

# Miscellaneous lampholders —

## Part 1: General requirements and tests

The European Standard EN 60838-1:2004 has the status of a British Standard

ICS 29.140.10

## National foreword

This British Standard is the official English language version of EN 60838-1:2004. It is identical with IEC 60838-1:2004. It supersedes BS EN 60838-1:1998 which will be withdrawn on 2007-10-01.

The UK participation in its preparation was entrusted to Technical Committee CPL/34/2, Lamp caps and holders, 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.

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### Summary of pages

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EUROPEAN STANDARD

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English version

**Miscellaneous lampholders**  
**Part 1: General requirements and tests**  
(IEC 60838-1:2004)

Douilles diverses pour lampes  
Partie 1: Prescriptions générales et essais  
(CEI 60838-1:2004)

Sonderfassungen  
Teil 1: Allgemeine Anforderungen  
und Prüfungen  
(IEC 60838-1:2004)

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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 document 34B/1152/FDIS, future edition 4 of IEC 60838-1, prepared by SC 34B, Lamp caps and holders, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60838-1 on 2004-10-01.

This European Standard supersedes EN 60838-1:1998 + A1:1999 + A2:2002 + A2:2002/corrigendum July 2003.

In this edition of EN 60838-1 the new requirements for creepage distances and clearances have been adopted which are currently circulated to amend the EN 60598 family of luminaire standards.

It also includes additional requirements regarding testing of lampholders for double-ended R7s/RX7s lamps.

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) 2005-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2007-10-01

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 60838-1:2004 was approved by CENELEC as a European Standard without any modification.

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## MISCELLANEOUS LAMPHOLDERS –

## Part 1: General requirements and tests

**1 General****1.1 Scope**

This part of IEC 60838 applies to lampholders of miscellaneous types intended for building-in (to be used with general purpose light sources, projection lamps, floodlighting lamps and street-lighting lamps with caps as listed in annex A) and the methods of test to be used in determining the safe use of lamps in lampholders.

This part of IEC 60838 also covers lampholders which are integral with a luminaire. It covers the requirements for the lampholder only.

This part of IEC 60838 also covers lampholders integrated in an outer shell and dome similar to Edison screw lampholders. Such lampholders are further tested in accordance with the following subclauses of IEC 60238: 8.4; 8.5; 8.6; 9.3; 10.7; 11; 12.2; 12.5; 12.6; 12.7; 13; 15.3; 15.4; 15.5 and 15.9.

Lampholders designed with a barrel thread for shade holder rings should comply with IEC 60399.

Requirements for lampholders for tubular fluorescent lamps, Edison screw lampholders and bayonet lampholders are covered by separate standards.

**1.2 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.

NOTE With regard to IEC 60598-1, the references cited in this document are liable to change.

IEC 60061(all parts), *Lamp caps and holders together with gauges for the control of interchangeability and safety*

IEC 60061-1: *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60061-2: *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 2: Lampholders*

IEC 60061-3: *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 3: Gauges*

IEC 60068-2-20:1979, *Environmental testing – Part 2: Tests – Test T: Soldering*

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

IEC 60112:1979, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60238:2004, *Edison screw lampholders*

IEC 60245 (all parts), *Rubber insulated cables – Rated voltages up to and including 450/750 V*

IEC 60352-1, *Solderless connections – Part 1: Wrapped connections – General requirements, test methods and practical guidance*

IEC 60399: *Standard sheets for barrel thread for E14 and E27 lampholders with shade holder ring*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*<sup>1)</sup>  
Amendment 1 (1999)

IEC 60598-1: *Luminaires – Part 1: General requirements and tests*

IEC 60664-1:1992, *Insulation co-ordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*<sup>2)</sup>  
Amendment 1 (2000)  
Amendment 2 (2002)

IEC 60695-2-2, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*

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

ISO 1456:2003, *Metallic coatings – Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium*

ISO 2081:1986, *Metallic coatings – Electroplated coatings of zinc on iron or steel*

ISO 2093:1986, *Electroplated coatings of tin – Specification and test methods*

ISO 4046-4:2002, *Paper, board, pulps and related terms – Vocabulary – Part 4: Paper and board grades and converted products*

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<sup>1)</sup> A consolidated edition 2.1 (2001) exists that includes edition 2.0 (1989) and its Amendment 1 (1999).

<sup>2)</sup> A consolidated edition 1.2 (2002) exists that includes edition 1.0 (1992), its amendment 1 (2000) and amendment 2 (2002).

