least one part of the cable anchorage is integral with, or permanently fixed to, one of the component parts of the box;
– of insulating material or be provided with an insulating lining fixed to the metal parts.

Compliance is checked by inspection and the following test.

The effectiveness of the cable anchorage is checked by means of an apparatus as shown in Figure 12.

The cable anchorage is applied as in normal use, clamping screws, if any, being tightened with a torque equal to the 2/3 of the relevant torque specified in Table 4 or, for glands, equal to the relevant torque specified in Table 4.

After reassembly of the specimen, it shall not be possible to push the flexible cable into the specimen by more than 1 mm with the relevant force as specified in Table 3.

The cable is then subjected 50 times for 1 s to a pull force as specified in Table 3 and immediately afterwards the flexible cable is subjected to a torque not less than the relevant value specified in Table 4 for (15 ± 1) s applied as near as practicable to the cable entry.

Table 3 – Forces and torques to be applied to cable anchorages

External dimensions of flexible cable	Force	Torque
mm	N	Nm
Up to and including 5,2 × 7,6	40 ± 2	0,05
Up to and including 8	50 ± 2	0,1
Above 8 up to and including 11	60 ± 2	0,15
Above 11 up to and including 16	80 ± 2	0,35
Above 16	100 ± 2	0,42

After the tests, the flexible cable shall not have been displaced by more than 2 mm and the cable anchorage shall not show any damage which leads to non-compliance with this document.

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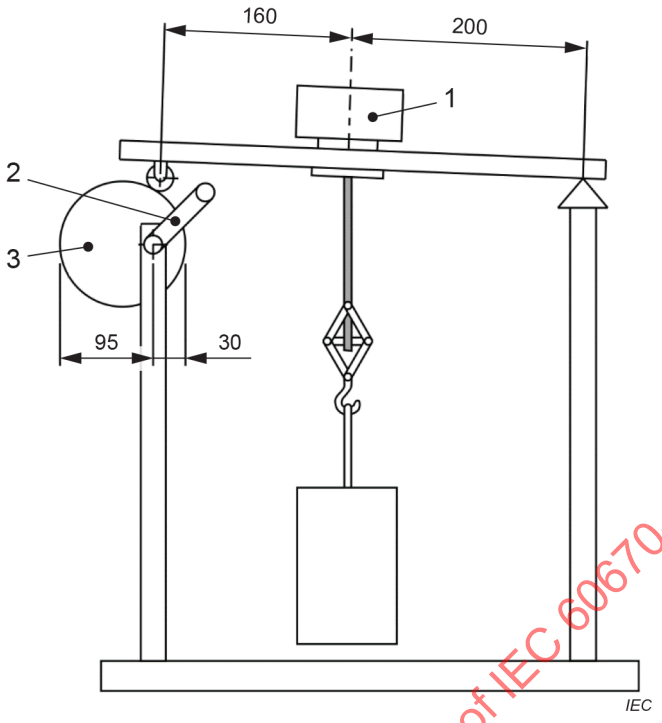
Dimensions in millimetres



Key

1 box

2 crank

3 eccentric

Figure 112 – Apparatus for testing the cable anchorage

12.8 Boxes and enclosures with cable retention means

Cable retention means of boxes and enclosures classified according to 7.4.1 shall retain the cable in place.

NOTE In the following countries, a cable retention is required for boxes and enclosures for hollow walls due to installation practices: DE.

Compliance is checked by the following test which is carried out on three specimens of retention means.

For boxes and enclosures classified according to 7.5.2 or 7.5.3, the test shall be carried out at (−15 ± 2) °C and (−25 ± 2) °C respectively and at the declared temperature of use ± 2 °C for boxes and enclosures according to 7.5.4.

First a cable of the maximum nominal cross-sectional area and, subsequently, a cable with the minimum nominal cross-sectional area as declared by the manufacturer shall be used.

The cable is fitted in the cable retention means according to the instructions.

The cable is loaded with an axial force of (20 ± 1) N.

The load is maintained for 1 min and at the end of this period the displacement of the cable shall not exceed 3 mm following the removal of the load.

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12.9 Knock-outs intended to be removed by mechanical impact

12.9.1 General

It shall be possible to remove knock-outs intended to be removed by mechanical impact without damaging the box.

Knock-outs intended for use with cables shall be free from chips or burrs.

In knock-outs intended for use with conduits and/or a grommet or a membrane, chips and burrs are disregarded.

In order to close an open knock-out in a box or an enclosure classified according to 7.1.2, a blanking-plug can be used.

This blanking-plug used without a locknut

– shall not become dislodged or damaged, and
– its effectiveness shall not be impaired, and
– it shall fulfil all requirements for knock-outs.

This requirement does not apply to a blanking-plug which is assembled by threading into a threaded inlet.

Compliance is checked by inspection and by the tests as specified in 12.9.2 and 12.9.3.

12.9.2 Knock-out retention

For boxes and enclosures having knock-outs that

– *do not provide access to live parts and are accessible after installation, a force of (30 ± 1) N shall be applied to a knock-out for (15 ± 1) s,*
– *provide direct access to live parts after installation, a force of (40 ± 1) N shall be applied to a knock-out for (60 ± 1) s,*

by means of a 6 mm diameter mandrel with a flat end.

The force is to be applied without a blow in a direction perpendicular to the plane of the knock-out and at a point most likely to cause movement.

When the box is provided with a multi-stage knock-out, the force shall be applied to the smallest knock-out.

The knock-out shall remain in place and the degree of protection of the box or enclosure shall be unchanged when measured 1 h after the force has been removed.

12.9.3 Knock-out removal

The knock-outs shall be removed by means of a tool, as stated by the manufacturer. The side edge of a screwdriver may be run along the edge of the knock-out opening once to remove any fragile tabs remaining along the edge.

For boxes or enclosures according to 7.1.1 or 7.1.3 the test is repeated with one previously untested box or enclosure which has been conditioned for 5 h ± 10 min in air maintained at the minimum temperature during installation and use as specified according to 7.5, but not lower than −25 °C for boxes according to 7.5.4. Immediately following this conditioning, the knock-out is to be removed as specified in the first paragraph of this Subclause 12.9.3.

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For a box or enclosure employing multi-stage knock-outs, there shall be no displacement of a larger stage when a smaller stage is removed.

After the test, there shall be no sharp edges, except for knock-outs for conduits and/or for use with a grommet or a membrane and the box and enclosure shall not be damaged.

12.9.4 Flat surfaces surrounding knock-outs

Knock-outs intended for the use of grommets, glands or fittings shall be located on flat surfaces to permit grommets, glands or fittings to be seated fully against these surfaces when installed as intended.

Projections or indentations in the flat surface area shall be prohibited, however holes shall be allowed. The flat surface areas of adjacent knock-outs that partially or wholly overlap meet the intent of this requirement.

Compliance is checked by inspection and by measurement according to the appropriate national standard sheet, if any.

12.10 Screw fixings

Fixing means for lids, covers, cover plates, accessories, terminals, connecting devices, strain reliefs, etc. effected by screws shall be so designed and constructed that these means withstand the mechanical stresses occurring during installation and normal use.

Screws or other fixing means made from insulating material similar to screws without standardized thread which have to be tightened by any tool for fixing covers shall be tested according to the instructions.

NOTE In the following country flush-type boxes shall have metal inserts and be provided with metal screws having ISO metric thread: NL.

Thread-forming and thread-cutting screws intended only for mechanical assembly may be used provided they are supplied together with one of the pieces with which they are intended to be assembled.

For thread-forming and thread-cutting screws, the screw assembly operation shall be done before carrying out the tests.

Compliance is checked by inspection and by the following test.

The screws of the fixing means are tightened and loosened:

– *10 times for metal screws in engagement with a thread of insulating material;*
– *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 reinserted each time. The test is carried out by using a suitable screwdriver or an appropriate tool applying a torque as indicated in Table 4.

If a screw has a hexagonal head with a slot, only the test with the screwdriver is carried out, with the relevant torque given in column II of Table 4.

Greater values of torque may be used if specified in the instructions.

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Column I of Table 4 applies:

- *to screws which cannot be tightened by means of a screwdriver with a blade wider than the nominal diameter of the thread of the screw,*
- *to non-metallic screws,*
- *to metallic screws in a thread of insulating material. In this latter case, the width of the profile of the recess to tighten the screw is chosen instead of the diameter of the thread when this profile width is smaller than the nominal diameter of the thread with a minimum of 3 mm.*

Column II of Table 4 applies to other screws which are tightened by means of a screwdriver.

Column III of Table 4 applies to screws and nuts which are tightened by means other than a screwdriver.

Column IV of Table 4 applies to screws which are tightened by means of a square blade 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 the threads or to the enclosure impairing the further use of the fixing means. The screws shall be gradually tightened in one smooth and continuous movement.

Table 4 – Tightening torques for the verification of the mechanical strength of screws

Nominal diameter of screw thread mm	Torque for metallic and non-metallic screws Nm			
	I	II	III	IV
Up to and including 2,8	0,20	0,40	0,40	0,70
Over 2,8 up to and including 3,0	0,25	0,50	0,50	0,90
Over 3,0 up to and including 3,2	0,30	0,60	0,60	1,10
Over 3,2 up to and including 3,6	0,40	0,80	0,80	1,40
Over 3,6 up to and including 4,1	0,70	1,20	1,20	1,80
Over 4,1 up to and including 4,7	0,80	1,80	1,80	2,30
Over 4,7 up to and including 5,3	0,80	2,00	2,00	4,00
Over 5,3 up to and including 6,0	1,20	2,50	3,00	4,40
Over 6,0 up to and including 8,0	2,50	3,50	6,00	4,70
Over 8,0	3,00[a]	4,00	10,00	5,00

[a] Or to be specified by the manufacturer.

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12.11 Fixing of boxes and enclosures classified according to 7.2.1

Flush type boxes and enclosures other than for hollow walls shall be provided with fixing means for their suitable attachment to the wall, ceiling or floor. These fixing means may be supplied separately. Screws intended to fix the box or enclosure to the building structure are not required to be supplied with the box or enclosure but can be provided by the installer according to the instructions.

Separately supplied fixing means for a box or enclosure shall comply with the requirements for the fixing means of the box or enclosure with which they are intended to be used and shall include a means for fixing to the box or enclosure.

Screws, additional mechanical supports or design features, which prevent the displacement of the box or the enclosure, are considered to be adequate fixing means.

NOTE Edges, ribs, recesses, partial edges and the like are examples of design features intended to prevent the displacement of the box or the enclosure.

Compliance is checked by inspection.

Boxes and enclosures not fulfilling at least one of the above requirements in this Subclause 12.11 and having an internal volume less than 400 cm^3, shall be tested as follows.

The internal volume of the box or enclosure shall be checked by inspection or by the test in 12.16.

For boxes and parts of enclosures to be embedded in masonry the specimen is mounted into the mounting block shown in Figure 13 and fixed according to the instructions.

The gap between the main external profile of the specimen and the internal profile of the recess in the mounting block shall be at least 20 mm and for parts that project from the main profile the gap shall never be less than 10 mm. The block is filled by the material specified in the instructions, or by plaster where the instructions do not specify the material.

The assembly is kept at ambient temperature for (10 + 1/0) days.

The auxiliary device described in Figure 14 is mounted on the specimen and the screws are tightened with a torque equal to two thirds of the applicable torque given in Table 4.

The assembly is then fixed to the mounting plate (A) of an apparatus shown in Figure 15, so that the axes of the screws are normal to the mounting plane.

The total weight of the device including the principal weight (PW) shall be (72 ± 0,1) N, and the supplementary weight (SW) shall be (8 ± 0,1) N.

The supplementary weight (SW) and the principal weight (PW) are introduced on the axis of the device and fixed by the carrier (C) (see Figure 15).

The supplementary weight shall fall from a height of 50 mm onto the principal weight 10 times.

After the test the specimen shall not have been displaced by more than 0,5 mm from the mounting block.

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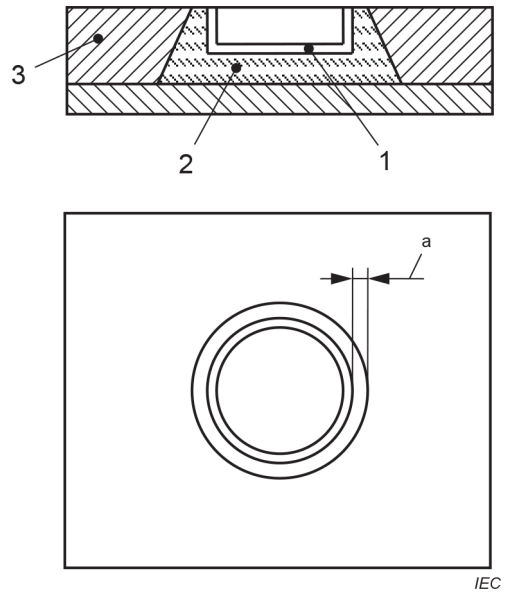


Key

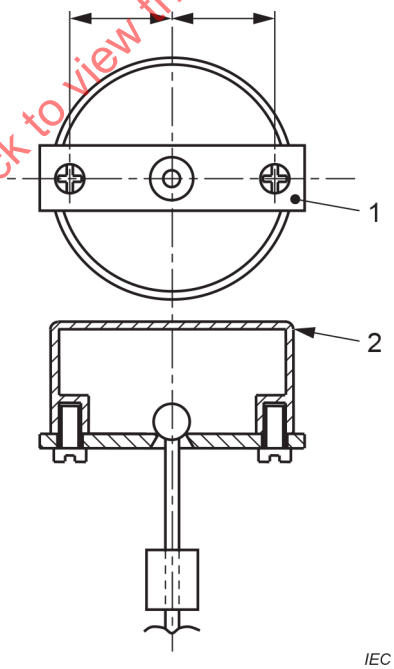
1 specimen

2 plaster

3 block of wood

[a] The gap between the main external profile of the box and the internal profile of the recess in the mounting block shall be at least 20 mm, and for parts which project from the main profile, the gap shall never be less than 10 mm.

