

Australian/New Zealand Standard™

**Boxes and enclosures for electrical
accessories for household and similar
fixed electrical installations**

Part 1: General requirements



AS/NZS IEC 60670.1:2012

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Australian/New Zealand Standard™

Boxes and enclosures for electrical accessories for household and similar fixed electrical installations

Part 1: General requirements

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-004, Electrical Accessories.

The objective of this Standard is to provide the Australian and New Zealand electrical industry, including manufacturers, regulators, test laboratories and certification bodies, with requirements for boxes, enclosures and parts of enclosures for electrical accessories with a rated voltage not exceeding 1 000 V a.c. and 1 500 V d.c., intended for household or similar fixed electrical installations, either indoors or outdoors.

The essential safety requirements in AS/NZS 3820, *Essential safety requirements for electrical equipment*, that could be applicable to boxes and enclosures for electrical accessories for household and similar fixed electrical installations are covered by this Standard, taken in conjunction with any other relevant requirements affecting safety.

This Standard is identical with, and has been reproduced from, IEC 60670-1, Ed. 1.1 (2002), *Boxes and enclosures for electrical accessories for household and similar fixed electrical installations—Part 1: General requirements*, which incorporates Amendment 1 (2011). Marginal bars and strikeout are used to indicate amendments.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number appears on the cover and title page while the International Standard number appears only on the cover.
- (b) In the source text ‘this part of IEC 60670’ should read ‘this Australian/New Zealand Standard’.
- (c) A full point substitutes for a comma when referring to a decimal marker.

Only international references that have been adopted as Australian or Australian/New Zealand Standards have been listed.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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AUSTRALIAN/NEW ZEALAND STANDARD

Boxes and enclosures for electrical accessories for household and similar fixed electrical installations**Part 1:
General requirements****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 a.c. and 1 500 V d.c. intended for household or similar fixed electrical installations, either indoors or outdoors.

NOTE Requirements for particular types of boxes and enclosures are given in the relevant parts 2 of IEC 60670.

Boxes and enclosures complying with this standard are suitable for use at ambient temperature not normally exceeding 25 °C but occasionally reaching 35 °C.

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

NOTE This standard may also be used as a reference document for other IEC technical committees and subcommittees.

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 standard 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 referenced documents are indispensable for the application 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 60068-2-75:1997, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60112:1979, *Method for determining the comparative and the proof-tracking indices of solid insulating materials under moist conditions*

IEC 60423:1993, *Conduits for electrical purposes – 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 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products*

IEC 60695-10-2:1995, *Fire hazard testing – Part 10-2: Guidance and test methods for the minimization of the effects of abnormal heat on electrotechnical products involved in fires – Method for testing products made from non-metallic materials for resistance to heat using the ball pressure test*

IEC 60981:1989, *Extra-heavy duty rigid steel conduits for electrical installations*

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

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

IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*

IEC 62444:2010, *Cable glands for electrical installations*

3 Definitions

For the purposes of this part of IEC 60670, the following definitions apply.

3.1

enclosure

combination of parts, such as boxes, 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 (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.)

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

lid, cover or 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

3.5

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 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.

3.6

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

3.7

surface mounting box or enclosure

box or enclosure which is intended for mounting on a surface (see Annex A)

3.8**flush-mounting box or enclosure**

box or enclosure which is intended for mounting flush with the surface (see Annex A)

3.9**semi-flush mounting box or enclosure**

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

3.10**cable gland**

~~device designed to permit the entry of a cable into an enclosure and which provides sealing and retention. It may also provide other functions such as earthing, bonding, insulation, cable guarding, strain relief or a combination of these~~

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

3.11**seal (packing)**

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

3.12**gasket**

material introduced between mating surfaces of an enclosure which in compression forms a joint

3.13**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 (see Figure 1)

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

3.15**protecting 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 (see Figure 1).

3.16**composite material**

combination of metal and insulating material

3.17**spout (hub)**

open entry of a box permitting the insertion and containment of a conduit

3.18**cable retention**

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

3.19**cable anchorage**

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

3.20**blanking-plug**

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

4 General requirements

Each part of the enclosure shall be so designed and constructed that, when mounted and installed as for normal use, the enclosure ensures adequate electrical and mechanical protection to the parts so enclosed and minimizes the risk of danger to the user or surroundings.