## **2 Definitions**

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

### **2.1**

#### **rated voltage**

the voltage declared by the manufacturer to indicate the highest working voltage for which the lampholder is intended

### **2.2**

#### **working voltage**

the highest r.m.s. voltage that may occur across any insulation, transients being disregarded, both when the lamp is operating under normal conditions and when the lamp is removed

### **2.3**

#### **rated current**

the current declared by the manufacturer to indicate the highest current for which the lampholder is intended

### **2.4**

#### **lampholder for building-in**

a lampholder designed to be built into a luminaire, an additional enclosure or the like

#### **2.4.1**

##### **unenclosed lampholder**

a lampholder for building-in so designed that it requires additional means, for example enclosures, to meet the requirements of this standard with regard to protection against electric shock

#### **2.4.2**

##### **enclosed lampholder**

a lampholder for building-in so designed that it fulfils on its own the requirements of this standard with regard to protection against electric shock

### **2.5**

#### **rated operating temperature**

The highest temperature for which the lampholder is designed

### **2.6**

#### **rated pulse voltage**

the highest peak value of pulse voltages the holder is able to withstand

### **2.7**

#### **lamp connectors**

a set of contacts specially designed to provide for electrical contact but not supporting the lamp

### **2.8**

#### **type test**

a test or series of tests made on a type test sample, for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard



## 2.9

### **type test sample**

a sample consisting of one or more similar specimens submitted by the manufacturer or responsible vendor for the purpose of a type test

## 2.10

### **live part**

a conductive part which may cause an electric shock

## 2.11

### **impulse withstand category**

a numeral defining a transient overvoltage condition

NOTE Impulse withstand categories I, II, III and IV are used.

#### a) Purpose of classification of impulse withstand categories

Impulse withstand categories are to distinguish different degrees of availability of equipment with regard to required expectations on continuity of service and on an acceptable risk of failure.

By selection of impulse withstand levels of equipment, insulation co-ordination can be achieved in the whole installation reducing the risk of failure to an acceptable level providing a basis for overvoltage control.

A higher characteristic numeral of an impulse withstand category indicates a higher specific impulse withstand of the equipment and offers a wider choice of methods for overvoltage control.

The concept of impulse withstand categories is used for equipment energized directly from the mains.

#### b) Description of impulse withstand categories

Equipment of impulse withstand category I is equipment which is intended to be connected to the fixed electrical installations of buildings. Protective means are taken outside the equipment – either in the fixed installation or between the fixed installation and the equipment – to limit transient overvoltages to the specific level.

Equipment of impulse withstand category II is equipment to be connected to the fixed electrical installations of buildings.

Equipment of impulse withstand category III is equipment which is part of the fixed electrical installations and other equipment where a higher degree of availability is expected.

Equipment of impulse withstand category IV is for use at or in the proximity of the origin of the electrical installations of buildings upstream of the main distribution board.

## 2.12

### **primary circuit**

a circuit which is directly connected to the AC mains supply. It includes, for example, the means for connection to the AC mains supply, the primary windings of transformers, motors and other loading devices

## 2.13

### **secondary circuit**

a circuit which has no direct connection to a primary circuit and derives its power from a transformer, converter or equivalent isolation device, or from a battery

Exception: autotransformers. Although having direct connection to a primary circuit, the tapped part of them is also deemed to be a secondary circuit in the above sense.

NOTE Mains transients in such a circuit are attenuated by the corresponding primary windings. Also inductive ballasts reduce the mains transient voltage height. Therefore, components located after a primary circuit or after an inductive ballast can be suited for an impulse withstand category of one step lower, i.e. for impulse withstand category II.

## 3 General requirement

Lampholders shall be so designed and constructed that in normal use they function reliably and cause no danger to persons or surroundings.

In general, compliance is checked by carrying out all the tests specified.

## 4 General conditions for tests

### 4.1 Tests according to this standard are type tests.

NOTE The requirements and tolerances permitted by the standard are related to testing of type test sample submitted for that purpose. Compliance of type test sample does not ensure compliance of the whole production of a manufacturer with this safety standard. Conformity of production is the responsibility of the manufacturer and should include routine tests and quality assurance in addition to type testing.

For further information see IEC 60061-4<sup>3)</sup> (inclusion of guidance on conformity testing during manufacture is in preparation).

### 4.2 Unless otherwise specified, the tests are made at an ambient temperature of 20 °C ± 5 °C and with the holder in the most unfavourable position for normal use.

If a lampholder is declared to accept different lamp fits, it shall comply with the requirements of each of the fits mentioned.