Figure 113 – Example of mounting block for boxes to be embedded in masonry (flush type and semi-flush type)



Key

1 auxiliary device

2 specimen

Figure 114 – Example of the fixing of the auxiliary device mounted on a specimen

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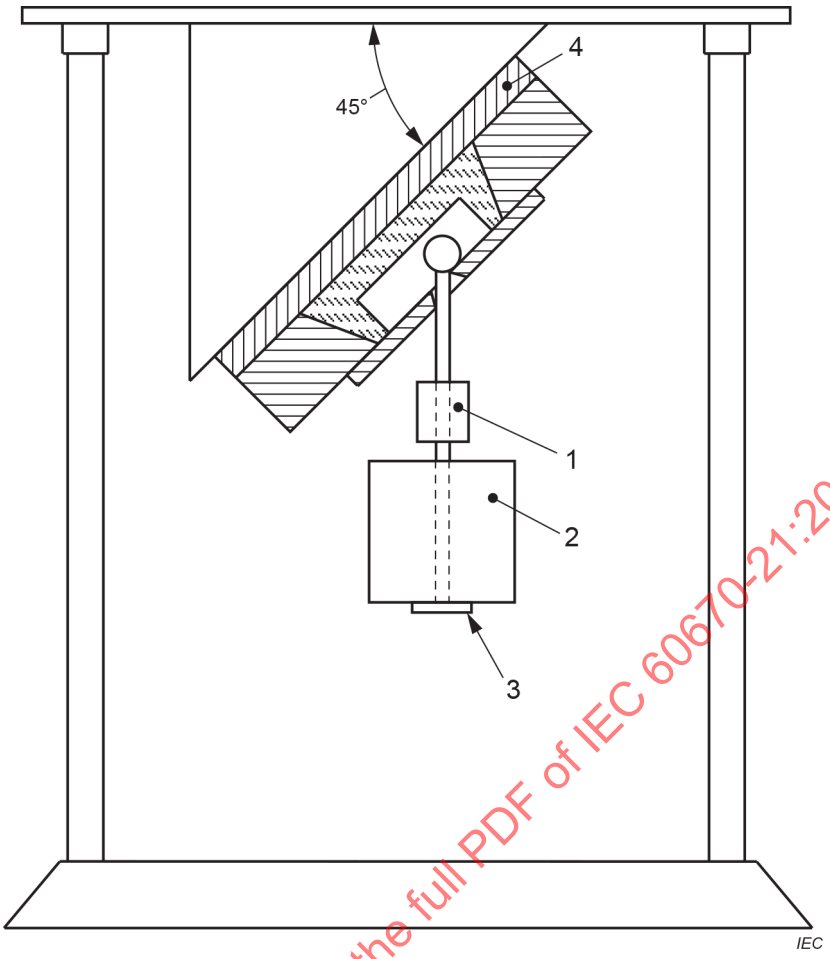

Key

1 supplementary weight (SW)

2 principal weight (PW)

3 carrier (C)

4 mounting plate (A)

Figure 115 – Example of test apparatus for the test

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12.12 Fixing of flush type and semi-flush type boxes and enclosures classified according to 7.2.2.1

Boxes and enclosures for hollow walls or the like classified according to 7.2.2.1 shall have suitable means for fixing the box or the enclosure to hollow walls, hollow ceilings, hollow floors or furniture.

The fixing means shall not rely on the cable management system.

Compliance is checked by the following test.

A specimen of the box or enclosure is mounted in a test wall in accordance with the instructions. Where the instructions are not specific regarding the type of wall, a sheet of plywood (10 ± 1) mm thick, 500 mm wide and 500 mm high shall be used.

a) Checking pull and torque

A lever shall be fixed with the fixing means for accessories or covers to the specimen, as shown in Figure 16.

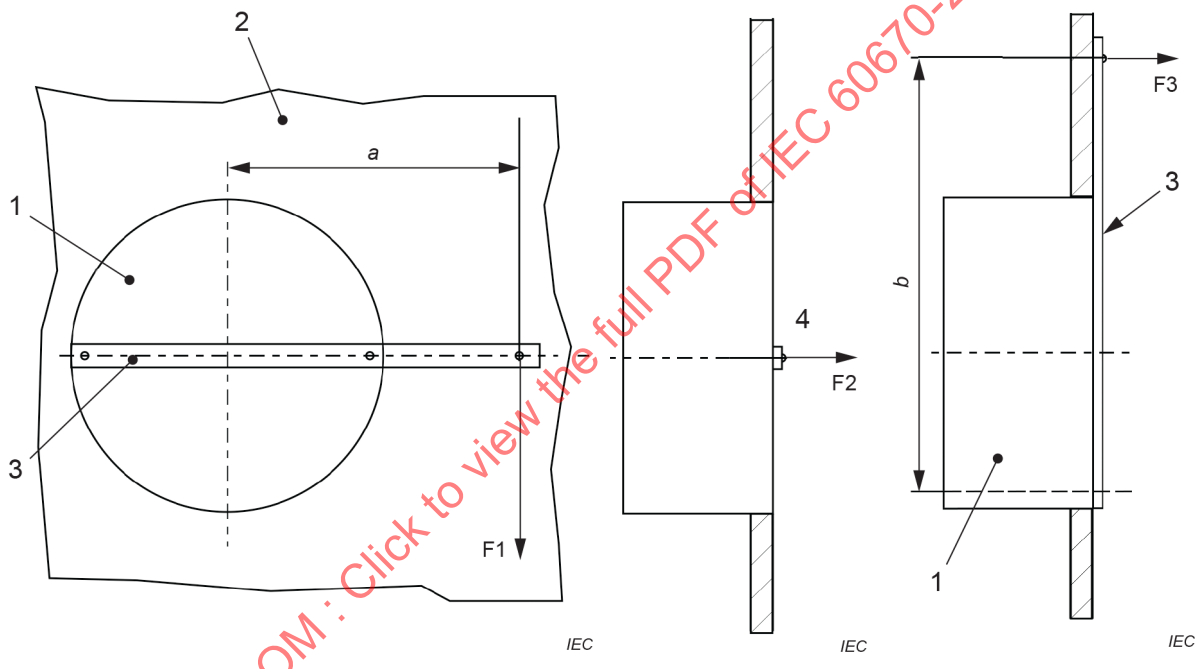
This lever is loaded for 1 min with a force F1 as shown in Figure 16 a) in such a way that a torque (F1 × a) of 3 Nm is applied to the box and simultaneously with a force F2 as shown in Figure 16 b) of 100 N applied on the main axis of the box perpendicular to the mounting surface.

After this test, the specimens shall show no damage impairing their further use and the displacement of the lever shall be no more than 2°.

b) Checking displacement

The end of the lever is subjected for 1 min to a force F3 applied to the same point where F1 was applied in such a way that a torque (F3 × b) of 3 Nm is applied to the box as shown in Figure 16 c).

After the test, the edge of the box shall not have been displaced by more than 1 mm in comparison to the mounting surface.



Key

1 test specimen

2 sheet of plywood

3 lever

4 main axis of the box

Figure 116 – Verification of fixing means for boxes and enclosures classified according to 7.2.2.1

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12.13 Boxes and enclosures classified according to 7.2.2.2 and 7.2.2.3

12.13.1 General

Boxes and enclosures for hollow walls or the like classified according to 7.2.2.2 and 7.2.2.3 shall have suitable means for fixing the box or the enclosure to hollow walls and hollow ceilings.

The fixing means shall not rely on the cable management system.

Compliance is checked by the tests in 12.13.2, 12.13.3, 12.13.4 or 12.13.6 as applicable.

12.13.2 Boxes intended for mounting on a wooden structural member of a wall

The box shall be mounted as in normal use to a (38 mm × 90 mm) wood structural member of any convenient length so that the plane of the front of the box is in vertical position.

The assembly shall withstand a force of 225 N gradually applied centrally from the base of the box for a period of 5 min.

After the removal of the force, there shall be no pulling out of the nails or screws used to mount the box or movement of the face of the box in the horizontal plane of more than 3 mm.

12.13.3 Boxes intended for mounting to a wooden structural member of a ceiling

The box shall be mounted as in normal use to a (38 mm × 190 mm) wood structural member of any convenient length so that the plane of the front of the box is in horizontal position.

The assembly shall withstand a force of 225 N gradually applied centrally from the face of the box for a period of 1 min.

With the force still applied, the deflection of the face of the box shall not exceed 6 mm measured from a plane parallel to the horizontal face of the structural member.

12.13.4 Boxes intended for mounting to a steel-stud structural member of a wall

The box shall be mounted as in normal use to a steel-stud structural member as shown in Figure 17.

The assembly shall withstand a force of 180 N gradually applied centrally from the face of the box for a period of 5 min, first in a direction tending to push the box into the wall opening and then in the opposite direction, tending to pull the box out of the opening.

With the force still applied, the deflection of the box shall not exceed 2 mm in either direction.

Additional support for the box can be necessary to minimize deflection.

Application of the force and measurement of the displacement are shown in Figure 17.

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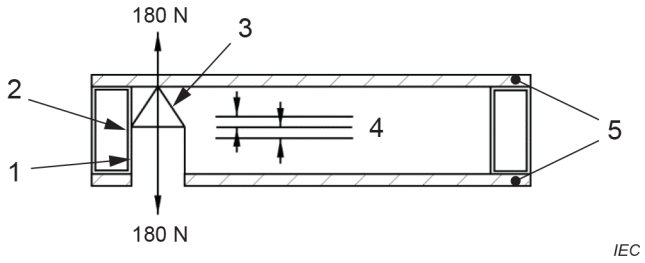
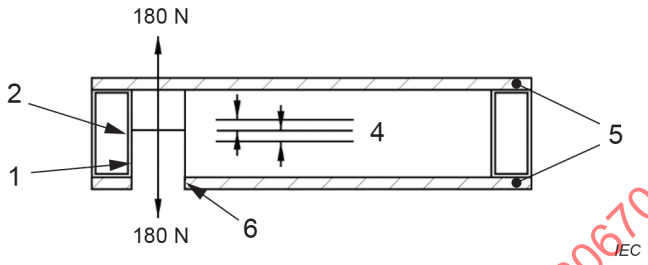
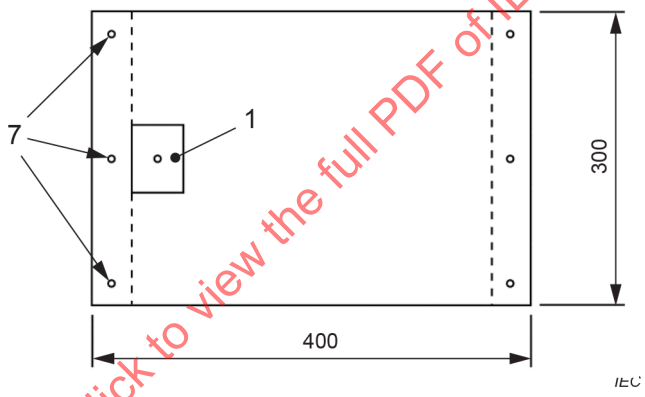
Dimensions in millimetres



a) Box with permanently attached additional support



b) Bracket providing additional support (for field installation)



c) Front view

Key

1 box
2 steel stud
3 additional support
4 maximum deflection
5 plywood
6 bracket
7 three screws per side per panel

Figure 117 – Test of the force and measurement of the displacement

12.13.5 Internal volume of boxes and enclosures classified according to 7.2.2.2 and 7.2.2.3

For boxes, enclosures, raised covers and box extensions classified according to 7.2.2.2 and 7.2.2.3, the declared internal volume of a box, enclosure, raised cover or box extension shall be verified.

A box or enclosure provided with a partition shall have the volume of each partitioned section verified.

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Compliance is checked by the test of 12.16.

12.13.6 Boxes intended for mounting in a finished structure

The supporting means of a box intended for installation in a finished structure shall not crack or break nor shall the face of the box be permanently displaced more than 3,2 mm from the plane of the face of the test surface when measured 1 min after the test load is removed.

NOTE In a finished structure, structural framing members are not typically accessible for mounting and supporting boxes or enclosures flush or semi-flush in hollow walls.

Compliance is checked by the following test:

Six boxes intended for use in walls or eight boxes intended for use in ceilings shall be installed in a 9,5 mm thick plywood sheet reinforced with a support 152 mm from one edge of the opening for the boxes, or in a finished surface in accordance with the instructions.

Screws for the box supporting means shall be tightened in accordance with the instructions. In the absence of instructions, screws shall be tightened in accordance with column IV of Table 4. A screw that strips before being tightened to the torque specified shall not override more than once.

Following installation, a force of 222 N shall be applied for 5 min consecutively to each of two boxes in a direction normal to the plane of the face of the test surface along the centerline of the box and tending to push the box into the opening. The same force is to be applied to each of two previously untested boxes in a direction tending to pull the box out of the opening. Following this test, the screw shall be capable of being removed by a screwdriver.

Two additional samples of a box secured so that the plane of the front of the box is vertical, shall be subjected to a force of 222 N applied for 5 min suspended from the lower rear corner of the outer back edge of the box.

12.14 Cable gland entry

Cable glands shall not damage the box or enclosure when used as intended.

Compliance is checked by the following test.

Cable glands are fitted with a cylindrical metal rod having a diameter, in millimetres, equal to the internal diameter of the gasket rounded to the nearest whole number as specified in the first column of Table 5. The cable glands are then tightened and loosened 10 times by means of a suitable tool with the torque specified in Table 5 with a tolerance of ($^{+5}_{0}$) %, the relevant torque being applied for 1 min ± 5 s.

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Table 5 – Torque test values for cable glands

Diameter of test rod mm	Torque Nm	
	Metal glands	Glands of insulating material
Up to and including 8	4,0	2,5
Over 8 up to and including 14	6,3	3,8
Over 14 up to and including 20	7,5	5,0
Over 20	10,0	7,5

After the test, the boxes and enclosures shall show no damage within the meaning of this document.

