

Empty enclosures for low-voltage switchgear and controlgear assemblies — General requirements

The European Standard EN 62208:2003 has the status of a
British Standard

ICS 29.130.20

National foreword

This British Standard is the official English language version of EN 62208:2003. It is identical with IEC 62208:2002. It supersedes BS EN 50298:1999 which will be withdrawn on 1 February 2005.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear controlgear and HV-LV co-ordination, to Subcommittee PEL/17/3, Low voltage switchgear and controlgear assemblies, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

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English version

**Empty enclosures for low-voltage switchgear and controlgear assemblies –
General requirements
(IEC 62208:2002)**

Enveloppes vides destinées aux ensembles
d'appareillage à basse tension –
Règles générales
(CEI 62208:2002)

Leergehäuse für Niederspannungs-
Schaltgerätekombinationen –
Allgemeine Anforderungen
(IEC 62208:2002)

This European Standard was approved by CENELEC on 2003-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 62208:2002, prepared by SC 17D, Low-voltage switchgear and controlgear assemblies, of IEC TC 17, Switchgear and controlgear, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 62208 on 2003-12-01 without any modification.

This European Standard supersedes EN 50298:1998.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2004-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-12-01

Annexes designated "normative" are part of the body of the standard.

In this standard, Annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62208:2002 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- | | | |
|---------------|------|---|
| IEC 60417 | NOTE | Harmonized in EN 60417 series (not modified). |
| IEC 61000-5-7 | NOTE | Harmonized as EN 61000-5-7:2001 (not modified). |

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EMPTY ENCLOSURES FOR LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES – GENERAL REQUIREMENTS

1 Scope

This International Standard applies to empty enclosures, prior to the incorporation of switchgear and controlgear components by the user, as supplied by the enclosure manufacturer.

This standard specifies definitions, classifications, characteristics and test requirements of enclosures to be used as part of switchgear and controlgear assemblies in accordance with the IEC 60439 series, the rated voltage of which does not exceed 1 000 V a.c. at frequencies not exceeding 1 000 Hz, or 1 500 V d.c. and suitable for general use for either indoor or outdoor applications.

This standard does not apply to enclosures, which are covered by other specific products standards (e.g. IEC 60670).

Compliance with the safety requirements of the applicable product standard is the responsibility of the final assembly manufacturer.

NOTE This standard may serve as a basis for other technical committees.

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 60068-2-2:1974, *Basic environmental testing procedures – Part 2: Tests – Tests B: Dry heat*
Amendment 2 (1994)

IEC 60068-2-11:1981, *Basic environmental testing procedures – Part 2: Tests – Test Ka: Salt mist*

IEC 60068-2-30:1980, *Basic environmental testing procedures – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)*
Amendment 1 (1985)

IEC 60068-2-75:1997, *Environmental testing – Part 2: Tests – Test Eh: Hammer tests*

IEC 60439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 60439-1:1999, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*

IEC 60439-5:1996, *Low-voltage switchgear and controlgear assemblies – Part 5: Particular requirements for assemblies intended to be installed outdoors in public places – Cable distribution cabinets (CDCs) for power distribution in networks*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*

IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

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

IEC 60890:1987, *A method of temperature-rise assessment by extrapolation for partially type-tested assemblies (PTTA) of low-voltage switchgear and controlgear*
Amendment 1 (1995)

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

ISO 178:2001, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact strength*

ISO 2409:1992, *Paints and varnishes – Cross-cut test*

ISO 4628-3:1982, *Paints and varnishes – Evaluation of degradation of paint coatings – Designation of intensity, quantity and size of common types of defect – Part 3: Designation of degree of rusting*

ISO 4892-2:1994, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc sources*

ISO 11469:2000, *Plastics – Generic identification and marking of plastic products*

3 Terms and definitions

For the purposes of this International Standard, the following definitions apply.

3.1

empty enclosure

enclosure intended for support and installation of electrical equipment, whose internal space provides suitable protection against external influences as well as a specified degree of protection against approach to or contact with live parts and against contact with moving parts

NOTE Throughout this standard, the word enclosure is used for empty enclosure.