*Compliance is checked with separate sets of specimens according to 4.3.*

*If the use of different lamp fits in turn is permitted by the manufacturer, only one set of specimens is used to check compliance with all requirements.*

*For all tests the most critical of the relevant fits and gauges shall be used and in the most onerous sequence.*

### 4.3 The tests and inspections are carried out in the order of the clauses, on a total of

- 10 pairs of matching holders intended for linear double-capped lamps;

NOTE If a pair of holders consists of identical holders, it is sufficient that one holder instead of one pair is subjected to all the tests, except for the tests of clause 7, 10.2, 10.3, clause 12, clause 15 and 16.6 where pairs are needed.

- 10 specimens intended for single-capped lamps;

in the order of the clauses, as follows:

- three pairs or three specimens: clauses 3 up to and including 14 (except for 8.2);

NOTE The tests of 8.2 are carried out on the number of separate specimens as required by the relevant standards.

- three pairs or three specimens: clause 15 and 16.6;
- one pair or one specimen: 16.1;
- one pair or one specimen: 16.3;
- one pair or one specimen: 16.4;
- one pair or one specimen: 16.5 and clause 17.

Together with these units, the manufacturer's mounting instructions (see 6.3) shall be supplied.

In such cases, where according to the mounting instructions the rated pulse voltage of the holder can only be achieved with a cap inserted, suitable caps shall be supplied together with the type test sample. The relevant tests are then carried out with a cap inserted.

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3) IEC 60061-4: *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 4: Guidelines and general information*

**4.4** Lampholders are deemed to comply with this standard if no specimen fails in the complete series of tests specified in 4.3.

If one specimen fails in one test, that test and the preceding ones which may have influenced the result of that test are repeated on another set of specimens for the number required by 4.3, all of which shall then comply with the repeated tests and with the subsequent tests. Lampholders are deemed not to comply with this standard if there are more failures than one.

The applicant may submit, together with the first set of specimens, the additional set which may be needed in case of failure of one specimen. The testing station shall then, without further request, test the additional specimens and will reject only if a further failure occurs.

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

## 5 Classification

Lampholders are classified as follows.

**5.1** According to their installation conditions:

- unenclosed lampholders;
- enclosed lampholders.

**5.2** According to their resistance to heat:

- for rated operating temperatures up to and including 80 °C;
- for rated operating temperatures over 80 °C (T-marked lampholders).

The measuring point for the operating temperature is that area of the lampholder which makes electrical contact with the lamp cap/base. If the heat resistance of insulating parts, terminals and leads of the lampholder deviates from this operating temperature, these different values shall be stated in the manufacturer's catalogue and are checked after appropriate installation in a luminaire or other additional enclosure, when that equipment is tested according to its own standard.

## 6 Marking

**6.1** Lampholders shall be marked with the following mandatory markings:

- a) mark of origin (this may take the form of a trade mark, manufacturer's identification mark or the name of the responsible vendor);
- b) either a unique catalogue number or an identifying reference.

NOTE An identifying reference may include numbers, letters, colour, etc., to identify the lampholder by reference to the manufacturer's catalogue or similar literature.

If a combination of lampholder components determines the lampholder designation, for example an assembly of a lamp connector and a retaining spring, the combination should be clearly identifiable.

*Compliance is checked by inspection.*

**6.2** In addition to the above mandatory markings, the following information shall be given either on the lampholder or be made available in the manufacturer's catalogue or the like:

- a) the rated voltage in volts and rated pulse voltage in kilovolts (kV), if applicable;

- b) the rated current in amperes;
- c) the rated operating temperature T, if greater than 80 °C, in steps of 10 °C;
- d) the conductor sizes for which the terminal is designed.

If symbols are used, these shall be as follows.

For electrical rating:

- volt: V;
- ampere: A;
- watt: W;
- pulse voltage: kV.

NOTE Alternatively, for volt and ampere ratings, figures may be used alone, the figure for the rated current being marked before or above that for the rated voltage and separated from the latter by an oblique stroke or line. Therefore the marking of current and voltage may be as follows:

2 A 250 V or 2/250 or  $\frac{2}{250}$

For the rated pulse voltage, the symbol shall be preceded by its value (e.g. 5 kV).

For rated operating temperature:

the symbol T shall be followed by its value in °C (e.g. T 300).

For cross-section of conductors:

the relevant value or values in the case of a range, in square millimetres (mm<sup>2</sup>), shall be followed by a small square (e.g. 0,5 □).

*Compliance is checked by inspection.*

For lampholders according to this standard, the distances for impulse withstand category II are usually applicable. For holders in equipment where a higher degree of availability is expected, distances for impulse withstand category III may be applicable. This information has to be indicated in the manufacturer's catalogue or the like.

**6.3** The instructions supplied by the holder manufacturer or responsible vendor shall contain all the information required to ensure correct mounting and operation of the connectors or holders.