12.15 Boxes and enclosures with inlets or spouts (hubs) for conduits

12.15.1 *Boxes and enclosures classified according to 7.3.4 and conical spouts as in 7.3.6 shall withstand the tests of 12.15.2, 12.15.3 and 12.15.4.*

Threaded spouts are not submitted to the tests of 12.15.2 and 12.15.3.

Boxes and enclosures classified according to 7.4.3 shall withstand the tests of 12.15.2 and 12.15.3.

The tests are carried out with conduits of minimum nominal size according to IEC 60423 or IEC 60981 after installation as in normal use or assembly according to the instructions.

12.15.2 *Enclosures with the spout for conduits shall be tested so that a minimum size piece of conduit is pressed for 1 min ± 5 s with a force of (100 ± 2) N. The spout shall prevent further entry of the conduit into the box.*

12.15.3 *A pull-out test shall be carried out after the test according to 12.15.2, as follows. The conduit with the minimum size corresponding to the insert opening shall be loaded axially for 1 min with a tensile force of (20 ± 2) N. The conduit shall not come loose from the spout of the enclosure.*

12.15.4 *The resistance to bending strain of a spout shall be tested as follows. A piece of a conduit shall be inserted into the spout with a compressible force of (100 ± 2) N and loaded with a bending moment of 3 Nm. The strain shall slowly rise from zero to full value and the test shall be carried out in six different directions through the centre line of the spout with an interval of (60 ± 2)°. At each angle position the spout shall be loaded for 1 min. The spout shall not come loose or be damaged and the conduit shall stay within the spout.*

NOTE An inlet stop can be designed as a rib on the inside of the spout.

12.16 Internal volume of boxes and enclosures

When referred to in this document, the declared internal volume of the box or enclosure, each partitioned section of a box or enclosure, raised covers and box extensions shall be measured in the following manner.

a) All internal screws, clamps, etc., shall be removed except earthing terminals and assembly screws.

b) Any projections such as a cover or flush-mounting ears that extend beyond the normal edge of the box or enclosure shall be ground flush with the edge.

c) All knock-outs shall be left as punched and shall be sealed externally.

d) All openings shall be plugged with modelling clay, putty, wax or other material(s) and shall be filled flush with the internal surface.

e) The box, enclosure, or raised covers shall be covered with a flat plate of any convenient transparent material not more than 3,2 mm thick. In the centre of the plate a hole with a nominal diameter of 13 mm shall be provided (see Figure 18). If necessary, the gap between the box, enclosure or raised cover and the plate shall be sealed with the material used to seal the other openings.

f) Using any convenient graduated cylinder or measuring flask filled with water at room temperature, the box, enclosure, or raised cover shall be filled without overflowing. The difference in the volume of water in the measuring cylinder measured before and after the filling of the box, enclosure or raised cover indicates the volume of the box.

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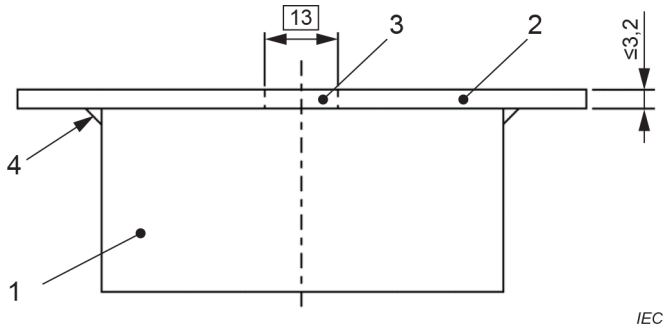
The volume of a side pocket provided to increase the volume of a box or enclosure shall be calculated using a depth-of-pocket not more than the smallest dimension of the opening into that side pocket.

Dimensions in millimetres



Key

1 box

2 cover

3 opening for water fill

4 seal, if necessary

Figure 118 – Volume measurement

12.101 Provision for suspension means

Unless otherwise declared by the manufacturer, screws for fixing accessories and/or covers are not considered as provision for suspension means.

12.102 Minimum mass to be supported by suspension means

Boxes and enclosures with provision for suspension means shall be able to support a mass of at least 5 kg.

NOTE For fixing means of a luminaire, a minimum supported mass of 5 kg is given in IEC 60364-5-55:2011, 559.5.2.

Compliance is checked by the tests of 15.101.

13 Resistance to ageing, protection against ingress of solid objects and against harmful ingress of water

13.1 Resistance to ageing

13.1.1 Boxes and enclosures, glands, grommets and replaceable membranes of insulating or composite material, shall be resistant to ageing.

Compliance is checked as follows:

Boxes and enclosures of insulating or composite material with provision for glands or grommets are mounted and assembled as in normal use or according to the instructions.

Boxes and enclosures of insulating or composite material without provision for glands, grommets, or membranes are assembled according to the instructions.

Parts intended for decorative purposes which can be removed without the aid of a tool, shall be removed before the tests.

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For boxes and enclosures provided with glands or grommets, approximately half of the number of glands or grommets of each of the boxes and enclosures are fitted with seals together with cylindrical metal rods having a diameter equal to the lower limit specified for the mean overall diameter of the smallest cable as declared by the manufacturer. The remainder of the glands or grommets of the same boxes and enclosures are fitted with seals together with cylindrical metal rods having a diameter equal to the upper limit specified for the mean overall diameter of the largest cable as declared by the manufacturer.

Where the number of glands or grommets in a box is greater than six, the test is carried out with three glands or grommets equipped for the smallest cable size and three glands or grommets equipped for the largest cable size on each box.

In the case of grommets, the rod shall be kept in place in such a way that the rod cannot move. The means to keep the rod in place shall have no influence on the results of the tests.

The glands are tightened with a torque equal to two-thirds of that applied during the test of 12.14 (Table 5) any other openings being closed. Greater values of torque may be used if so stated by the manufacturer.

The specimens are then subjected to a test in a heating cabinet with an atmosphere having the composition and pressure of the ambient air.

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

The specimens are kept in the cabinet for (168 $^{+4}_{0}$) h.

After the treatment, the specimens are removed from the cabinet and kept at room temperature for (96 $^{+4}_{0}$) h.

After the test, the specimen shall show no harmful deformation or similar damage, which may impair their further use within the meaning of this document.

13.1.2 Grommets, blanking plugs and entry membranes in inlet openings and protective membranes 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, which shall be applied to all grommets, blanking plugs, replaceable and non-replaceable membranes.

Grommets, blanking plugs and membranes are tested while being fixed to the enclosures.

First, the enclosures that have been subjected to the treatment specified in 13.1.1 are placed for 2 h ± 15 min in a heating cabinet as described in 13.1.1, the temperature being maintained at (40 ± 2) °C.

Immediately after this period, a force of (30 $^{0}_{-2}$) N is applied for (5 ± 1) s to various parts of the grommets, blanking plugs and/or membranes by means of the tip of test probe 11 according to IEC 61032.

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

For grommets, blanking plugs and/or membranes likely to be subjected to an axial pull in normal use, an axial pull of (30 $^{0}_{-2}$) N shall be applied for (5 ± 1) s.

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The test is then repeated on the same enclosures fitted with grommets, blanking plugs and/or membranes which have not been subjected to any treatment.

After the test, grommets, blanking plugs and/or membranes shall show no harmful deformation, cracks or similar damage which would lead to non-compliance with this document.

13.1.3 Grommets, blanking plugs and entry membranes in inlet openings of boxes and enclosures classified according to 7.5.2, 7.5.3 and 7.5.4 shall be so designed and made of such material that the introduction of the cables and conduits is permitted when ambient temperature is low.

Compliance is checked by the following test.

The enclosure is fitted with grommets, blanking plugs and/or entry membranes which have not been subjected to any ageing treatment.

After being left to cool down to the ambient temperature, the boxes and enclosures are then kept for 2 h in a freezer

- *at a temperature of (−15 ± 2) °C for boxes and enclosures classified according to 7.5.2, or*
- *at a temperature of (−25 ± 2) °C for boxes classified according to 7.5.3 and 7.5.4.*

Immediately after conditioning, while the boxes and enclosures are still cold and, in the freezer, it shall be possible to pierce any blind grommets, blanking plugs and entry membranes and to introduce cables and conduits of the maximum diameter intended, the cables and conduits having been submitted to the same conditioning as the boxes and enclosures.

After the test, the grommets, blanking plugs or entry membranes shall show no harmful deformation, cracks or similar damage which would lead to non-compliance with this document.

13.2 Protection against the ingress of solid objects

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

For boxes and enclosures classified according to 7.2.2.1 the above requirement applies also to the part mounted inside the hollow wall according to classification 7.8.

NOTE In the following countries a minimum protection degree of IP30 is required for parts of boxes and enclosures inside hollow walls due to installation practices: DE, DK, SE, NO

Compliance is checked by the appropriate test of IEC 60529 under the following test conditions.

Enclosures are mounted as for normal use according to the instructions.

For boxes and enclosures classified according to 7.2.2.1, the test on the part mounted inside the wall is made on a box mounted so that the rear part is accessible for the test.

Unless otherwise stated in this document, where the enclosure has drain holes, at least one open drain hole shall be in the lowest position.

Enclosures with screwed glands or grommets are fitted with cables having the smallest and the largest cross-sectional area and/or conduit having the smallest and the largest diameter or dimensions, if any, as declared by the manufacturer.

Fixing screws of the cover or cover-plate of the box are tightened with a torque equal to two- thirds of the values from Table 4 used for the test of 12.10.

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Greater values of torque may be used if so stated by the manufacturer, when the relevant information is provided.

Other fixing means shall be fastened as in normal use or, if provided, according to the instructions.

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

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

Glands are not filled with sealing compound or the like.

For degree of protection IP5X, the test is carried out according to IEC 60529 category 2 and the drain holes, if any, shall not be open.

For degrees of protection up to and including IP4X, the protection is satisfactory if the full diameter of the probe does not pass through any opening other than through drain holes, in which case the probe shall not touch live parts within the enclosure.

For degree of protection IP5X, the protection is satisfactory if the dust does not cover the whole inner surface.

For degree of protection IP6X, the test is carried out according to IEC 60529 and the drain hole, if any, shall not be open. The protection is satisfactory if there is no dust inside the box or enclosure.

13.3 Protection against harmful ingress of water

13.3.1 Enclosures with a degree of protection higher than IPX0 shall provide a degree of protection against harmful ingress of water in accordance with the declared IP Code.

Compliance is checked by the appropriate tests of IEC 60529 under the following test conditions.

For surface enclosures and flush and semi-flush enclosures with dimensions S ≤ 0,04 m^2 or perimeter ≤ 0,8 m, see 13.3.2 and 13.3.3.

For surface enclosures and flush and semi-flush enclosures with dimensions S > 0,04 m^2 and perimeter > 0,8 m, see 13.3.2 and 13.3.4.

The reference surface S to be chosen for verification is calculated as follows.

– *For square and rectangular boxes and enclosures, the surface to take into account is the smallest interior width (l) multiplied by the depth (h) (see Figure 19 a)).*

– *For round boxes and enclosures, the surface to take into account is the interior depth (h) of the box or enclosure multiplied by the smallest diameter (d) divided by 4 (see Figure 19 b)).*

Enclosures with screwed glands or grommets are fitted with cables having the smallest and the largest cross-sectional area and/or conduit having the smallest and the largest diameter/dimensions, if any, as declared by the manufacturer.

Fixing screws of the cover or cover-plate of the box are tightened with a torque equal to two-thirds of the values from Table 4 used for the test of 12.10.

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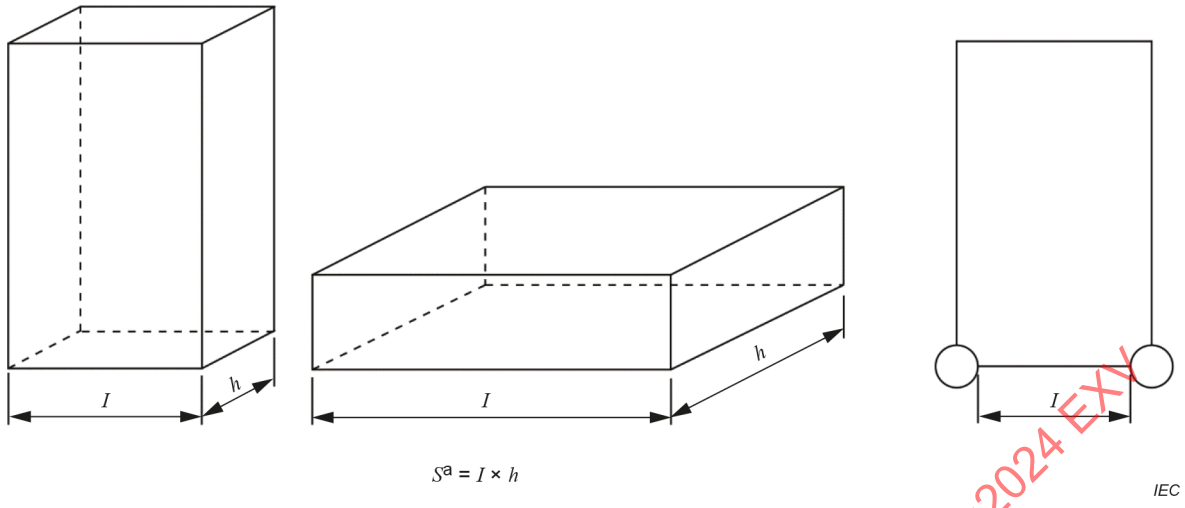


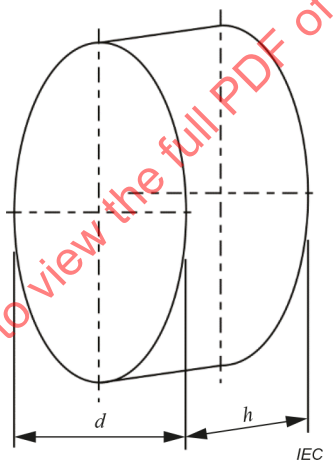
Key

h depth

I internal width

[a] For a rectangular box placed horizontally, the surface *S* to take into account is the smallest one.

a) Reference surface for square boxes and enclosures



Key

h internal depth

d smallest diameter

b) Reference surface for round boxes and enclosures

Figure 119 – Reference surfaces for boxes and enclosures

13.3.2 *Surface-mounting enclosures are mounted as for normal use according to the instructions with any open drain holes in the lowest position unless otherwise specified in the instructions.*

Flush type and semi-flush type enclosures are fixed in a test wall in accordance with the instructions.