3.2

protected space

internal space or portion of the internal space of the enclosure as specified by the manufacturer intended for the mounting of switchgear and controlgear for which the specified protection is provided by the enclosure

3.3

cover

external part of the enclosure

3.4

door

hinged or sliding cover

3.5

mounting plate

separate internal accessory of the enclosure intended for the mounting of electrical components

3.6

cable gland plate

removable accessory of the enclosure, intended for securing and sealing of cables, conductors and conduits at their point of entry

3.7

removable cover

cover which is designed for closing an opening in the external enclosure and which can be removed for carrying out certain operations and maintenance work.

NOTE A lid is considered as a removable cover.

3.8

enclosure manufacturer

manufacturer of an enclosure or the vendor who resells under his own responsibility

3.9

box

enclosure, generally of small dimensions and, in principle, intended to be mounted on a vertical plane

3.10

cubicle

empty enclosure, generally of large dimensions, and in principle of the floor standing type, which may comprise several sections, sub-sections or compartments

NOTE Enclosures with an irregular shape, such as a desk, are considered cubicles for testing purposes.

4 Classification

Enclosures are classified according to

a) the type of material:

- insulating
- metallic
- combination of insulating and metallic

b) method of fixing:

- floor standing
- wall mounting
- flush mounting
- pole mounting

c) the intended location:

- outdoor
- indoor

d) the degree of protection:

- IP code, according to IEC 60529
- IK code, according to IEC 62262

e) rated insulation voltage (for enclosures made of insulating materials)

5 EMC requirements

EMC requirements are not applicable for enclosures to this standard. For degrees of protection provided by enclosures against electromagnetic disturbances (EM code) see IEC 61000-5-7.

6 Information to be given regarding the enclosure

The following information shall be given by the manufacturer.

6.1 Marking

The enclosure shall be identifiable, making it possible for the final assembler to obtain relevant information from the enclosure manufacturer. Such identification shall comprise:

- either the name, trade mark or identification mark of the enclosure manufacturer;
- type designation or identification number of the enclosure.

The marking shall be durable and easily legible and may be inside the enclosure.

Compliance is checked according to the test of 9.2 and by inspection.

Marking for the recycling of plastic parts shall be as stated in ISO 11469.

NOTE Marking of enclosures intended for class II assemblies with the symbol IEC 60417-5172 is the responsibility of the final assembly manufacturer.

6.2 Documentation

The manufacturer's documentation shall include all relevant constructional, mechanical characteristics, the enclosure classification (see clause 4) and any instruction necessary for the correct handling, assembling, mounting and service conditions of the enclosure as well as reference to this standard.

Information shall also be available concerning the thermal power dissipation relative to the effective cooling surface. This will provide the user with the correct data for the selection of electrical equipment to be installed. For the purpose of the calculation, it is assumed that the heat generated by the selected equipment is distributed uniformly inside the protected space.

NOTE 1 Thermal power dissipation may be determined using an appropriate method of calculation (see e.g. IEC 60890), or by test (see e.g. 8.2.1.4 of IEC 60439-1).

NOTE 2 The basis external ambient temperature is defined in clause 7.

7 Service conditions

Enclosures conforming to this standard are intended for use under the following service conditions.

The enclosure manufacturer shall specify the locations for which the enclosure is intended.

7.1 Normal service conditions

7.1.1 Ambient air temperature

7.1.1.1 Ambient air temperature for indoor locations

The ambient air temperature does not exceed +40 °C and its average over a period of 24 h does not exceed +35 °C.

The lower limit of the ambient air temperature is –5 °C.

7.1.1.2 Ambient air temperature for outdoor locations

The ambient air temperature does not exceed +40 °C and its average over a period of 24 h does not exceed +35 °C.

The lower limit of the ambient air temperature is –25 °C in a temperate climate and –50 °C in an arctic climate.

NOTE The use of enclosures in an arctic climate may require a special agreement between the enclosure manufacturer and user.

7.1.2 Atmospheric conditions

7.1.2.1 Atmospheric conditions for indoor locations

The air is clean and its relative humidity does not exceed 50 % at a maximum temperature of +40 °C. Higher relative humidity may be permitted at lower temperatures, for example 90 % at +20 °C.

7.1.2.2 Atmospheric conditions for outdoor locations

The relative humidity may be temporarily as high as 100 % at a maximum temperature of +25 °C.