NOTE The information may be part of the manufacturer's or responsible vendor's catalogue.

*Compliance is checked by inspection.*

**6.4** Marking shall be durable and easily legible.

*Compliance is checked by inspection and by trying to remove the marking by rubbing lightly for 15 s with a piece of cloth soaked with water and for a further 15 s with a piece of cloth soaked with petroleum spirit.*

*After the test the marking shall still be legible.*

NOTE The petroleum spirit used should consist of a solvent hexane with a content of aromatics of maximum 0,1 volume percentage, a kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry-point of approximately 69 °C and a specific density of approximately 0,68 g/cm<sup>3</sup>.

## 7 Protection against electric shock

7.1 Enclosed lampholders shall be so constructed that, when the holder has been built in or installed and wired as in normal use, their live parts are not accessible

- without a lamp inserted;
- with the appropriate lamp inserted, and
- during insertion or removal of the lamp.

For lampholders which have been in use for a long time, such as B22d-3, BY22d, G22, G38, P28s, P30s and P40, the above requirement applies only with the appropriate lamp inserted.

The insertion of only one pin of the lamp (in case of caps with more than one pin) to the first point of contact with live parts shall be prevented.

Lampholders G22 and G38 are exempted from this requirement.

*Compliance is checked by means of the standard test finger specified in IEC 60529. This test finger is applied in every possible position with a force not exceeding 10 N, an electrical indicator being used to show contact with live parts.*

*It is recommended that a voltage of not less than 40 V be used.*

*The lampholders are mounted as in normal use, i.e. on a supporting surface or the like with the most unfavourable conductor size fitted for which it is intended before being subjected to the above test.*

*Unenclosed lampholders are only tested after appropriate installation in a luminaire or other additional enclosure when that equipment is tested according to its own standard.*

7.2 Lampholders for double-ended lamps shall be so constructed that, when the two holders have been built in or installed and wired as in normal use, their live parts are not accessible

- without a lamp inserted;
- with the appropriate lamp inserted, and
- during insertion and removal of the lamp.

In case of lampholders R7s/RX7s, a test which simulates insertion or removal of the lamp is not available because in both cases testing has to be done against the spring force of the single contact. This situation does not give the repeatability required for judgement. Therefore, this test is replaced by one with the lamp inserted.

*Compliance is checked in accordance with IEC 60061 or unless otherwise specified in IEC 60061, with the standard test finger.*

## **8 Terminals**

**8.1** Lampholders shall be provided with at least one of the following means of connection:

- screw-type terminals;
- screwless terminals;
- tabs or pins for push-on connections;
- posts for wire wrapping;
- soldering lugs;
- connecting leads (tails).

Terminal screws and nuts shall have a metric ISO thread.

Lampholders with screwless terminals, unless intended for sale to luminaire or equipment manufacturers, shall be provided with terminals which are equally satisfactory with both rigid (solid or stranded) conductors and flexible cables or cords.

Other means of connection than those specified are permitted provided they are equal in performance to the methods listed.

*Compliance is checked by the tests of 8.2 or 8.3 respectively.*

**8.2** Terminals shall comply with the following requirements.

- Screw-type terminals shall comply with clause 14 of IEC 60598-1.
- Screwless terminals shall comply with clause 15 of IEC 60598-1.
- Tabs or pins for push-on connections shall comply with clause 15 of IEC 60598-1.
- Posts for wire wrapping shall comply with IEC 60352-1. Wire wrapping applies only to single solid round wire for internal wiring.
- Soldering lugs shall comply with the requirements for good solderability. Suitable requirements can be found in IEC 60068-2-20.
- Connecting leads (tails) shall comply with the requirements prescribed in 8.3.

For T-marked lampholders, the terminals are tested at the rated operating temperature, unless otherwise stated by the manufacturer.

*Compliance is checked by the relevant tests.*

**8.3** Connecting leads (tails) shall be connected to the lampholder by soldering, welding, crimping or any other at least equivalent method.

Leads shall consist of insulated conductors. The insulation of the leads shall be at least equal in their mechanical and electrical properties to those specified in IEC 60227 or IEC 60245 or comply with the relevant requirements given in 5.3 of IEC 60598-1.

Insulation of the free end of the leads may be stripped.

Fixing of the leads to the holder shall withstand the mechanical efforts which may occur in normal use.