In this case, the instructions shall specify a type of wall, as well as the mounting method. These shall be described in sufficient detail to ensure reproducible tests.

Where the instructions do not specify a type of wall, the test wall according to Figure 20 is used.

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Dimensions in millimetres

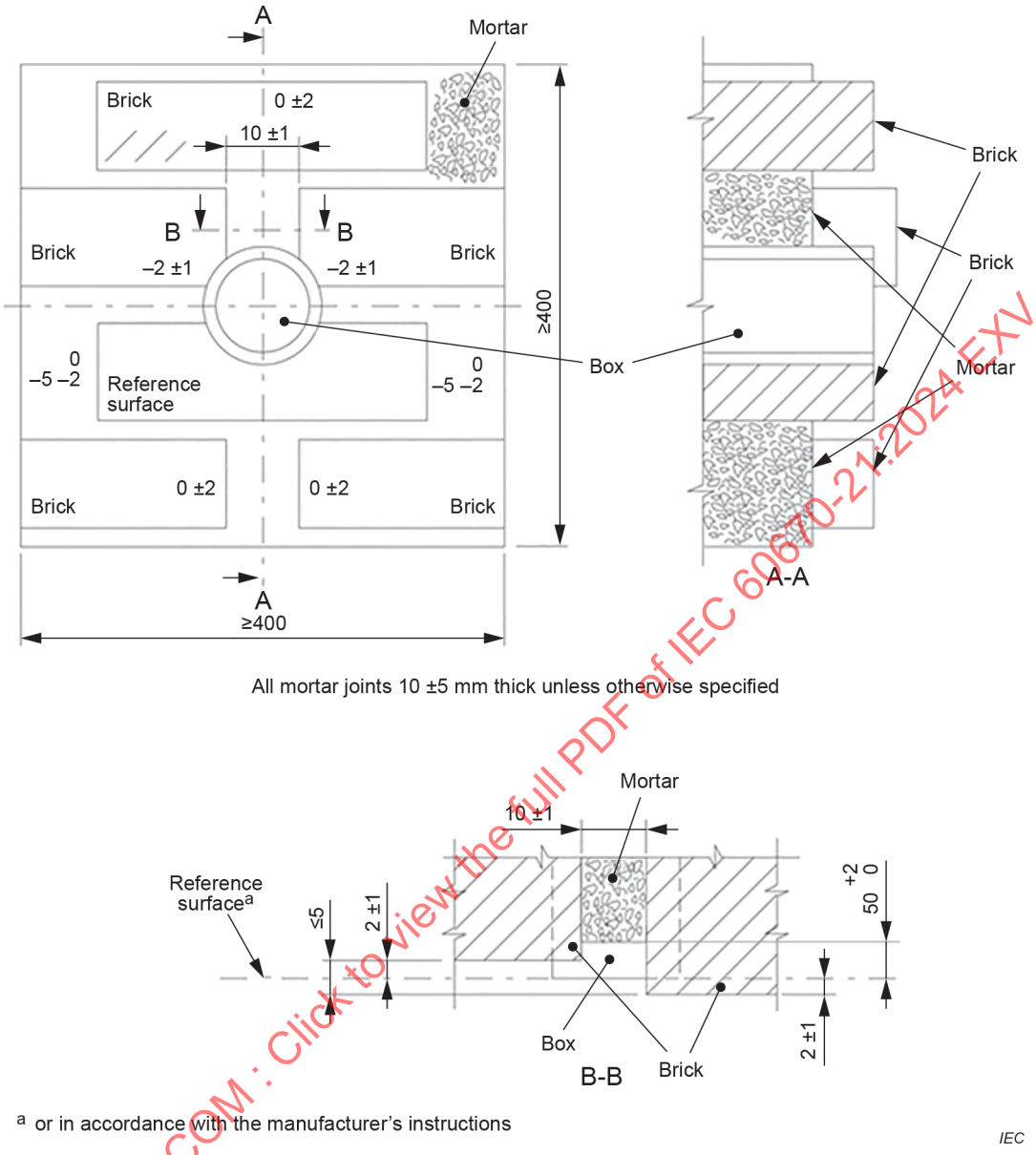

Figure 120 – Test wall

The test wall of Figure 20 is made with bricks having smooth surfaces. When the box is mounted in the test wall, it shall fit tight against the wall so that water cannot enter between the box and the wall.

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

NOTE Figure 20 shows an example where the edge of the box is positioned in the reference plane, other positions are possible according to the instructions of the manufacturer.

The test wall is placed in a vertical position.

Enclosures are mounted as in normal use and fitted with cables having conductors of the largest and smallest cross-sectional area as declared by the manufacturer.

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For IPX3 and IPX4, the oscillating tube according to Figure 4 of IEC 60529:1989 is used unless the dimensions of the enclosure imply the use of the spray nozzle according to Figure 5 of IEC 60529:1989.

During the tests of enclosures of degree of protection higher than IPX4, drain holes, if any, shall not be opened.

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

13.3.3 *Immediately after the test, there shall be no more than 0,2 ml × S (cm^2) water in the enclosure.*

NOTE For a degree of protection higher than IPX4, it can be necessary to open the drain holes for inspection.

If the enclosure is not provided with drain holes, consideration should be given to any accumulation of water which may occur, for example, condensation.

After the test, the specimens of boxes and enclosures classified according to 7.1.1, 7.1.3 and 7.1.4, as appropriate, shall withstand an electric strength test specified in 14.2 which shall be started within 5 min of the completion of the test according to this Subclause 13.3.3.

13.3.4 *Ingress of water is verified by the use of dry absorbent paper positioned to cover the base area of the protected volume.*

NOTE The base is always the bottom of the protected volume when installed.

Unless it is decided otherwise by the manufacturer the protected volume shall correspond to the total internal space of the box reduced by 5 % on each face of the box, i.e. 10 % on each dimension of the enclosure (see Figure 21).

$$V_p = 0{,}9\ L \times 0{,}9\ D \times 0{,}9\ H$$

where

V_p is the protected volume;

L is the length;

D is the depth;

H is height.

In case of a round box the protected volume is equal to $V_p = 0{,}9\ H \times \pi(0{,}9 \times d)^2 / 4$.

In order to have the absorbent paper properly placed, the manufacturer should provide a specimen where the absorbent paper is suspended by a reliable suspension means.

For doors or covers intended to accommodate accessories, a strip of paper, bent to form a 90° angle profile, is attached to the cover or lid in the lowest position in order to protrude inside the box until it reaches the internal protected volume of the box (see Figure 21).

If the enclosure can have more than one position of installation the test shall be carried out in all possible installation positions.

Immediately after the test, the indicator paper shall still be dry.

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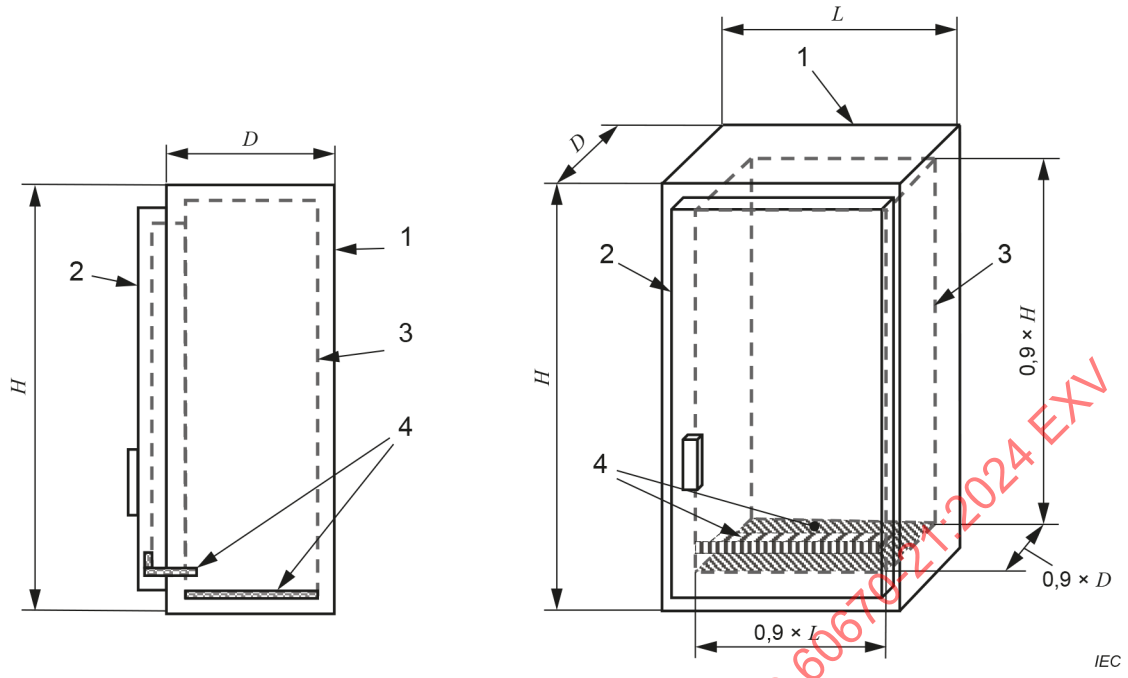

Key

1 box

2 cover

3 protected volume

4 absorbent paper

Figure 121 – Example of the protected volume

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14 Insulation resistance and electric strength

14.1 The insulation resistance and the electric strength of enclosures classified according to 7.1.1, 7.1.3 and 7.1.4 shall be adequate.

Compliance is checked by the tests of 14.2, these tests being made immediately after the following humidity treatment.

The specimens are placed in a humidity cabinet containing air with a relative humidity maintained between 91 % and 95 %.

The temperature of the air where the specimens are placed is maintained within ± 2 °C of any convenient value t between +20 °C and +30 °C.

Before being placed in the humidity cabinet, the specimens are brought to a temperature between t and (t + 4) °C.

The specimens are kept in the cabinet for

- *2 days (48 $^{+2}_{0}$) h for enclosures classified IPX0;*
- *7 days (168 $^{+4}_{0}$) h for other enclosures.*

NOTE In most cases, the specimens can 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 % and 95 % can be obtained by placing 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 the humidity cabinet.

After this treatment, the specimen shall show no damage impairing its further use and shall pass the following tests.

When a solid material is intended to provide electrical insulation between live parts and the body, the insulation resistance between the body and a metal foil in contact with the internal surface of the box and enclosure, is measured with a DC voltage of approximately 500 V, the measurement being made 1 min after application of the voltage.

The term "body" includes all accessible metal parts, metal foil in contact with the outer surface of accessible external parts of insulating material, fixing screws of backplates or covers and external assembly screws.

If metal foil is used for testing the insulation resistance and the electric strength, one metal foil is placed in contact with the inner surfaces and another metal foil, having a size not exceeding 200 mm × 100 mm, is placed in contact with the external surfaces and, if necessary, is moved so as to test all parts.

During the test, the distance between the inner and the outer metal foil shall be arranged in such a way that there is no flashover in the surroundings of holes, premoulded knock-outs, membranes, etc.

When there are holes in the enclosure, they are not tested, and the metal foil is interrupted at these places because there is no more solid insulation.

The insulation resistance shall be not less than 5 MΩ.

14.2 The electric strength is tested by applying a voltage of a substantially sinusoidal waveform, having a nominal frequency of 50 Hz or 60 Hz and a value as specified in Table 6, for 1 min between the parts listed in 14.2.

The test voltage is taken from Table 6 according to the rated voltage as declared by the manufacturer.

For enclosures having class II protection, the test voltage according to Table 6 is multiplied by 1,5.

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

No flashover or breakdown shall occur during the test.

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Table 6 – Test voltage for electric strength test

Rated voltage	Test voltage
V	V
≤ 130	1 250
> 130 and ≤ 250	2 000
> 250 and ≤ 450	2 500
> 450 and ≤ 750	3 000
> 750	3 500

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 at least 200 mA. The overcurrent relay shall not trip when the output current is less than 100 mA.

The RMS value of the test voltage applied is measured within ±3 %.

Glow discharges without a drop in voltage are disregarded.

During the test a metal foil, as described in 14.2, is placed in contact with the inner surfaces and another metal foil is placed in contact with the external surfaces and, if necessary, moved so as to test all the parts.

15 Mechanical strength

15.1 General

Boxes and enclosures shall have adequate strength to withstand the mechanical stresses occurring during installation and normal use.

Compliance is checked by the appropriate tests of 15.2 to 15.5 as follows:

– *for non-metallic boxes and enclosures intended for use in cast concrete classified according to 7.2.1.2 or 7.2.1.3, by the test of 15.2;*

– *for non-metallic boxes and enclosures intended for use in cast concrete and able to withstand 90 °C during the casting process classified according to 7.2.1.3, by the test of 15.3;*

– *for non-metallic boxes and enclosures classified according to:*

  a) 7.2.3,

  b) 7.2.1.1 or 7.2.2 and also classified according to 7.5.2 or 7.5.3, by the test of 15.4;

– *for non-metallic boxes and enclosures, the parts which are intended to be accessible after the completion of the building-process, by the test of 15.4;*

– *for boxes and enclosures classified according to 7.1.4, by the test of 15.5.*

When an enclosure is too large to fit the test apparatus shown in Annex D of IEC 60068-2-75:2014, or where it is impractical to use the pendulum hammer for tests at low temperature, the tests are carried out in the same conditions as those specified in 15.2 or 15.4, but using the spring hammer according to IEC 60068-2-75 calibrated to the impact energy corresponding to the impact required by the relevant subclause, 15.2 or 15.4.