7.1.3 Description of locations

For outdoor locations the additional tests specified in 9.11 and 9.12 apply.

For indoor locations, the additional test specified in 9.12.1 a) applies.

7.2 Special service conditions

Where any of the following special service conditions exist, the applicable particular requirements shall be subject to agreement between user and manufacturer.

Examples of such conditions may include the following:

- abnormal ambient air temperature and humidity;
- presence of corrosive substances;
- presence of particular dusts (coal, cement, etc.);
- abnormal mechanical stresses (seismic, etc.);
- presence of fauna, flora, mould;
- ionizing influences;
- electromagnetic interferences;
- vibrations.

Agreements reached shall not contradict any safety regulations in force.

7.3 Conditions during transport and storage

Unless otherwise specified, the following temperature range applies during transport and storage: between $-25\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$ and for short periods not exceeding 24 h up to $+70\text{ }^{\circ}\text{C}$.

8 Design and construction

8.1 General

The enclosure shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses, as specified in clause 9, as well as the effects of humidity which are likely to be encountered in normal use.

Protection against corrosion shall be ensured by the use of suitable materials or by the application of protective coating to the exposed surface, taking into account the intended conditions of use.

Compliance to this requirement is checked by the test of 9.12.

In addition for enclosures or parts of enclosures made of insulating materials, thermal stability, resistance to heat, fire and weathering shall be verified according to the tests of 9.8 and 9.11.

Where parts of an enclosure are designed to retain current-carrying parts in position, the relevant standard shall apply for their design and verification.

8.2 Dimensions

The dimensions shall be given in millimetres.

The external dimensions: height, width and depth are nominal values and shall be indicated in the catalogue of the enclosure manufacturer.

The projection of cable gland plates, removable covers and handles shall not be included in the external nominal dimensions, the dimensions of such shall be included in the manufacturer's documentation.

8.3 Mounting arrangements

8.3.1 Enclosure

The means and location of the enclosure mounting shall be defined in the enclosure manufacturer's documentation.

8.3.2 Equipment mounting surfaces

The location of the equipment mounting surfaces and their means of fixing shall be defined in the enclosure manufacturer's documentation.

8.4 Static loads

The enclosure manufacturer shall specify, in the documentation, the maximum permissible loads in the enclosure and on its door.

Compliance is checked according to the test of 9.3.

8.5 Lifting and transport support

Where required, enclosures shall be provided with the appropriate lifting devices or transport means.

The correct location and installation of such devices or means and the thread size of lifting devices, if applicable, shall be given in the enclosure manufacturer's documentation or in the instructions on how the enclosure has to be handled.

Compliance is checked according to the test of 9.4.

8.6 Access to the interior of the enclosure

Adequate access to the protected space shall be provided by means of a door(s) or removable cover(s). Access may only be achieved by the use of a key or tool.

Cable gland plates and covers which are removable from the outside shall require the use of a tool.

8.7 Protective circuit

Metallic enclosures shall ensure electrical continuity throughout either by the conductive structural parts of the enclosure or provisions for a separate protective conductor to earth or both. The enclosure manufacturer shall indicate in the technical documentation, if the enclosure itself fulfils the requirements or if and how separate protective conductors to the protective circuits of the installation shall be carried out.

When a removable part of an enclosure is removed the protective circuit for the remainder of the enclosure shall not be interrupted.

For lids, doors, removable covers and the like, the usual metal screwed connections and metal hinges may ensure continuity of the protective circuit provided no electrical equipment is attached to them. Where these are intended for mounting electrical equipment additional means shall be provided to ensure the continuity of the protective circuit.

Compliance is checked according to the test of 9.10.

The enclosure manufacturer shall provide means to facilitate the connection of the external protective conductor by the final assembly manufacturer. The location and the designed I^2t withstand capacity under electrical fault conditions of such means shall be indicated in the enclosure manufacturer's documentation.

NOTE The final assembly manufacturer ensures that the design of the protective circuit is be capable of withstanding the highest thermal and dynamic stresses that may occur at the place of installation.

8.8 Dielectric strength

The enclosures constructed of an insulating material shall fulfil the dielectric test of 9.9.