*Compliance is checked by inspection and by the following test which is made after the test of clause 15 on the same three specimens.*

*Each connecting lead is subjected to a pull of 20 N. The pull is applied without jerks for 1 min in the most unfavourable direction. During the test, leads should not move from their fixing. If, however, certain pull directions are not allowed according to the mounting instructions this shall be taken into account.*

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

## **9 Provision for earthing**

**9.1** Lampholders, with provision for earthing other than those provided with connecting leads, shall have at least one earthing terminal.

*Compliance is checked by inspection.*

NOTE Lampholders intended to be earthed but not provided with an earthing terminal or with connecting leads are not for retail sale.

**9.2** Accessible metal parts of lampholders with an earthing terminal which may become live in the event of an insulation fault shall be permanently and reliably connected to the earthing terminal.

Accessible metal parts of lampholders without an earthing terminal which may become live in the event of an insulation fault shall allow reliable earthing.

There shall be earth continuity between external metal parts unless these are screened from live parts by double or reinforced insulation.

*Compliance is checked by the following test:*

*Lampholders provided with an earthing terminal are fitted with a rigid conductor of the smallest cross-sectional area for which the holder is intended.*

*Immediately after the electric strength test of 11.2.2, the resistance between the means of earthing and the external metal parts, if applicable, is measured. In case of lampholders provided with an earthing terminal, this is done between the point where the conductor leaves the earthing terminal and the external metal parts, if applicable.*

*In case of lampholders without an earthing terminal this is done between that area of the lampholder where it is earthed in the luminaire and the external metal parts.*

*A current of at least 10 A, derived from a source with a no-load voltage not exceeding 12 V, shall be passed for 1 min between the earthing terminal or earthing contact and each of the accessible metal parts in turn.*

*The voltage drop between the earthing terminal or earthing contact and the accessible metal part shall be measured and the resistance calculated from the current and the voltage drop. In no case shall the resistance exceed 0,1  $\Omega$ .*

NOTE For the purpose of this requirement, small isolated metal screws and the like for fixing bases or covers are not deemed to be accessible parts which may become live in the event of an insulation fault.

**9.3** Earthing terminals shall comply with the requirements of clause 8.

Their clamping means shall be adequately locked against accidental loosening, and it shall not be possible to loosen screw terminals by hand and screwless terminals unintentionally by hand.

*Compliance is checked by inspection and by the tests of clause 8.*

NOTE In general, the designs commonly used for current-carrying terminals (complying with the requirements of this standard) provide sufficient resilience to comply with the latter requirement; for other designs, special provisions such as the use of an adequate resilient part which is not likely to be removed inadvertently may be necessary.

**9.4** The metal of earthing terminals shall be such that there is no risk of corrosion resulting from contact with the copper of the earthing conductor.

The screw or the body of the earthing terminal shall be of brass or other metal no less resistant to corrosion and the contact surfaces shall be bare metal.

*Compliance is checked by inspection.*

NOTE The risk of corrosion is particularly great when copper is in contact with aluminium.

**9.5** Metal parts of the cord anchorage, including clamping screws, shall be insulated from the earthing circuit.

*Compliance is checked by inspection.*

## **10 Construction**

**10.1** Wood, cotton, silk, paper and similar hygroscopic materials are not allowed as insulation unless suitably impregnated. Lacquer or enamel are not deemed to provide insulation.

*Compliance is checked by inspection.*

**10.2** Lampholders shall be so designed that a lamp can be easily inserted and removed and cannot work loose due to vibration or temperature variation.

Lampholder dimensions shall comply with IEC standards in so far as they exist.

*Compliance for such lampholders is checked in accordance with IEC 60061-2 and by the test of 10.4.*

**10.3** Lampholders R7s and RX7s having their contacts declared of silver, shall be so designed that the contact area has a thickness of at least 0,25 mm.

NOTE The thickness may be measured by means of a magnifying glass (approximately 6x magnification) scaled at tenths of a millimetre (0,1 mm). It may be necessary to cut the contact and measure the thickness of the silver.

**10.4** Contacts and all other current-carrying parts shall be so constructed as to prevent excessive temperature rise.

*Compliance is checked by the following test.*



*The holder contacts are bridged by means of a testcap, having nominal dimensions, inserted in the holder, the terminals of which are fitted with conductors of the maximum cross-sectional area for which the holder is intended.*

NOTE 1 It is not necessary for the test cap to have keys if they only have keying function.

NOTE 2 Nominal values are understood to be the medium values.