15.2 Impact test at low temperature

The specimen shall be subjected to an impact test with a vertical hammer test apparatus (see Figure 22) placed on a pad of closed cell expanded sponge rubber 40 mm thick when uncompressed and having a density of approximately 538 kg/m^3.

The whole arrangement together with the specimens shall be placed in a freezer, the temperature within being maintained for 2 h ± 15 min at:

- *(−5 ± 2) °C for types classified according to 7.5.1;*
- *(−15 ± 2) °C for types classified according to 7.5.2;*
- *(−25 ± 2) °C for types classified according to 7.5.3;*
- *The declared temperature of use ± 2 °C for types classified according to 7.5.4.*

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At the end of this period, each specimen is subjected to an impact by means of a mass of 1 kg falling vertically from a height of 100 mm.

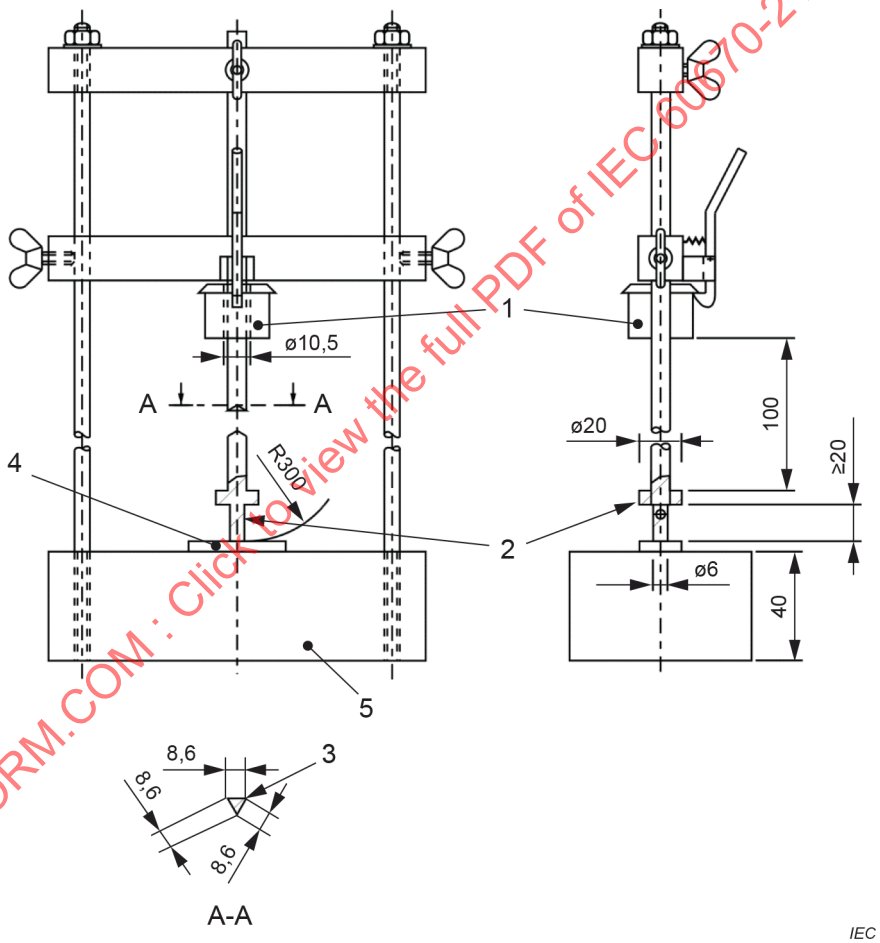
One blow is applied on the back and four equally spaced blows are applied on the side walls.

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

Damage to the finish, small dents and small chips which do not adversely affect the protection against electric shock or harmful ingress of water are disregarded.

Cracks passing through the material not visible with normal or corrected vision without magnification, surface cracks in fibre-reinforced mouldings and small indentations are disregarded.

Dimensions in millimetres



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Key

1 falling weight (1 000 ± 1) g

2 steel intermediate piece 100 g

3 slightly rounded edges

4 specimen

5 steel support (10 ± 1) kg

Figure 122 – Apparatus for impact test at low temperature

15.3 Compression test

The boxes and enclosures are placed in a heating cabinet for (60 $^{+15}_{0}$) min at a temperature of (+90 ± 5) °C.

The boxes and enclosures are then allowed to cool down to ambient temperature.

After the test, the boxes and enclosures shall show neither deformation nor damage leading to non-compliance with this document.

The boxes and enclosures are then placed between two flat hardwood plates each having a surface area sufficient to cover the face and back of the box. The plates are then loaded without impact with a force of (500 ± 5) N for 1 min ± 5 s which is applied away from the front face of the box towards the back.

After the test, the box and the enclosure shall show no deformation or damage leading to non-compliance with this document or affecting its further intended use.

During these two tests, the boxes and enclosures shall be fitted according to the instructions, with the special part, if any, intended to improve the mechanical behaviour of the boxes and enclosures during the casting of the concrete.

For the test, any special part shall be delivered together with the box and the enclosure.

15.4 Impact test for boxes and enclosures

The specimens are checked by applying blows by means of the pendulum hammer test apparatus as described in IEC 60068-2-75 (test EHA), with an equivalent mass of 250 g.

For boxes classified according to 7.5.2 or 7.5.3, this test shall be performed by placing the assembly including the specimen and the mounting block to which it is attached in a freezer, the temperature within being maintained for 2 h ± 15 min at the following temperature:

- *(−15 ± 2) °C for types as classified according to 7.5.2;*
- *(−25 ± 2) °C for types as classified according to 7.5.3;*
- *The declared temperature of use ± 2 °C for types as classified according to 7.5.4.*

At the end of this period the specimens are removed from the freezer and immediately submitted to the impact test.

Specimens classified according to 7.2.1.1 intended to be flush-mounted in normal use are reverse-mounted for the purpose of the test, so that the rear surface of the specimen is accessible as shown in Figure 23.

Test specimens are mounted on a mounting block made from an 8 mm thick, 175 mm × 175 mm plywood sheet which is secured at its top and bottom edges by a rigid bracket. Inlet openings without knock-outs are left open. Where inlet openings are provided with knock-outs, one is opened.

Specimens classified according to 7.2.3 are mounted in accordance with the instructions.

The mounting support as shown in Figure 23 shall be designed to allow the specimen to be moved horizontally and turned about an axis perpendicular to the surface of the plywood sheet.

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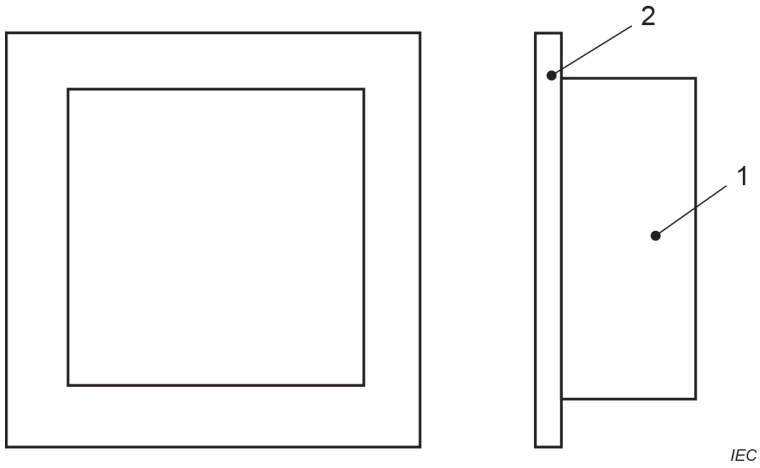

Key

1 box

2 mounting plate

Figure 123 – Mounting block for flush-type boxes and enclosures in order to apply blows on the rear surface

The design of the mounting support shall be such that

– *the mounting support has a mass of (10 ± 1) kg and is mounted on a rigid frame;*

– *the specimen can be mounted so that the point of impact lies in the vertical plane through the axis of the pivot;*

– *the plywood sheet can be turned about a vertical axis.*

Parts are submitted to an impact energy and a specified number of blows dependent on the distance of the accessible surface of the specimen from the surface of the plywood sheet when mounted as specified in this Subclause 15.4. Distances A, B, C, D, E, F and G are defined as indicated in Table 7.

Table 7 – Determination of parts A, B, C, D E, F and G

Part to be tested	Distance (*d*) from the surface of the plywood sheet mm	Parts
Front surfaces of covers and cover-plates of enclosures which are intended to be accessible after installation, and Rear surfaces of boxes and enclosures classified according to 7.5.2 or 7.5.3	Not applicable	A
Parts of boxes and enclosures intended to be accessible after installation and classified according to 7.2.1 semi-flush, 7.2.2 semi-flush or 7.2.3, with the exception of front surfaces already tested as parts A	$5 \leq d < 15$	B
	$15 \leq d < 25$	C
	$25 \leq d < 50$	D
	$50 \leq d < 100$	E
	$100 \leq d < 200$	F
	$200 \leq d$	G

The striking element shall fall from a height which is specified in Table 8.

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Table 8 – Height of fall for impact test

Height of fall mm	impact energy J	Parts of enclosures to be subjected to the impact
80	0,2	A
120	0,3	B
160	0,4	C
200	0,5	D
240	0,6	E
320	0,8	F
400	1,0	G

The height of fall is the vertical distance between the position of the 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 axis of the steel tube of the pendulum and the striking element, perpendicular to the place through both axes, meets the surface.

The specimens are subjected to blows, which are evenly distributed over the specimen.

The following blows are applied:

– *for each part A (as far as applicable), five blows as follows:*
  - *one blow in the centre;*
  - *then, after the specimen has been moved horizontally, one on each of the two least favourable points between the centre and the edges;*
  - *and then, after the specimen has been turned 90° ± 2° about its axis perpendicular to the plywood, one on each of two similar points;*
– *for parts B (as far as applicable), C, D, E, F and G, four blows (see Figure 24) as follows:*
  - *one blow is applied on the side of the specimen on which the blow can be applied after the plywood sheet has been turned 60° ± 2° about a vertical axis;*
  - *one blow is applied on the opposite side on which the blow can be applied after the plywood sheet has been turned 60° ± 2° about a vertical axis in the opposite direction;*
  - *after the specimen is turned 90° ± 2° about its axis perpendicular to the plywood, one blow is applied on one of the sides of the specimen on which the blow can be applied after the plywood sheet has been turned 60° ± 2° about a vertical axis;*
  - *one blow is applied on the opposite side of the specimen on which the blow can be applied after the plywood sheet has been turned 60° ± 2° about a vertical axis in the opposite direction.*

The blows shall not be applied to

– *knock-outs or to an area within 10 mm of them,*
– *other parts not necessary to achieve the declared IP of the enclosure,*
– *accessories and equipment complying with the other relevant standards,*
– *fixing means recessed below the surface that are not subject to impacts in normal use.*

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

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

There shall be no cracks passing through the material which are visible to normal or corrected vision without magnification. Surface cracks in fibre-reinforced mouldings and small indentations are ignored.

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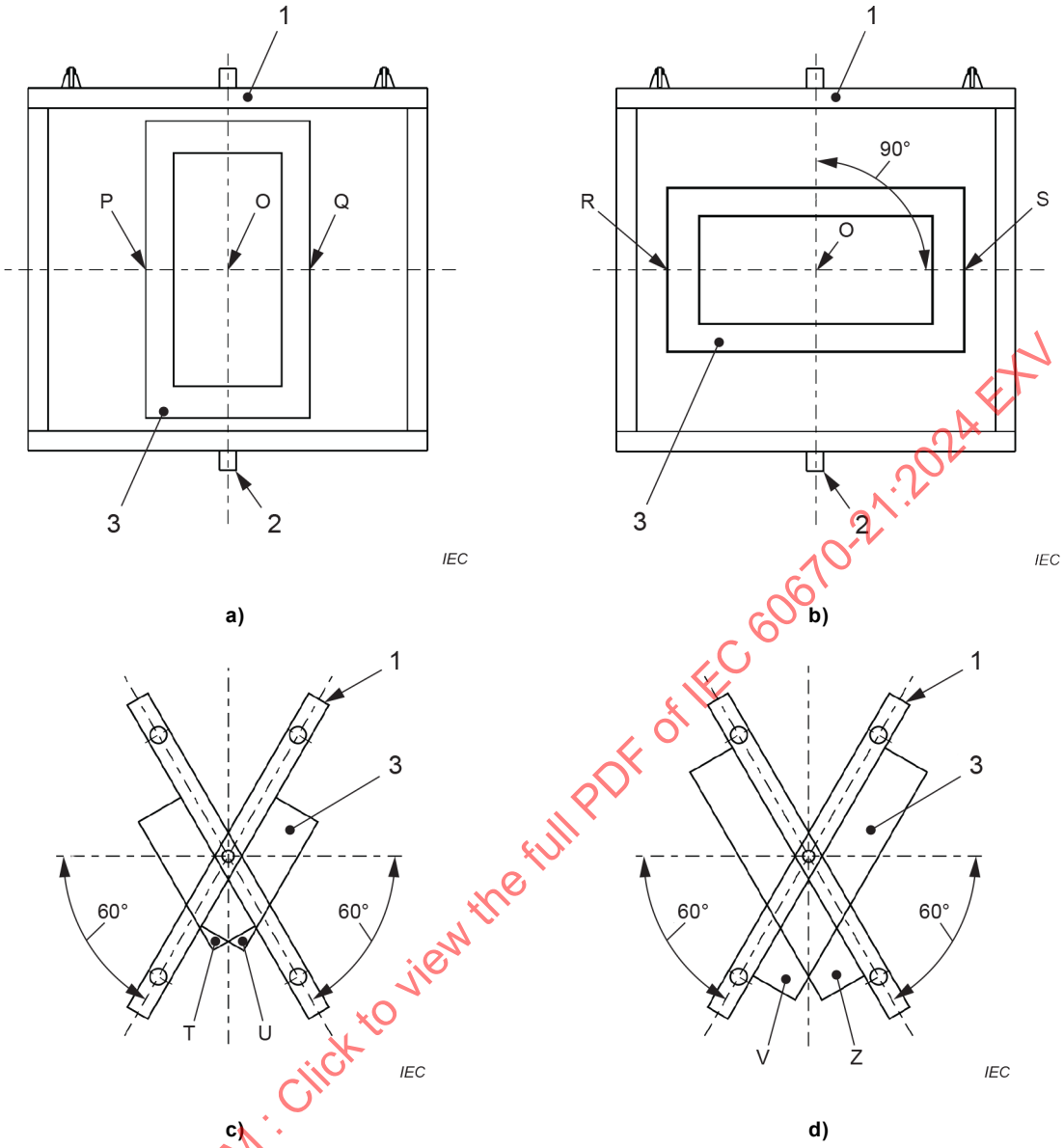

Key

1 mounting support

2 pivot

3 specimen

Application of the blows			
Sketch	**Total number of blows**	**Points of application**	**Parts to be tested**
a)	3	One at the centre One between O and P* One between O and Q*	Front surfaces and rear surfaces of boxes or enclosures classified according to 7.2.1.1
b)	2	One between O and R* One between O and S*	
c)	2	One on the surface T* One on the surface U*	Accessible parts of boxes or enclosures intended to be surface mounted in normal use except front surfaces and rear surfaces of boxes or enclosures classified according to 7.2.1.1
d)	2	One on the surface V* One on the surface Z*	
* The blow is applied to the most unfavourable point.			