8.9 Degree of protection (IK code)

The enclosures shall fulfil the degree of protection against mechanical impact in accordance with IEC 62262. The degree of protection shall be indicated by the manufacturer.

Compliance is checked according to the test of 9.6.

8.10 Degree of protection (IP code)

The degree of protection shall be in accordance with IEC 60529 and as defined by the enclosure manufacturer.

Compliance is checked according to the test of 9.7.

NOTE An enclosure may be assigned differing IP codes dependent upon the declared IK code.

9 Type tests

Tests according to this standard are type tests.

9.1 General conditions of tests

The enclosures under test shall be mounted and installed as in normal use according to the enclosure manufacturer's instructions.

Unless otherwise specified, the tests shall be carried out at an ambient temperature of $(20 \pm 5) ^\circ\text{C}$.

Table 1 shows the number of samples to be tested and the order of test per sample.

Table 1 – Number of samples to be tested and order of test per sample

Subclause	Test	Sample 1	Sample 2	Sample 3	Representative sample (see 9.11)
9.3	Static loads	1			
9.4	Lifting	2			
9.5	Verification of axial loads of metal inserts	3			
9.6	Verification of degree of protection against external mechanical impacts (IK code)	4			
9.7	Verification of degree of protection (IP code)	5			
9.8.1	Verification of thermal stability		1		
9.8.2	Verification of resistance to heat		2		
9.8.3	Verification of resistance to abnormal heat and fire		3		
9.9	Verification of dielectric strength	6			
9.10	Verification of the continuity of the protective circuit	7		2	
9.11	Verification of resistance to weathering				^a
9.12	Verification of resistance to corrosion			1	
9.2	Marking	8			
^a Tests carried out on representative sample only.					

All tests shall be carried out on complete enclosures. If this is not possible, they can be carried out on representative samples taken from the enclosure.

9.2 Marking

Marking made by moulding or pressing shall not be submitted to this test.

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

NOTE The petroleum spirit is defined as a solvent hexane with a content of aromatics of maximum 0,1 % in volume, a kauributanol value of 29, an initial boiling point of 65 °C, a final boiling point of 69 °C and a density of approximately 0,68 g/cm³.

After the test the marking shall be easily legible.

9.3 Static loads

The enclosure fitted with all its required components to support the maximum permissible load is loaded with a weight of 1,25 times the maximum load as described in 8.4.

The loads are arranged on the mounting plate or switchgear and controlgear supports and on the door evenly distributed as specified by the enclosure manufacturer.

The loads are retained for 1 h in the closed position.

For enclosures constructed of insulating material and metallic enclosures with parts (hinges, locks, etc.) of insulating material, this shall be carried out at 70 °C.

The closed door is opened five times through 90°, resting at least 1 min in the open position.

For enclosures constructed of insulating material and metallic enclosures with parts (hinges, locks, etc.) of insulating material, this part of the test may be carried out at ambient temperature external to the heating cabinet.

After the test, with the test loads in place, the enclosure shall show no cracks or permanent distortions and during the test no deflections which could impair any of its characteristics.

9.4 Lifting

This test only applies to enclosures with provisions for lifting.

The enclosure is loaded as in 9.3 and with its door closed, is lifted with the specified lifting means and in the manner defined by the enclosure manufacturer.

From the standstill position, the enclosure is raised up three times in a vertical plane returning to the standstill position.

The enclosure is raised up and suspended for 30 min at a height of $(1 \pm 0,1)$ m without any movement.

Following this test, the enclosure is raised to a height of $(1 \pm 0,1)$ m and moved $(10 \pm 0,5)$ m horizontally, then set down. This cycle, which should be carried out for $1 \text{ min} \pm 5 \text{ s}$ is repeated three times at uniform speed.

After the test, with the test loads in place, the enclosure shall show no cracks or permanent distortions and during the test no deflections which could impair any of its characteristics.

9.5 Verification of axial loads of metal inserts

This test only applies to the enclosures when threaded metal inserts are provided to retain the mounting plate or switchgear and controlgear supports in place.

The test shall be carried out by applying an axial load for 10 s to representative samples, as indicated in Table 2.