Compliance is checked by carrying out the relevant tests specified.

5 General notes on tests**5.1** Tests according to this standard are type tests.

Unless otherwise specified boxes and enclosures are tested as delivered.

Accessories complying with other standards are not tested.

Tests on boxes and enclosures of insulating material shall be performed after a preconditioning of at least 10 days at ambient temperature and relative air humidity of between 45 % and 85 %.

Unless otherwise specified the tests shall be carried out in the order of the clauses at an ambient temperature of $(20 \pm 5) ^\circ\text{C}$ on a set of three new specimens.

5.2 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 made 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 may also submit the additional set of specimens which may be necessary, should one specimen fail. 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.

6 Ratings

See relevant parts 2 of this standard.

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	
7.2 The method of installation ^a	7.2.1 Flush, semi-flush or embedded in	7.2.1.1 Non-combustible walls, non-combustible ceilings or non-combustible floors
		7.2.1.2 Combustible walls, combustible ceilings or combustible floors
		7.2.1.3 Hollow walls, hollow ceilings, hollow floors or furniture
	7.2.2 Surface mounting on	7.2.2.1 Non-combustible walls, non-combustible ceilings, non-combustible floors or non-combustible furniture
		7.2.2.2 Combustible walls, combustible ceilings, combustible floors or combustible furniture
	7.2.3 Placement	7.2.3.1 Suitable for installation into concrete during the casting process (see 7.6)
		7.2.3.2 Suitable for all types of installation except into concrete
7.3 The type(s) of inlets (outlets) ^b	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 (hub)	
	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 and maximum temperatures during installation	7.5.1 –5 °C to +60 °C	
	7.5.2 –15 °C to +60 °C	
	7.5.3 –25 °C to +60 °C	
7.6 The maximum temperature during the casting process ^c	7.6.1 +60 °C	
	7.6.2 +90 °C ^d	

Table 1 (continued)

Classification criteria		
7.7 Boxes and enclosures for hollow walls and the like according to 7.2.1.3 are classified as	7.7.1 Class Ha	
	7.7.2 Class Hb	7.7.2.1 Class Hb for walls
		7.7.2.2 Class Hb for ceilings
	7.7.3 According to the degree of protection of the part mounted in the hollow wall	7.7.3.1 IP2X
		7.7.3.2 >IP2X
7.8 The provision for fixing accessories to boxes	7.8.1 Boxes supplied with screws	
	7.8.2 Boxes intended to receive screws	
	7.8.3 Boxes intended to receive claws	
	7.8.4 Boxes intended to receive other means	
^a Boxes and enclosures may be suitable for more than one method of installation. ^b Boxes and enclosures may have more than one type of inlet. ^c These apply only to boxes and enclosures classified according to 7.2.3.1. ^d These types are for use in concrete and will temporarily withstand temperatures up to +90 °C during the casting process.		

8 Marking

8.1 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 IP code against ingress of solid objects if higher than IP2X in which case the second IP numeral shall also be marked;
- c) the IP code against harmful ingress of water if higher than IPX0 in which case the first IP numeral shall also be marked.
- d) the following marking $\begin{matrix} \text{IPXX} \\ \wedge \wedge \wedge \end{matrix}$ on cover of flush enclosures intended to be mounted on rough surfaces and where the IP is dependent on the surface (see Figure 5).

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

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 of the manufacturer:

- f) the maximum temperature during the building process if 90 °C;
- g) 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;
- h) the minimum temperature during installation for boxes classified according to 7.5.2 and 7.5.3;

- i) for boxes and enclosures classified as in 7.7.2, the minimum internal volume in cm³ as determined by the test in 12.15 2-5. 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;
- j) the symbol Ha for boxes classified according to 7.7.1 and the symbol Hb for boxes classified according to 7.7.2.

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

In special cases, in order to achieve a higher degree of protection by the use of special parts an instruction sheet 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 The marking on the boxes and enclosures shall be durable and easily legible.

Compliance with 8.1 and 8.2 is checked by inspection and by the following test.

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

NOTE 1 Marking made by ~~impression~~, moulding, pressing or engraving is considered durable and is therefore not subjected to this test.