Figure 124 – Sequence of blows for parts A, B, C, D, E, F and G

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15.5 Compression test for enclosures made of natural or synthetic rubber or a mixture of both

Boxes and enclosures classified according to 7.1.4 shall withstand a load which can be expected in normal use.

Compliance is checked by the following test:

The enclosure shall be mounted according to the instructions of the manufacturer in a horizontal position in or on a sheet of plywood. Then, the cover of the enclosure and special parts, if any, are loaded as follows (see Figure 25).

a) The cover is loaded with a force of 50 N, applied gradually on an area of 1 cm^2 at the foreseeable point of maximum deflection of the cover.

The enclosure shall support the test load for 1 min without deflecting more than 3 mm. The deflection is to be measured when the force reaches the specified value, excluding any influence resulting from the deflection of the plywood and gasket compression.

The permanent deformation at any point on the cover, excluding the deflection of the plywood and gasket compression, shall not exceed 1 mm, measured 1 h after the load is removed.

b) A pressure of 50 N/cm^2 is gradually applied (up to a maximum force of 1 000 N) by means of a sheet of plywood with a thickness of (9 ± 1) mm, in contact with the whole area of the cover.

The enclosure shall support the test load for 1 min and there shall be no damage to the enclosure.

After the test, the boxes or enclosures shall show no damage leading to non-compliance with this document.

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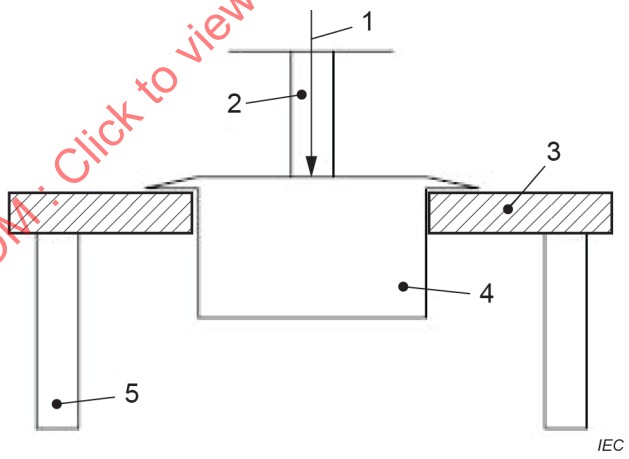


Key

1 test force

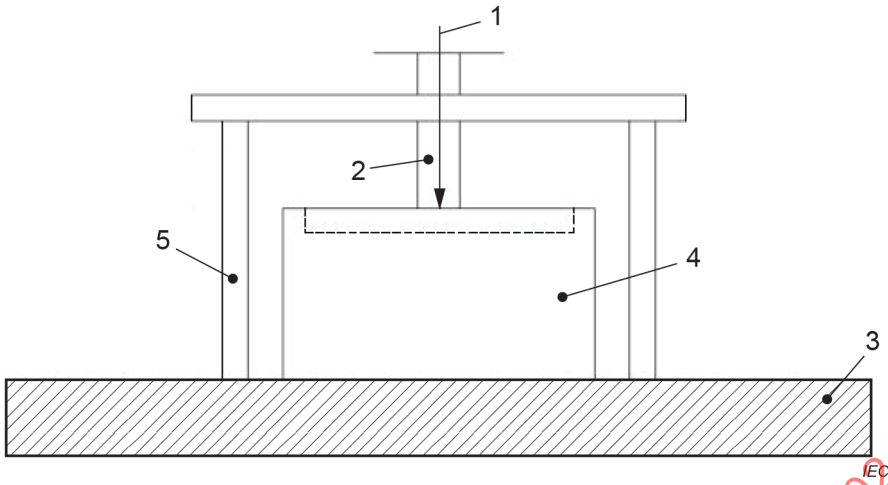
2 cylinder

3 plywood panel

4 boxes made of natural or synthetic rubber or a mixture of both

5 support

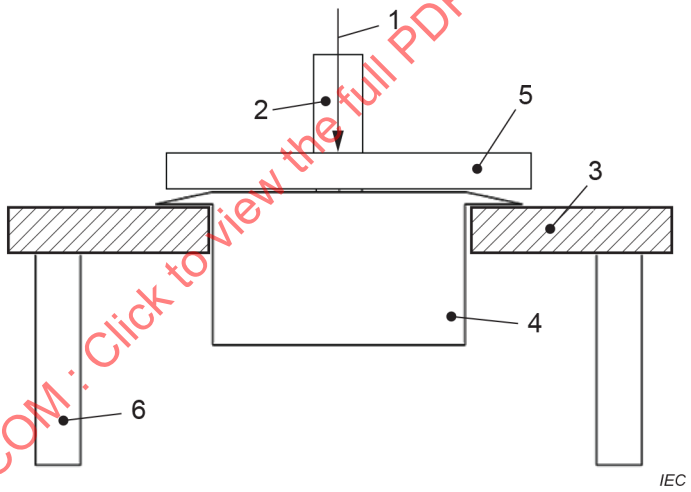
a) For test a (flush-mounted enclosures)



Key

1 test force
2 cylinder
3 solid surface
4 boxes made of natural or synthetic rubber or a mixture of both
5 support

b) For test a (surface-mounted enclosures)



Key

1 test force
2 weight
3 solid surface
4 boxes made of natural or synthetic rubber or a mixture of both
5 plywood (9 ± 1) mm thick
6 support

c) For test b (flush-mounted enclosures)

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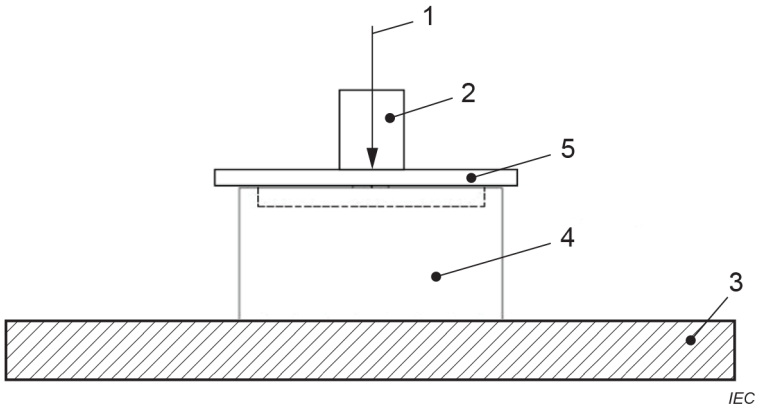

Key

1 test force

2 weight

3 solid surface

4 boxes made of natural or synthetic rubber or a mixture of both

5 plywood (9 ± 1) mm thick

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

d) For test b (surface-mounted enclosures)

Figure 125 – Test devices for load compression test for enclosures made of natural or synthetic rubber or a mixture of both

15.6 Test for boxes and enclosures declared with IK code

When boxes or enclosures are declared with an IK code according to IEC 62262, they are tested according to Annex B of this document.

15.101 Boxes and enclosures with provision for suspension means

15.101.1 Boxes and enclosures with provision for suspension means shall withstand the thermal and mechanical stresses occurring in normal use.

Boxes and enclosures with provision for suspension means according to:

– 7.101.1 shall comply with the requirements of 15.101.2 and 15.101.3;

– 7.101.2 shall comply with the requirements of 15.101.4.

Examples of boxes and enclosures with provision for suspension means are shown in Figure 102.

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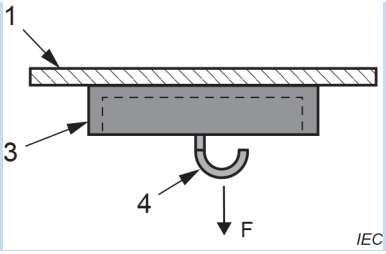
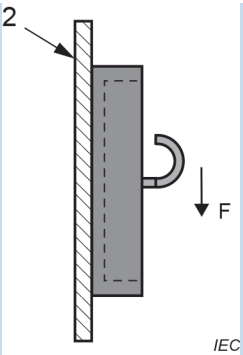
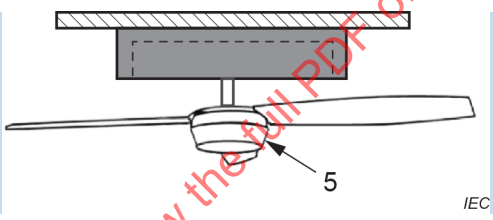


a) Boxes and enclosures which are intended for suspension of loads from a ceiling.



b) Boxes and enclosures which are intended for suspension of loads from a wall



c) Boxes and enclosures which are intended to support a ceiling fan

Key

1 ceiling
2 wall
3 box
4 suspension mean
5 ceiling fan

Figure 126 – Examples of boxes and enclosures with provision for suspension means

15.101.2 Boxes and enclosures which are intended for suspension of loads from a ceiling shall withstand a test force of 250 N or a higher test force X corresponding to five times the maximum supported mass in kilograms declared by the manufacturer.

The test force F in newtons is the result of the maximum supported mass in kilograms multiplied by the gravity and multiplied by a safety factor of 5; this value is rounded up to the next decimal, for example: 5 kg × 9,81 m/s^2 × 5 ≈ 245, gives a test force of 250 N.

NOTE 101 In the following countries there is no requirement for all boxes and enclosures for suspension means to withstand 250 N and no requirement for non-metallic boxes and enclosures to withstand 90° C: UK.

NOTE 102 In the following country, the test force Y shall correspond to 5 times the marking in kilograms as required in item k) of 8.1: DK

NOTE 103 In Spain, there are no requirements for all boxes and enclosures for suspension means to withstand 90 °C.

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Compliance is checked by the following test.

The specimen is fitted with a suspension means and installed as for normal use according to the manufacturer's instructions, any screw being tightened to two-thirds of the torque given in the relevant column of Table 4.

Greater values of torque may be used if so declared by the manufacturer, when the relevant information is provided.

A test force of (250 ± 5) N, or of (X ± 2 %) N, is applied to the suspension means for 24 h at ambient temperature.

For boxes and enclosures according to 7.1.1 and 7.1.3 the test is repeated in a heating cabinet at (90 ± 2) °C for 1 h with a test force of (50 ± 1) N, or a higher test force corresponding to the mass declared by the manufacturer without considering the safety factor.

NOTE 104 In the following country the test of this Subclause 15.101.2 shall be carried out at (80 ± 2) °C instead of (90 ± 2) °C: NL.

During the test, the box and the enclosure or the suspension means shall not become detached and the specimen shall show no damage which leads to non-compliance with this document.

15.101.3 Boxes and enclosures which are intended for suspension of loads from a wall shall withstand a test force of 100 N or a higher test force Y corresponding to two times the maximum supported mass in kilograms declared by the manufacturer.

NOTE In the following countries there is no requirement for all suspension means to withstand 100 N: UK.

Compliance is checked by inspection and by the following test.

The box or the enclosure including covers and cover plates (if any) shall be installed as for normal use according to the manufacturer's instructions and shall be placed in a heating cabinet, any screw being tightened to two-thirds of the torque given in the relevant column of Table 4.

A force, equally distributed between each means if more than one, of (100 ± 2) N or of (Y ± 2 %) N is then applied for 24 h at (40 ± 2) °C downward at a distance not exceeding 5 mm protruding from the plane formed by the mounting surface of the luminaire as shown in Figure 103.

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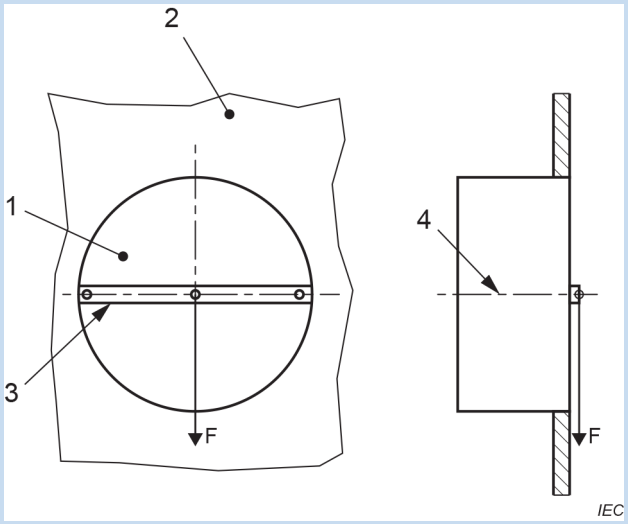

Key

1 test specimen

2 sheet of plywood

3 lever

4 main axis of the box

Figure 127 – Verification of suspension means intended to be used on a wall

During the test, the box or enclosure or the suspension means shall not become detached and the specimen shall show no damage which leads to non-compliance with this document.