Table 2 – Axial loads of metal inserts

Size of inserts M ^a	Axial load N
4	350
5	350
6	500
8	500
10	800
12	800
^a M = metric thread-size.	

During the test, the enclosure shall fully rest on a supporting platform to allow the application of the above-mentioned load.

At the end of the test, the insert shall still be in its original position; any sign of movement is not acceptable.

Cracks and splits in the material containing the insert are also not acceptable.

NOTE Small cracks or air bubbles that were visible before the test, but not caused by the application of the axial load, are ignored.

9.6 Verification of degree of protection against external mechanical impacts (IK code)

Verification of the degree of protection against mechanical impacts shall be carried out in accordance with IEC 62262 by means of a test hammer as described in IEC 60068-2-75 suitable for the dimensions of the enclosure.

The enclosure shall be fixed on a rigid support as for normal use.

An impact energy in accordance with Table 3 shall be applied:

- three times to each exposed surface in normal use whose largest dimension is not above 1 m;
- five times to each exposed surface in normal use whose largest dimension is greater than 1 m.

The test shall not be applied to the enclosure components (e.g. locks, hinges, etc.).

The impacts shall be applied with even distribution over the faces of the enclosure.

Table 3 – Relation between IK code and impact energy

IK code	IK00	IK01	IK02	IK03	IK04	IK05	IK06	IK07	IK08	IK09	IK10
Impact energy, J	^a	0,14	0,2	0,35	0,5	0,7	1	2	5	10	20
^a Not protected according to this standard.											
NOTE 1 When higher impact energy is required, the value of 50 J is recommended.											
NOTE 2 A characteristic group numeral of two figures has been chosen to avoid confusion with some national standards which used a single numeral for a specific impact energy.											

After the test, the enclosure shall continue to provide the IP code and dielectric strength, removable covers can be removed and reinstalled, doors opened and closed.

Where the enclosure is too large for the verification of degree of protection test in 9.7, the tests in accordance with 9.7.2 and 9.7.3 alone are acceptable.

NOTE When defining the protected space, allowance should be made for any deflection due to impacts.

9.7 Verification of degree of protection (IP code)

9.7.1 Verification of degree of protection against access to hazardous parts and against the ingress of solid foreign objects indicated by first characteristic numeral

9.7.1.1 Verification of the protection against access to hazardous parts

Subclauses 12.1 and 12.2 of IEC 60529 apply.

The access probes shall not enter the protected space.

9.7.1.2 Verification of degree of protection against the ingress of solid foreign objects

For IP2X, IP3X, IP4X enclosures, 13.2 and 13.3 of IEC 60529 apply.

For IP5X enclosures, 13.4, category 2 (without vacuum pump) and 13.5 (without vacuum pump) of IEC 60529 apply. Ingress of talcum powder into protected space is verified as follows:

- Ingress of talcum powder is verified by using a watch glass installed at the centre of the base of the protected space of the enclosure in order to pick up the talcum powder entering the protected space during the test. After the test, talcum powder shall not form deposits of more than 1 g/m².
- In practice the weight of the watch glass is measured before and at the end of the test and the difference between both measures is representative of the amount of the talcum powder which has entered the protected space.

For IP6X enclosures, 13.6 of IEC 60529 applies. No talcum powder shall be observable inside the enclosure at the end of the test.

9.7.2 Verification of degree of protection against ingress of water as indicated by second characteristic numeral

Subclauses 14.1 and 14.2 of IEC 60529 apply.

After the test, water shall not have ingressed into the protected space.

Ingress of water is verified by the use of dry absorbent paper positioned to occupy the base area of each protected space.

For doors or covers intended to accommodate equipment, a strip of paper, bent to form a 90° angle profile, is attached to the base of the declared protected space for that surface.

The paper should project from the surface equal to the depth of the protected space or a maximum of 30 mm.

Where the enclosure has any uncovered aperture, a section of absorbent paper, equal to or greater than the size of the aperture, is positioned on the surface of the protected space in its immediate vicinity.

Immediately after the test, all indicator papers shall still be dry.

In practice, a coloured blotting or filter paper will show very clearly any moisture by its discolouration.

9.7.3 Verification of degree of protection against hazardous parts as indicated by additional letter

Clause 15 of IEC 60529 applies.

The access probe shall not touch the surface of the protected space.