*In the case of lamp bases, loose contact pins should be used.*

*In the case of holders for double-ended lamps, a dummy lamp is used having both ends electrically connected. The contacts shall be representative of those of an actual lamp.*

*For multi-contact holders, the appropriate contacts of the test cap are bridged to carry the rated current.*

*Care should be taken that the contacts of the test cap have good electrical conductivity, for example, brass. That part of the lamp dummy representing the bulb should be shielded with insulating material.*

*The contacts shall be carefully cleaned and polished before carrying out the tests.*

*The lampholder is loaded for 1 h with 1,25 times its rated current.*

*The temperature rise of the contacts shall not exceed 45 K. This temperature is determined with the aid of melting particles or by thermocouples, not by means of thermometers.*

NOTE Pellets of beeswax (diameter 3 mm, melting temperature 65 °C) may be used as melting particles provided that the ambient temperature equals 20 °C.

## **11 Moisture resistance, insulation resistance and electric strength**

### **11.1 Holders shall be moisture-proof.**

*Compliance is checked as follows.*

*The humidity treatment is carried out in a humidity cabinet containing air with a relative humidity maintained between 91 % and 95 %. The temperature of the air, at all places where specimens can be located, is maintained within 1 °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 two days (48 h).*

*After this treatment, the holders shall show no damage within the meaning of this standard.*

### **11.2 The insulation resistance and the electric strength of the holders shall be adequate**

- between live parts of different polarity;
- between such live parts and external metal parts, including fixing screws.

*Compliance is checked by an insulation resistance measurement according to 11.2.1 and by an electric strength test according to 11.2.2 in the humidity cabinet or the room in which the holder was brought to the prescribed temperature.*

NOTE Unenclosed lampholders are tested for insulation resistance and electric strength between live parts and external metal parts only after appropriate installation in a luminaire or other additional enclosure, when that equipment is tested according to its own standard.

**11.2.1** Immediately after the moisture treatment, the insulation resistance is measured with a d.c. voltage of approximately 500 V, the measurement being made 1 min after application of the voltage. The insulation resistance is measured consecutively between the parts mentioned in table 1 and shall be not less than the value shown.

**Table 1 – Minimum values of insulation resistance**

Insulation to be tested	Minimum value of insulation resistance	
	MΩ	
	Rated voltage up to and including 50 V	Rated voltage over 50 V
Between live parts of different polarity	1	2
Between live parts connected together and external metal parts intended to be earthed	—	2
Between live parts connected together and external metal parts including fixing screws and metal foil covering external parts of insulating material in lampholders without provision for earthing	1	4

**11.2.2** The electric strength test is made immediately after the measurement of the insulation resistance.

*The test voltage is applied consecutively between the same parts as indicated for the measurement of the insulation resistance.*

*The insulation is subjected for 1 min to an a.c. voltage of substantially sinewave form, with a frequency of 50 Hz or 60 Hz and with an r.m.s. value as follows:*

- *for lampholders with a rated voltage up to and including 50 V, the test voltage is 500 V;*
- *between the lamp contacts of lampholders, the electric strength test voltage is twice the working voltage;*
- *for all other cases, the electric strength test voltage is equal to  $(2U + 1\ 000)$  V (where  $U$  is the rated voltage).*

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

*No flashover or breakdown shall occur during the test.*

NOTE Electric strength test requirements with regard to distances subjected to pulse voltages are under consideration.

## 12 Mechanical strength

Holders shall have adequate mechanical strength.

*The mechanical strength of external parts of insulating material with or without a conductive outer surface is checked by means of the pendulum hammer test specified in IEC 60068-2-75, subject to the following details (see clause 4 of IEC 60068-2-75):*

a) *Method of mounting*

*Direct, as prescribed in IEC 60068-2-75.*

*Combined pairs of holders shall be mounted with their relevant bracket.*

*Connectors shall be held against the support.*

NOTE For connectors different from the cylindrical shape, the condition of the axis parallel to the support may be obtained by adequate pinewood shimmings.

b) *Height of fall*

*The striking element shall fall from one of the heights given in the following table:*

<b>Material</b>	<b>Height of fall</b> mm
Ceramic parts	100 ± 1
Parts made of other material	150 ± 1,5

c) *Number of impacts*

*Four blows shall be applied to points equally divided over the surface of the external parts.*

d) *Preconditioning*

*Not applicable.*

e) *Initial measurements*

*Not applicable.*

f) *Attitudes and impact locations*

*See c) above.*

g) *Operating mode and functional monitoring*

*The sample shall not operate during impact.*

h) *Acceptance and rejection criteria*

*After the test, the sample shall show no serious damage within the meaning of this standard, in particular:*

*1) live parts shall not have become accessible.*

*Damage to the lampholder which does not reduce creepage distances or clearances below the values specified in clause 14 and small chips which do not adversely affect the protection against electric shock or ingress of water shall be ignored;*

*2) cracks not visible to the naked eye and surface cracks in fibre-reinforced mouldings and the like shall be ignored.*

*Cracks or holes in the outer surface of any part of the lampholder shall be ignored if the lampholder complies with this standard even if that part is omitted.*

i) *Recovery*

*Not applicable.*

j) *Final measurements*

*See h) above.*

NOTE The mechanical strength of lampholders used in luminaires or other equipment may be checked by means of the spring hammer specified in IEC 60068-2-75. In IEC 60598-1, the test impact energy used varies from 0,2 Nm to 0,7 Nm depending on component material and luminaire type.