15.101.4 Boxes and enclosures which are intended to support a ceiling fan shall withstand the thermal and mechanical stress occurring in normal use.

During the test the box or enclosure or its supporting means shall not be pulled loose from the test structure when subjected to the following tests.

One specimen shall be tested in each of the horizontal and inclined positions.

A specimen shall be mounted in accordance with the manufacturer's instructions to a supporting test structure so as to be tested while both in a horizontal position and inclined 30° from the horizontal with the mounting screws perpendicular to the ceiling and the fan blades parallel to the floor (see Figure 104).

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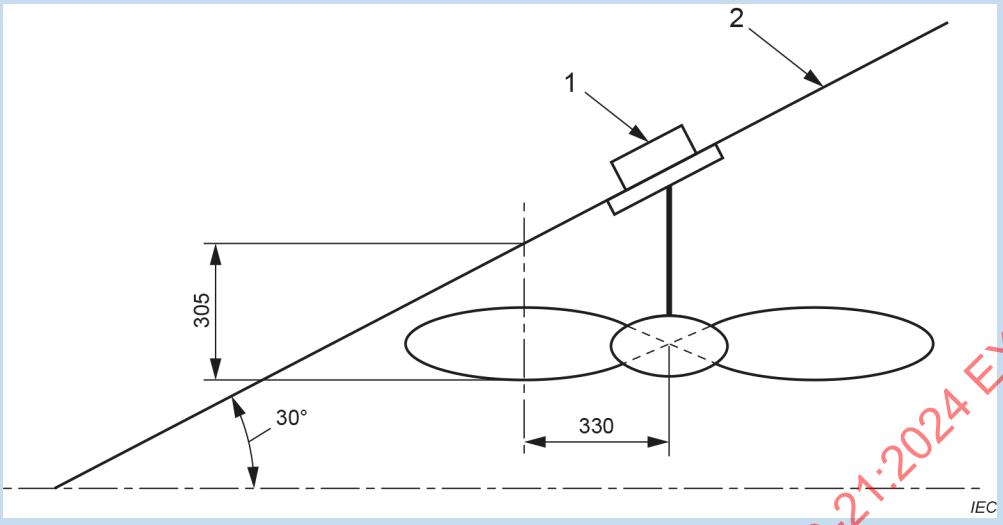
Dimensions in millimetres



Key

1 Box

2 Ceiling

Figure 128 – Inclined ceiling test

A test fan having four blades with a diameter of (1 320 ± 25) mm, weighing or ballasted to a weight of (155 ± 5) N (corresponding to a mass of (15,8 ± 0,5) kg) or the rated load Y declared by the manufacturer, whichever is higher, shall be used for the tests. A 0,392 N (corresponding to a mass of 40 g) imbalance shall be placed at the centre of gravity of one blade, measured independently from the test fan.

The test fan shall be provided with a downrod of rigid metal pipe of a length sufficient to position the lower end of the fan blades (305 ± 25) mm below the surface of the ceiling after mounting. The downrod shall be welded at the upper end to a 7,9 mm thick fan mounting bracket.

The test fan mounting bracket shall be secured to the box or enclosure in accordance with the manufacturer's instructions. Screws or nuts shall be tightened with a torque given in the relevant column in Table 4. A universal type joint mounting construction shall not be used for the test. The fan motor shall be such that the speed can be controlled.

The speed of the test fan shall be adjusted to maintain a blade tip speed of 1 220 m/min (294 r/min).

The blade pitch shall be reduced to a minimum. The fan shall operate continuously at the prescribed speed for $(24\ ^{+1}_{0})$ h.

At the end of the 24 h, one of the cover retaining screws or nuts shall be loosened two full turns and the fan shall operate as specified for an additional 24 h for each mounting condition, horizontal and inclined. This additional test is not required for constructions that employ cover retaining or fan mounting screws with captive, locking type washers or locknuts.

Additionally, there shall be no stripping of threads, cracking, crazing, breaking, or visible damage to the box or enclosure or its supporting means (other than bending).

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16 Resistance to heat

16.1 Parts of insulating material necessary to retain current-carrying parts

Parts of insulating material necessary to retain current-carrying parts and/or parts of the earthing circuit in position are subjected to a ball-pressure test by means of the apparatus according to IEC 60695-10-2 except that insulating parts necessary to retain earthing terminals in position shall be tested as specified in 16.2.

The test is made on one specimen.

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

When it is not possible to carry out the test on the specimen, the test should be carried out on a piece at least 2 mm thick which is cut from the specimen. If this is not possible, no more than four layers, each cut from the same specimen, may be used, in which case the total thickness of the layers should be not less than 2,5 mm.

The part under test shall be placed on a steel plate at least 3 mm thick and in direct contact with it.

The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against the surface with a force of (20 ± 0,5) N.

The test is made in a heating cabinet at a temperature of (+125 ± 2) °C. After (60 $^{+5}_{0}$) min, the ball is removed from the specimen, and the specimen is then cooled down within 10 s to approximately room temperature by immersion in cold water.

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

16.2 Parts of insulating material not necessary to retain current-carrying parts

Parts of insulating material not necessary to retain current-carrying parts and/or parts of the earthing circuit in position, even though they are in contact with them, except for parts made of natural or synthetic rubber or a mixture of both are subjected to a ball pressure test in accordance with 16.1, but the test is carried out at a temperature of (+70 ± 2) °C.

Parts of insulating material of flush-mounted enclosures classified according to 7.2.1.3 are subjected to the test described in 16.1 but at a temperature of (+90 ± 2) °C.

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

16.3 Boxes and enclosures of insulating materials classified according to 7.2.2.2 or 7.2.2.3

16.3.1 Mechanical strength

Boxes and enclosures of insulating material(s) classified according to 7.2.2.2 or 7.2.2.3 shall have adequate mechanical strength at high temperature.

Compliance is checked by the following test.

A specimen of a box of each type and size involved, each having at least two threaded or unthreaded holes shall be tested.

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A rigid crossbar (Figure 26) shall be secured across the face of each box with the size and type of screws normally provided by the box or wiring device manufacturer. The screws shall be secured in the threaded or unthreaded holes located at the face of the box by applying a torque according to the relevant column of Table 4.

A total force of 180 N, including the force exerted by the crossbar and any associated suspension means, shall be applied to the face of the box.

The boxes and enclosures shall be mounted, with the open face downward, in an air-circulating oven for 24 h at the following temperatures:

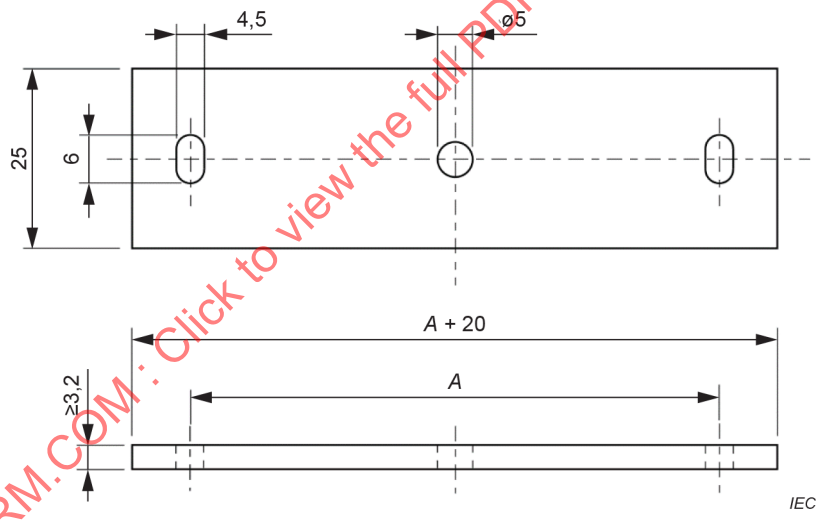
– *(+80 ± 2) °C for boxes and enclosures classified according to 7.2.2.2;*
– *(+105 ± 2) °C for boxes and enclosures classified according to 7.2.2.3.*

The box shall be supported at its open face by a flat plate that does not obstruct the test load support bracket.

After the oven ageing, the assembly shall be allowed to cool down to approximately ambient temperature in the oven, with the power switched off and the door opened.

The screws securing the crossbar to the box shall not have pulled out more than 6,3 mm. The screws shall be able to be removed by a screwdriver using a torque not exceeding 2,3 Nm.

Dimensions in millimetres



Key

A To align with the holes located at the face of the box.

Figure 129 – Rigid crossbar

16.3.2 Parts of insulating material necessary to retain parts of the earthing circuit

Parts of insulating material necessary to retain the earthing strap described in 11.2 shall be subjected to a pull test before and after ageing. After each test, the earthing strap shall not become loose or detached from the specimen.

Compliance is checked by the following tests.

The test shall be conducted on one specimen in the condition as delivered and on one specimen after it has been conditioned in an air-circulating oven for 168 h at 90 °C and then cooled to room temperature.

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The test strap shown in Figure 5 shall be attached to the earthing strap by placing the slotted end under the earthing terminal screw. The threads of the earthing terminal shall not be stripped when the torque shown in the relevant column of Table 4 is applied.

For testing of the conditioned sample the test strap shall be attached prior to the conditioning.

With the specimen secured, a force of 45 N shall be applied to the test strap for 5 min in the direction perpendicular to the open face of the specimen.

The force shall be gradually applied in one smooth and continuous movement. If a tensile machine is used, a jaw separation speed of 10 mm/min shall be applied.

17 Creepage distances, clearances and distances through sealing compound

Void.

18 Resistance of insulating material to abnormal heat and fire

Parts of insulating material which might be exposed to thermal stresses due to electric effects, the deterioration of which might impair 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 Clause 4 to Clause 10 of IEC 60695-2-11:2021, under the following conditions.

– *By the test made at 850 °C:*
  - *for parts of insulating material necessary to retain current-carrying parts and/or parts of the earthing circuit in position (with the exception of parts of insulating material needed to retain the earth terminal in position in a box), and*
  - *for parts of insulating material of boxes and enclosures classified according to 7.2.2, with the exception of parts protruding from the wall and internal parts (e.g. separators) not necessary to retain current carrying parts in position.*
– *By the test made at 650 °C:*
  - *for parts of insulating material not necessary to retain current-carrying parts in position (even though they are in contact with them), and*
  - *for parts of insulating material retaining earthing terminal in position;*
  - *for parts of insulating material of boxes and enclosures classified according to 7.2.2, protruding from the wall and internal parts (e.g. separators) not necessary to retain current carrying parts in position.*

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

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

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

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

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Small parts, where each surface lies completely within a circle 15 mm in diameter, or where any part of the surface lies outside a 15 mm diameter circle and where it is not possible to fit a circle 8 mm in diameter on any of the surfaces, are not subjected to the test of this Clause 18 (see Figure 27 for a diagrammatic representation).

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

The tests are not made on parts of ceramic material.

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 spreading 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 specimen should be a complete box or enclosure.

If the test cannot be made on a complete box or enclosure, a suitable part of it may be cut out 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 test is made by applying the glow wire once for (30 ± 1) s.

The specimen shall be positioned during the test in the most unfavourable position of its intended use (with the surface tested in a vertical position).

The tip of the glow wire shall be applied to the specified surface of the specimen taking into account the conditions of the intended use under which a heated or glowing element may come into contact with the specimen.

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

- *there is no visible flame and no sustained glowing, or if*
- *flames and glowing at the specimen extinguish within 30 s after the removal of the glow wire.*

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

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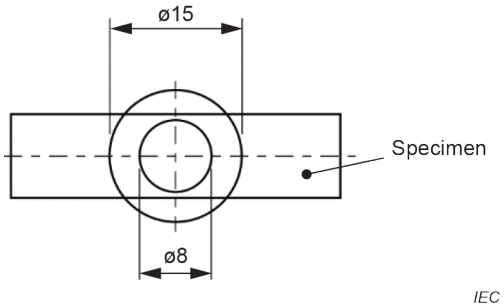
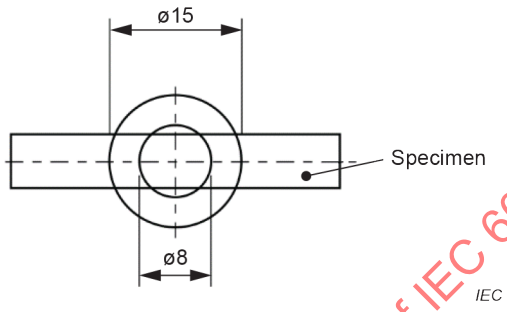
Dimensions in millimetres



a) To be tested



b) No test is required

Figure 130 – Diagrammatic representation of the glow-wire test

19 Resistance to tracking

For boxes and enclosures with protection degree higher than IPX0, all parts of the insulating material retaining live parts in position shall be made of a material resistant to tracking.

For materials other than ceramic and where the creepage distances are less than twice the values specified in Clause 17, compliance is checked by the test of IEC 60112 on three specimens.

A flat surface of the part to be tested, if possible, at least 15 mm × 15 mm and at least 3 mm thick, is placed in the horizontal position.

The material under test shall pass a proof-tracking index of 175 using test solution A with a time interval between drops of (30 ± 5) s.

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

Alternatively, the CTI value for the material may be used. The CTI value shall not be less than 175.

20 Resistance to corrosion

Ferrous parts of boxes and enclosures shall be adequately protected against rusting.