9.8 Properties of insulating materials

9.8.1 Verification of thermal stability

The test is carried out according to the method described in IEC 60068-2-2.

Parts, which have no technical significance and are intended for decorative purposes only shall not be considered for the purpose of this test.

Compliance is checked by the following test

The enclosure, mounted as for normal use, is subjected to a test in a heating cabinet with an atmosphere having the composition and pressure of the ambient air and ventilated by natural circulation. If the dimensions of the enclosure are inconsistent with those of the heating cabinet, the test may be carried out on a representative sample of the enclosure.

The temperature within the cabinet shall be $(70 \pm 2) ^\circ\text{C}$.

The enclosure or sample is kept in the cabinet for seven days (168 h).

The use of an electrically heated cabinet is recommended.

Natural circulation may be provided by holes in the walls of the cabinet.

After the treatment, the enclosure or sample is removed from the cabinet and kept at ambient temperature and a relative humidity of between 45 % and 55 % for at least four days (96 h).

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

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

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

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

9.8.2 Verification of resistance to heat

Enclosures are subjected to a ball-pressure test by means of the apparatus described in Figure 1.

If it is not possible to cut a piece of at least 2 mm thickness from the enclosure then up to four thinner pieces, taken from the enclosure, may be layered together to get a minimum thickness of the test specimen of 2,5 mm.

NOTE The thickness of the samples subjected to the test may be increased up to 2,5 mm to prevent the ball from hitting the plate below it.

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

The test is made in a heating cabinet at a temperature of $(70 \pm 2) ^\circ\text{C}$. After 1 h the ball is removed from the sample which is then cooled down within 10 s to approximately room temperature by immersion in cold water.

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

9.8.3 Verification of resistance to abnormal heat and to fire

Compliance is checked by tests in accordance with the principles of IEC 60695-2-10 and the details of IEC 60695-2-11. For a description of the test see clause 4 of IEC 60695-2-11. The apparatus to be used shall be as described in clause 5 of IEC 60695-2-11.

If the dimensions of the enclosure are inconsistent with those of the test apparatus, the test shall be carried out on a sample. This sample shall be taken from an area of minimum thickness taken from the enclosure. In case of doubt, the test shall be repeated on two further samples.

The sample is stored for 24 h in an atmosphere having a temperature between 15 °C and 35 °C and a relative humidity of between 35 % and 45 % before starting the test.

The apparatus shall be placed in a substantially draught-free dark room, so that the flames occurring during the test are visible.

Before starting the test, the thermocouple is calibrated in accordance with clause 6 of IEC 60695-2-10.

During the test, the procedure given in clause 8 of IEC 60695-2-10 and clause 10 of IEC 60695-2-11 shall be followed.

After each test, it is necessary to clean the tip of the glow wire of any residue of insulating material, for example by means of a brush.

The temperature of the tip of the glow wire shall be as follows:

- for parts intended to retain current-carrying parts in position: (960 ± 15) °C;
- for parts intended to be installed in hollow walls: (850 ± 15) °C;
- for all other parts, including parts not intended to retain current-carrying parts in position including the earth terminal and parts intended to be embedded in walls which are combustion-resistant: (650 ± 15) °C.

The duration of application shall be (30 ± 1) s.

During application of the glow wire and during a further period of 30 s, the specimen, the parts surrounding the specimen and the layer of tissue paper placed below it shall be observed.

The time at which the specimen ignites and the time when flames extinguish during or after the period of application are noted.

The specimen is considered to have withstood the glow-wire test if

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

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

NOTE Higher temperatures, shorter times for the flame to extinguish and other times of application can be applied, subject to agreement between manufacturer and user.

9.9 Verification of dielectric strength

This test only applies to enclosures constructed of insulating material.

Compliance is checked as follows:

9.9.1 Preconditioning

The enclosures are placed in a humidity cabinet containing air with relative humidity maintained at between 91 % and 95 %. The air temperature, where the enclosures are placed, is maintained at (40 ± 2) °C.

The enclosures are kept in the cabinet for two days (48 h).