NOTE 2 It is recommended that the petroleum spirit used consist of a solvent hexane with an aromatic content of maximum 0,1 % by volume, a kauributanol value of approximately 29, an initial boiling-point of approximately 65 °C, a dry point of approximately 69 °C and a density of approximately 0,68 g/cm³.

After the test the marking shall still be legible.

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 manufacturer's instructions, the live parts are not accessible.~~

~~Enclosures shall have a degree of protection of at least IPXXB, when assembled, equipped and installed as for normal use.~~

~~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 manufacturer's instructions.~~

~~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 enter that part of the enclosure where live parts are to be installed according to the manufacturer's instructions.~~

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

~~In addition, all enclosures according to 7.1.1 and 7.1.3 with parts of thermoplastic or elastomeric material shall be subjected for 1 min to a force applied through the tip of test probe 11 of IEC 61032 but at an ambient temperature of $(35 \pm 2)^\circ\text{C}$, the enclosure being at this temperature.~~

~~The probe is applied to~~

- ~~— all places except membranes or the like, where yielding of insulating material could impair the safety, with a force of 75 N;~~
- ~~— knock-outs with a force of 10 N.~~

Boxes and enclosures shall be so designed that, when they are assembled, equipped and installed as for normal use in accordance with the manufacturer's 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 manufacturer's instructions.

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 in the internal volume of the enclosure, as shown in Figure 26.

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

~~In addition, all enclosures according to 7.1.1 and 7.1.3 with parts made of thermoplastic or elastomeric material shall be subjected for 1 min to a force applied through the tip of test probe 11 of IEC 61032 but at an ambient temperature of $(35 \pm 2)^\circ\text{C}$, the enclosure being at this temperature.~~

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

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 inspection and the following test.~~

~~A current derived from an a.c. 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 calculated from the current and this voltage drop.~~

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

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

~~NOTE 2 In insulating boxes and enclosures having an IP > X0, provisions can be made for the addition of means for the effective continuity of the earthing conductor, when more than one inlet is provided.~~

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 coverplates, etc. isolated from live parts, are not considered as exposed conductive parts.

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.

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 a.c. 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 calculated from the current and this voltage drop.

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

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

NOTE 2 In insulating boxes and enclosures 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.

11.2 Boxes and enclosures of insulating material classified according to 7.7.2

~~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 mm². 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 2).~~

~~Compliance is checked by the following test.~~

~~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.~~

~~The test strap shown in Figure 3 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 applied without jerks. If a tensile machine is used, a jaw separation speed of 10mm/min shall be applied.~~

~~After each test the test strap shall not have become loose or detached from the specimen.~~

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 mm². 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 2).

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 made 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 made, 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 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 applies to other screws which are tightened by means of a screwdriver.

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

Column IV 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 not be tightened in jerks.

12 Construction

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.

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

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

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.

NOTE 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.

12.1.1 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.

12.1.2 Non-screw-type fixing operable without 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 applying a force according to Table 2 in a direction approximately perpendicular to the mounting/supporting surface,

- *when their removal may give access, with test probe A of IEC 61032, to live parts;*
- *when their removal may give access, with test probe A of IEC 61032, to non-earthed conductive parts separated from live parts by basic insulation;*
- *when their removal may give access, with test probe A of IEC 61032, only 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 a.c. or 60 V d.c.*

Compliance is checked by the tests of 12.1.2.1 and 12.1.2.2.

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

Accessibility with the test finger after removal of lids, covers or cover-plates or parts of them	Force to be applied N			
	Enclosures complying with 12.1.2.3 and 12.1.2.4		Enclosures not complying with 12.1.2.3 and 12.1.2.4	
	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.	40	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 ≤ 25 V a.c. or 60 V d.c.	40	120	40	120

Accessibility with the test finger after removal of lids, covers or cover-plates or parts of them	Force to be applied N			
	Enclosures complying with 12.1.2.3 and 12.1.2.4		Enclosures not complying with 12.1.2.3 and 12.1.2.4	
	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 ≤ 25 V a.c. or 60 V d.c.	10	120	10	120
* These columns do not apply for 12.1.3.				

When testing the force necessary for lids, covers or cover-plates to come off or not come off, the 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.

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

Forces are gradually applied without jerks 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.

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 ($1 \pm 0,1$) mm thick, has been fitted on the wall around the supporting frame, as shown in Figure 12.