The test can be made on representative parts of the box or enclosure.

Compliance is checked by the following test.

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All grease is removed from the parts to be tested by immersion in a degreasing agent for (10 ± 1) min.

The parts are then immersed for (10 ± 1) min in a 10 % solution of ammonium chloride in water at a temperature of (20 ± 5) °C.

Without drying, but after shaking off any drops, the parts are placed for (10 ± 1) min in a box containing air saturated with moisture to a level of 91 % to 95 % at a temperature of (20 ± 5) °C.

After the parts have been dried for (10 ± 1) min in a heating cabinet at a temperature of (100 ± 5) °C, their surface shall show no sign of rust.

Traces of rust on cut edges and any yellowish film removable by rubbing are ignored. Cut edges also include punched holes and thread surfaces of tapped holes.

21 Electromagnetic compatibility (EMC)

Products covered by this document are, in normal use, passive in respect to electromagnetic influences (emission and immunity).

Therefore, no tests are necessary.

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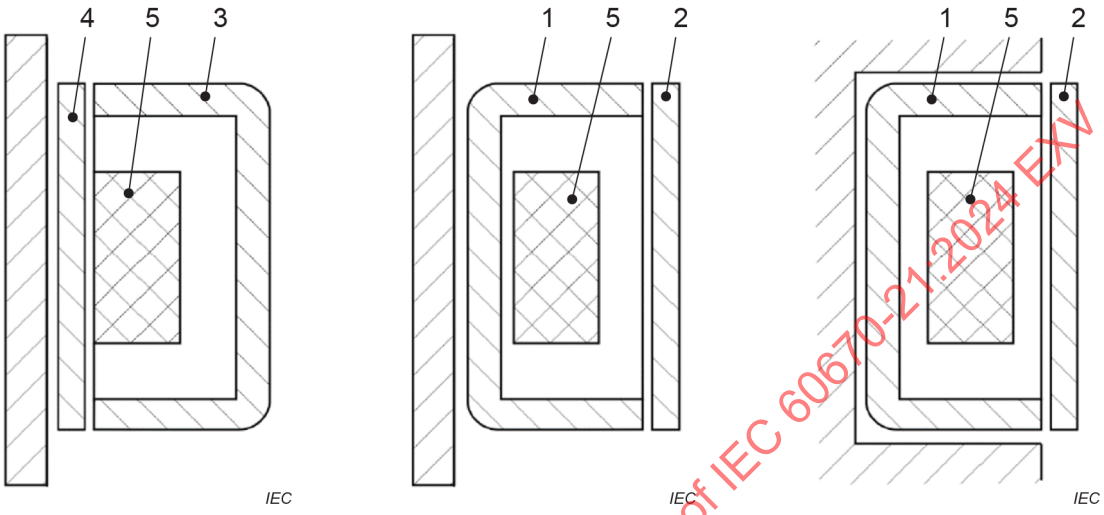
Annex A
(informative)

Examples of enclosures and parts thereof

Figure A.1 shows examples of enclosures and parts thereof.



a) Backplate and cover (only surface-type) **b) Box and cover-plate (surface-type)** **c) Box and cover-plate (flush-type)**

Key

1 box
2 cover-plate
3 cover
4 backplate
5 accessory

Figure A.1 – Examples of enclosures and parts thereof

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Annex B
(normative)

Test for boxes and enclosures declared with IK code

Boxes and enclosures declared with an IK code shall comply with the test and requirements of this Annex B.

Compliance is checked by the following test.

Specimens shall be tested according to IEC 62262 by means of a test hammer apparatus described in IEC 60068-2-75, suitable for the dimension of the enclosure, using impact energy related to the protection code as stated in IEC 62262:2002/AMD1:2021, Table 1.

The test is performed on a new set of specimens.

The box or enclosure shall be installed on a rigid support of sufficient dimension and arranged as in normal use.

The test shall be carried out under the conditions indicated in 5.1 of this document.

Three blows shall be applied on each surface accessible in normal use.

After the test, visual inspection shall verify that the specified IP code and dielectric properties have been maintained.

Removable covers shall still be removable and reinstallable, lids or doors shall still be openable and closable.

Damage to the finish, small dents and small chips which do not adversely affect the protection against electric shock or harmful ingress of water are disregarded.

Cracks passing through the material not visible with normal or corrected vision without magnification, surface cracks in fibre-reinforced mouldings and small indentations are disregarded.

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Bibliography

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IEC 60670-22, *Boxes and enclosures for electrical accessories for household and similar fixed electrical installations – Part 22: Particular requirements for connecting boxes and enclosures*

IEC 60670-23, *Boxes and enclosures for electrical accessories for household and similar fixed electrical installations – Part 23: Particular requirements for floor boxes and enclosures*

IEC 60670-24, *Boxes and enclosures for electrical accessories for household and similar fixed electrical installations – Part 24: Particular requirements for enclosures for housing protective devices and other power dissipating electrical equipment*

IEC 61084 (all parts), *Cable trunking systems and cable ducting systems for electrical installations*

IEC 62444, *Cable glands for electrical installations*

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INTERNATIONAL STANDARD

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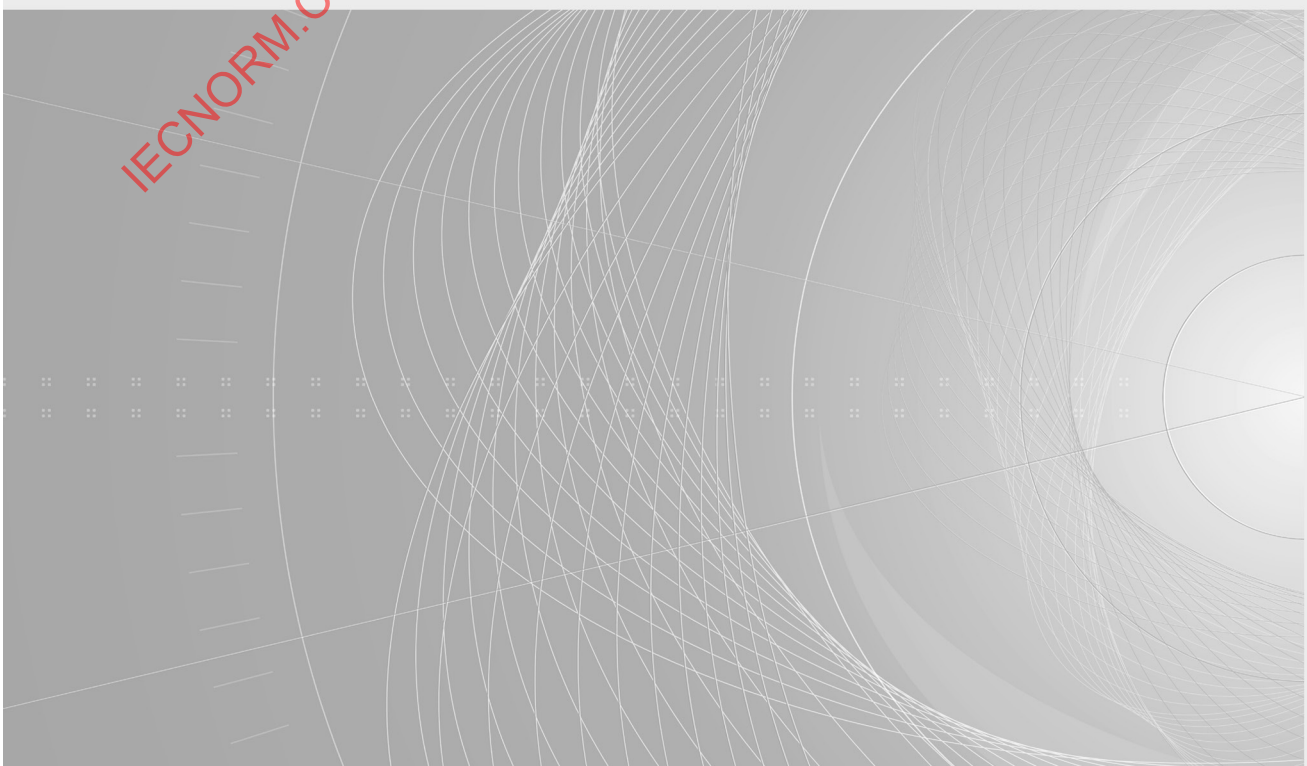
Boxes and enclosures for electrical accessories for household and similar fixed electrical installations –
Part 21: Particular requirements for boxes and enclosures with provision for suspension means

Boîtes et enveloppes pour appareillage électrique pour installations électriques fixes pour usages domestiques et analogues –
Partie 21: Règles particulières concernant les boîtes et enveloppes avec dispositifs de suspension



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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BOXES AND ENCLOSURES FOR ELECTRICAL ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

Part 21: Particular requirements for boxes and enclosures with provision for suspension means

FOREWORD

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IEC 60670-21 has been prepared by subcommittee 23B: Plugs, socket-outlets and switches, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This second edition cancels and replaces the first edition published in 2004 and Amendment 1:2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Complete revision of the tests and requirements of the suspension means.

The text of this International Standard is based on the following documents:

Draft	Report on voting
23B/1534/FDIS	23B/1552/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60670 series, published under the general title *Boxes and enclosures for electrical accessories for household and similar fixed installations*, can be found on the IEC website.

This document is to be used in conjunction with IEC 60670-1:2024. It lists the changes necessary to convert that standard into a specific standard for housing protective devices and other power dissipating electrical equipment.

Where this document states "addition", "modification" or "replacement", the relevant requirement, test specifications or explanatory matter in IEC 60670-1:2024 shall be adapted accordingly.

Clauses and subclauses, notes, figures or tables which are additional to those in IEC 60670-1:2024 are numbered starting from 101.

Additional annexes to IEC 60670-1:2024 are numbered AA, BB, etc.

In this publication the following print types are used:

- requirements proper: in roman type.
- *test specifications: in italic type.*
- notes: in smaller roman type.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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BOXES AND ENCLOSURES FOR ELECTRICAL ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

Part 21: Particular requirements for boxes and enclosures with provision for suspension means

1 Scope

Clause 1 of IEC 60670-1:2024 is applicable with the following modification:

Addition after the third paragraph:

This document applies to boxes and enclosures for ceiling and wall mounting with provision for suspension means.

2 Normative references

Clause 2 of IEC 60670-1:2024 is applicable.

3 Terms and definitions

Clause 3 of IEC 60670-1:2024 is applicable with the following modification:

Addition:

3.101
box with provision for suspension means
box intended to be used for suspending and supporting mechanical loads and which accepts the suspension means

3.102
suspension means
means comprising any necessary components (hooks, brackets, etc.) which may be delivered with the box and enclosure or supplied separately

Note 1 to entry: Examples of suspension means are shown in Figure 101.

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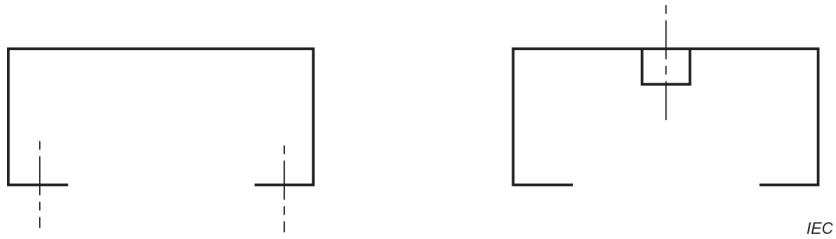
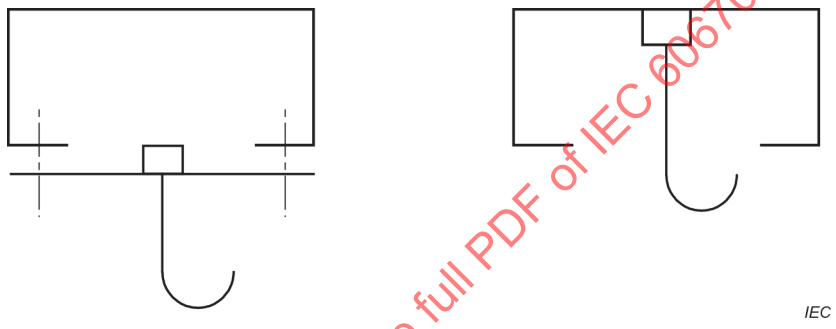


a) Box provided with provision for suspension means

b) Suspension means



c) Box and enclosure delivered with suspension means

Figure 101 – Examples of suspension means

4 General requirements

Clause 4 of IEC 60670-1:2024 is applicable.

5 General remarks on tests

Clause 5 of IEC 60670-1:2024 is applicable.

6 Ratings

Void.

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7 Classification

Clause 7 of IEC 60670-1:2024 is applicable with the following modification:

Addition to Table 1:

7.101 The provision for suspension means[b]	7.101.1 For supporting a luminaire.
	7.101.2 For supporting a ceiling fan.
[b] The suspension means may be provided with the box or not.	

8 Marking

Clause 8 of IEC 60670-1:2024 is applicable with the following modification:

8.1 General

Addition after item k):

l) for boxes and enclosures classified according to 7.101.1, the maximum supported mass in kilograms declared by the manufacturer.

NOTE 101 In the following countries boxes for luminaire support are marked "For luminaire support". Where boxes are intended to support a mass greater than 15,8 kg, the mass is to be marked: US.

NOTE 102 In the following country the marking in kilograms shall reflect a safety factor of 5 times: DK.

9 Dimensions

Clause 9 of IEC 60670-1:2024 is applicable.

10 Protection against electric shock

Clause 10 of IEC 60670-1:2024 is applicable with the following modification:

Addition:

Conductive parts of suspension means inside the box or enclosure shall be:

– protected by a layer of insulating material which complies with the tests for insulating linings, or
– located such that it will not come in contact with electrical conductors or live parts, or
– reliably connected to the earthing means complying with requirements of 11.1 when fitted as for normal use.

11 Provision for earthing

Clause 11 of IEC 60670-1:2024 is applicable.

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