In most cases, the enclosures may be brought to the specified temperature by keeping them at this temperature for at least 4 h before the humidity treatment. A relative humidity of between 91 % and 95 % can be obtained by placing in the cabinet a saturated solution of sodium sulphate (Na₂SO₄) or potassium nitrate (KNO₃) in water having a sufficiently large contact surface with the air.

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

9.9.2 Enclosures without metal elements inside the protected space

An r.m.s. voltage of substantially sine-wave form at a value according to 8.2.2.2 of IEC 60439-1 is applied for 1 min between two metal foils, one in contact with the external surface and the other inside the enclosure at the limit of the protected space.

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

9.9.3 Enclosures having metal elements inside the protected space

All internal metallic parts are connected to a bar, and an r.m.s. voltage of substantially sine-wave form at a value according to 8.2.2.2 of IEC 60439-1 is applied for 1 min between a metal foil in contact with the external surface and the bar.

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

NOTE A hole in the external surface of the enclosure is needed to enable the voltage to be connected to the bar. Creepage and clearance distances between the bar and the external surface should be taken into account.

9.9.4 Results to be obtained

The samples shall show no damage impairing their further use; no flashover or breakdown shall occur during the test.

9.10 Verification of the continuity of the protective circuit

It shall be verified that the different exposed conductive parts of the enclosure are effectively connected to the earthing terminal or contact of the protective circuit and that the resistance of the circuit does not exceed 0,1 Ω .

Verification shall be made using a resistance measuring instrument or arrangement which is capable of driving a current of at least 10 A (a.c. or d.c.). The current is passed between each exposed conductive part and the earthing termination point. The voltage drop between these points is measured. The resistance calculated from the current and this voltage drop shall not exceed 0,1 Ω .

NOTE In case of doubt, the test is carried out until a consistent measurement has been established.

9.11 Verification of resistance to weathering

This test only applies to representative samples of enclosures intended to be installed outdoors.

Samples of external parts constructed of synthetic materials or metals that are entirely coated by a synthetic material shall be subjected to the following test:

UV test according to ISO 4892-2 method A; cycles of 5 min of watering and 25 min of dry period with Xenon lamp providing a total test period of 500 h.

The values of temperature and humidity used for the test are $(65 \pm 3) ^\circ\text{C}$ and $(65 \pm 5) \%$ respectively, unless declared otherwise by the manufacturer.

After the test, samples shall be removed from the test chamber.

Compliance is checked by verification that the flexural strength (according to ISO 178) and Charpy impact (according to ISO 179) of synthetic materials have 70 % minimum retention. For the test carried out in accordance with ISO 178, the surface of the sample exposed to UV shall be turned face down and the pressure applied to the non-exposed surface. For the test carried out in accordance with ISO 179, no grooves shall be cut into the sample and the impact shall be applied to the exposed surface. After the test, samples shall be subjected to the glow wire test of 9.8.3. Adherence of protective coating of metallic enclosures (according to ISO 2409) shall have 50 % minimum retention.

Samples shall not show cracks or deterioration without the use of magnification.

9.12 Verification of resistance to corrosion

Metallic enclosures and external metallic parts of insulating and combined enclosures shall be tested to verify that they ensure protection against corrosion.

If it is not possible to carry out the test on the enclosure, the test shall be carried out on enclosure elements showing the same constructional detail as the enclosure itself: material, thickness, layer of coating, etc. In all cases hinges, locks and fastenings shall be tested.

The enclosure subjected to the test shall be mounted as for normal use according to the manufacturer's instructions.

The enclosure or samples shall be new and in a clean condition.

NOTE For special service conditions (7.2) other criteria may apply, subject to an agreement between manufacturer and user, see e.g. 8.2.11 of IEC 60439-5.

9.12.1 Test procedure

Enclosures shall be subjected to the following test:

a) Enclosures or metallic parts intended to be installed indoors and internal parts of enclosures intended to be installed outdoors

- six cycles of 24 h, damp heat cycling test according to test Db of IEC 60068-2-30 at 40 °C and relative humidity of 95 %;
- two cycles of 24 h, salt mist test according to test Ka of IEC 60068-2-11 at a temperature of (35 ± 2) °C.

b) Enclosures or metallic parts intended to be installed outdoors

- 12 cycles of 24 h, damp heat cycling test according to test Db of IEC 60068-2-30 at 40 °C and relative humidity of 95 %;
- 14 cycles of 24 h, salt mist test according to test Ka of IEC 60068-2-11 at a temperature of (35 ± 2) °C.