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

12.1.2.2 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 without jerks, 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 being fitted, after a sheet of hard material ($1 \pm 0,1$) mm thick, has been fitted on the wall around the supporting frame, as shown in Figure 12.

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

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

The gauge shown in Figure 13 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 14. 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.

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 12.1.2.4) when measurements are repeated starting from point X in the direction of the arrow Y (see Figure 15).

12.1.2.4 Verification of grooves, holes and reverse tapers

A gauge according to Figure 16, applied with a force of ($1 \pm 0,2$) 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 17.

NOTE The verification whether the gauge according to Figure 17 has entered more than 1,0 mm is made with reference to a surface perpendicular to face B and including the upper part of the outline of the grooves, holes, reverse tapers or the like.

12.1.3 ~~Other fixings~~ 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 manufacturer's instructions, compliance is checked by the same tests of 12.1.2 except that the lids, covers or cover-plates, or parts of them shall not come off when applying a force not exceeding 120 N in directions perpendicular to the mounting/supporting surface.~~

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 manufacturer's instructions

compliance is checked by the same tests of 12.1.2 except that the lids, covers or coverplates, or parts of them need not come off when applying a force not exceeding 120 N in directions perpendicular to the mounting/supporting surface.

12.2 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 mm² in area with a minimum width or length of 3 mm.

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

NOTE A drain hole in the back of the enclosure is deemed to be effective if the design of the enclosure ensures a clearance of at least 5 mm from the wall or provides a drainage channel of at least the size specified.

Compliance is checked by inspection and measurement.

12.3 Mounting of enclosures

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

~~Enclosures of insulating material shall be constructed in such a way that any conductive parts of an internal fixing means 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 at least 10 % of the maximum width of the cavity for the fixing means.~~

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.

12.4 Boxes and enclosures with inlets for flexible cables

~~Inlets (outlets) 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.~~

Inlets (outlets) 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 will not damage the flexible cable where it enters the box or enclosure impairing its further use.

Compliance is checked by manual test.

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

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

- a conduit or suitable fitting ~~terminating connecting it at~~ 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 are 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 and/or IEC 60981.

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

NOTE 1 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 2 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, SE.

12.6 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 it 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 11.

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 5.

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 3 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 mm	Force N	Torque 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 (strain relief) shall not show any damage which leads to non-compliance with this standard.

12.7 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 $(-15 \pm 2) ^\circ\text{C}$ and $(-25 \pm 2) ^\circ\text{C}$ respectively.

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 manufacturer's instructions.

The cable is loaded with an axial force of $(20 \pm 1) \text{ N}$.

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.

12.8 Knock-outs ~~inlets (outlets)~~ intended to be removed by mechanical impact

~~It shall be possible to remove knock-out inlets (outlets) intended to be removed by mechanical impact without damaging the box.~~

~~For knock-out inlets (outlets) for cables, chips or burrs are not accepted.~~

~~For knock-out inlets (outlets) for conduits and/or for use with a grommet or a membrane, chips and burrs are disregarded.~~

~~Compliance is checked by inspection and by the tests as specified in 12.8.1 and 12.8.2.~~

~~12.8.1 Knock-out retention~~

~~For boxes and enclosures having knock-outs accessible after installation, a force of $(30 \pm 1) \text{ N}$ shall be applied to a knock-out for $(15 \pm 1) \text{ s}$ 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.~~

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

~~12.8.2 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 box or enclosure which has been conditioned for $5 \text{ h} \pm 10 \text{ min}$ in air maintained at the minimum temperature during installation as specified according to 7.5. Immediately following this conditioning, the knock-out is to be removed as above.~~

~~For a box and an 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-out inlets (outlets) for conduits and/or for use with a grommet or a membrane, and the box and enclosure shall not be damaged.~~

12.8.1 General

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

For knock-outs for cables, chips or burrs are not accepted.

For knock-outs for conduits and/or for use with 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 assembles by threading into a threaded inlet.

Compliance is checked by inspection and by the tests as specified in 12.8.2 and 12.8.3.

12.8.2 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.

12.8.3 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 $5 \text{ h} \pm 10 \text{ min}$ in air maintained at the minimum temperature during installation as specified according to 7.5. Immediately following this conditioning, the knock-out is to be removed as above.

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.