### **13 Screws, current-carrying parts and connections**

Screws, current-carrying parts and mechanical connections, the failure of which might cause the holder to become unsafe, shall withstand the mechanical stresses occurring in normal use.

*Compliance is checked by inspection and the tests of subclauses 4.11 and 4.12 of clause 4 of IEC 60598-1.*

NOTE Examples of suitable metals for current-carrying parts with regard to mechanical strength, electrical conductivity and resistance to corrosion, when used within the permissible temperature range and under normal conditions of chemical pollution, are given in annex B.

### **14 Creepage distances and clearances**

Live parts and adjacent metal parts shall be adequately spaced. Creepage distances and clearances shall be not less than the values shown in tables 2a and 2b.

NOTE The distances specified in Table 2a apply to impulse withstand category II, the distances specified in Table 2b apply to impulse withstand category III in accordance to IEC 60664-1 and both tables refer to pollution degree 2, where normally only non-conductive pollution occurs but occasionally a temporary conductivity caused by condensation must be expected. For information on distances for other impulse withstand categories or higher pollution degrees, IEC 60664-1 should be consulted.

Attention is drawn to the fact that the values for creepage distance and clearance given in this clause are the absolute minimum.

The voltages shown in tables 2a and 2b are working voltages, not ignition voltages.

**Table 2a – Minimum distances for a.c. (50Hz/60 Hz) sinusoidal voltages – Impulse withstand category II**

Distances mm	Working voltage V			
	50	150	250	500
1 Between live parts of different polarity, and 2 Between live parts and external metal parts, or the outer surface of parts of insulating material which are permanently fixed to the holder <sup>1)</sup> , including screws or devices for fixing covers or fixing the holder to its support: – Creepage distances insulation PTI <sup>2)</sup> ≥ 600 PTI <sup>2)</sup> < 600 – Clearances	0,6  1,2  0,2	0,8  1,6  0,8	1,5  2,5  1,5	3  5  3
3 Between live parts and the mounting surface or a loose metal cover, if any, if the construction does not ensure that the values under item 2 are maintained under the most unfavourable circumstances: – Clearances	0,6	0,8	1,5	3
1) The distances between live contacts and the lampholder face (reference plane) shall, however, be in accordance with the relevant standard sheets of IEC 60061-2. 2) PTI (proof tracking index) in accordance with IEC 60112. – In the case of creepage distances to parts not energized or not intended to be earthed, where no tracking can occur, the values specified for material with PTI ≥ 600 apply for all materials (in spite of the real PTI). – For creepage distances subjected to working voltages of less than 60 s duration, the values specified for material with PTI ≥ 600 apply for all materials – For creepage distances not liable to contamination by dust or moisture, the values specified for material with PTI ≥ 600 apply for all materials (independent of the real PTI).  Values for creepage distances and clearances may be found for intermediate values of working voltages by linear interpolation between tabulated values. No values are specified for working voltages below 25 V as the voltage test of 11.2.2 is considered sufficient.  In Japan, the values given in the table are not applicable. Japan requires larger values than the values given in the table.				

**Table 2b – Minimum distances for a.c. (50 Hz/60 Hz) sinusoidal voltages – Impulse withstand category III**

Distances mm	Working voltage V			
	50	150	250	500
1 Creepage distances between live parts of different polarity	0,6	0,8	1,5	3
2 Between live parts and external metal parts, or the outer surface of parts of insulating material which are permanently fixed to the holder <sup>1)</sup> , including screws or devices for fixing covers or fixing the holder to its support:				
– Creepage distances				
insulation PTI <sup>2)</sup> ≥ 600	0,6	1,5	3	4
PTI <sup>2)</sup> < 600	1,2	1,6	3	5
– Clearances	0,2	1,5	3	4
3 Between live parts and the mounting surface or a loose metal cover, if any, if the construction does not ensure that the values under item 2 are maintained under the most unfavourable circumstances:				
– Clearances	0,6	1,5	3	4
1) The distances between live contacts and the lampholder face (reference plane) shall, however, be in accordance with the relevant standard sheets of IEC 60061-2.				
2) PTI (proof tracking index) in accordance with IEC 60112.				
– In the case of creepage distances to parts not energized or not intended to be earthed, where no tracking can occur, the values specified for material with PTI ≥ 600 apply for all materials (in spite of the real PTI).				
– For creepage distances subjected to working voltages of less than 60 s duration, the values specified for material with PTI ≥ 600 apply for all materials				
– For creepage distances not liable to contamination by dust or moisture, the values specified for material with PTI ≥ 600 apply for all materials (independent of the real PTI).				
Values for creepage distances and clearances may be found for intermediate values of working voltages by linear interpolation between tabulated values. No values are specified for working voltages below 25 V as the voltage test of 11.2.2 is considered sufficient.				
In Japan, the values given in the table are not applicable. Japan requires larger values than the values given in the table.				