9.12.2 Results to be obtained

After the test, the enclosure or samples shall be washed in running tap water for 5 min, rinsed in distilled or demineralized water then shaken or subjected to air blast to remove water droplets. The specimen under test shall then be stored under normal service conditions for 2 h.

Compliance is checked by visual inspection to ensure that

- there is no evidence of rust, cracking or other deterioration. However surface deterioration of the protective coating is allowed. In case of doubt, reference shall be made to ISO 4628-3 to verify that the samples conform to the specimen Ri1;
- seals are not damaged;
- doors, hinges, locks, fastenings and access means work without abnormal effort.

It shall also be checked that the different exposed conductive parts of the enclosure are effectively connected to the protective circuit according to 9.10.

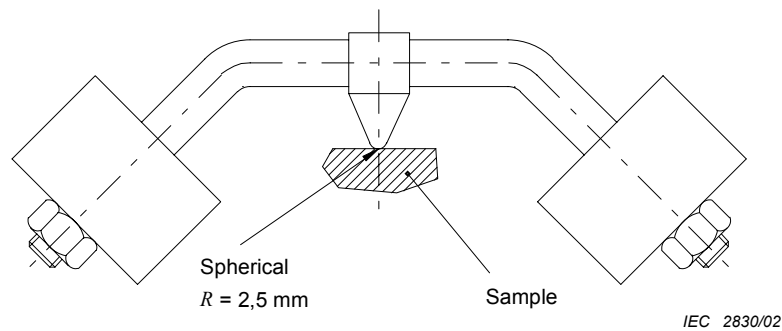


Figure 1 – Ball-pressure apparatus

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-2	1974	Basic environmental testing procedures Part 2: Tests - Test B: Dry heat	EN 60068-2-2 ¹⁾	1993
A2	1994		A2	1994
IEC 60068-2-11	1981	Part 2: Tests - Test Ka: Salt mist	EN 60068-2-11	1999
IEC 60068-2-30	1980	Part 2: Tests - Test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle)		
+ A1	1985		EN 60068-2-30	1999
IEC 60068-2-75	1997	Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	1997
IEC 60439	Series	Low-voltage switchgear and controlgear assemblies	EN 60439	Series
IEC 60439-1	1999	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type- tested assemblies	EN 60439-1	1999
IEC 60439-5	1996	Part 5: Particular requirements for assemblies intended to be installed outdoors in public places - Cable distribution cabinets (CDCs) for power distribution in networks	EN 60439-5	1996
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
IEC 60695-2-10	2000	Fire hazard testing Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2001

¹⁾ EN 60068-2-2 includes supplement A:1976 to IEC 60068-2-2.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60695-2-11	2000	Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	2001
IEC/TR3 60890 + corr. March + A1	1987 1988 1995	A method of temperature-rise assessment by extrapolation for partially type-tested assemblies (PTTA) of low-voltage switchgear and controlgear	- CLC/TR 60890	- 2002
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	2002
ISO 178	2001	Plastics - Determination of flexural properties	EN ISO 178	2003
ISO 179	Series	Plastics - Determination of Charpy impact properties	EN ISO 179	Series
ISO 2409	1992	Paints and varnishes - Cross-cut test	EN ISO 2409	1994
ISO 4628-3	1982	Paints and varnishes - Evaluation of degradation of paint coatings - Designation of intensity, quantity and size of common types of defect Part 3: Designation of degree of rusting	-	-
ISO 4892-2	1994	Plastics - Methods of exposure to laboratory light sources Part 2: Xenon arc sources	EN ISO 4892-2	1999
ISO 11469	2000	Plastics - Generic identification and marking of plastic products	EN ISO 11469	2000

Bibliography

IEC 60417 (all parts), *Graphical symbols for use on equipment*

IEC 60670:1989, *General requirements for enclosures for accessories for household and similar fixed electrical installations*

IEC 61000-5-7:2001, *Electromagnetic Compatibility (EMC) – Part 5-7: Installation and mitigation guidelines – Degrees of protection provided by enclosures against electromagnetic disturbances (EM code)*

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