However, the distances between live contacts and the lampholder face (reference plane) shall be in accordance with the values given in the relevant holder sheets of IEC 60061-2, if required.

In the case of non-sinusoidal pulse voltages, the clearances shall be not less than the values shown in the following table.

**Table 3 – Minimum distances for non-sinusoidal pulse voltages**

Rated pulse peak voltage kV	2	2,5	3	4	5	6	8	10	12	15	20	25	30	40	50	60	80	100
Minimum clearance mm	1	1,5	2	3	4	5,5	8	11	14	18	25	33	40	60	75	90	130	170

The distances specified in the table are derived from IEC 60664-1 (inhomogeneous field conditions). For distances subjected to both sinusoidal voltage as well as non-sinusoidal pulses, the minimum required distance shall be not less than the highest value indicated in either table.

For clearance distances without influence on safety, e.g. distances between the contacts, advantage might be taken from improved field conditions, but also in this case the values for the homogenous fields (see IEC 60664-1) remain the absolute minimum.

*Compliance is checked by tests with the rated pulse voltage of the holder. Voltage drops are not permissible.*

Creepage distances shall be not less than the required minimum clearances.

## 15 Endurance

Lampholders shall maintain good electrical contact with the lamp contacts.

*Compliance is checked by the following endurance test.*

*A commercial lamp cap, in accordance with an IEC standard, if applicable, shall be inserted 10 times into and removed 10 times from the holder.*

*A test cap made of steel having the same dimensions as the test cap mentioned in 10.4 is inserted. In the case of a combined pair of holders, the dummy lamp is replaced by a dummy lamp made of steel without shielding.*

*The holder is then placed in a heating cabinet with temperature control.*

*The temperature within the cabinet is adjusted so that, after thermal stabilization, the measuring point for the rated operating temperature attains  $90\text{ °C} \pm 5\text{ °C}$  or  $(T + 10)\text{ °C} \pm 5\text{ °C}$  for T-marked holders, while the holder is loaded with 1,1 times the rated current.*

*For lampholders which form an integral part of the luminaire, this temperature is replaced by that measured according to the operating conditions given in 12.4.2 of IEC 60598-1, plus 10 K, with a tolerance of  $\pm 5\text{ °C}$ .*

*After reaching and maintaining this temperature, the holder remains for 48 h under these conditions.*

*After this period, the lampholder is removed from the heating cabinet and allowed to cool down for 24 h without the test cap or the dummy lamp, respectively.*

*During the test, the holder shall not undergo any change impairing its further use, especially in the following respects:*

- there is no reduction of protection against electric shock;*
- there is no loosening of electrical contacts;*
- there are no cracks, swelling or shrinking;*
- the holder complies with the gauges of IEC 60061-3, as far as they exist.*

After the endurance test, the resistance of the lampholder contacts and connections is measured as follows:

- a test cap or a dummy lamp as specified in 10.4 is inserted in the lampholder and a current equal to the rated current of the lampholder is allowed to flow for a time just sufficient for the resistance to be measured;
- on lampholders equipped with leads, the resistance is measured between the leads 5 mm from where they come out of the holder;
- on lampholders without leads, it is necessary to attach leads of the minimum size for which the holder was designed (but not less than 0,5 mm<sup>2</sup> copper wire). The resistance is measured between the leads 5 mm from where they come out of the holder;
- the test cap used shall have minimum dimensions of the relevant standard sheet of IEC 60061-1 and its contacts shall be made of brass and shall be carefully cleaned and polished;
- the test cap shall be fully seated in the holder, irrespective of the position of the plunger, if any;
- for double-ended lamps, the combined pair of holders is measured. In this case the dummy lamp mentioned in 10.4 is used.

The measured resistance shall not exceed the following value:

$$0,045 \Omega + (A \times n)$$

with

$$A = 0,01 \Omega, \text{ if } n = 2;$$

$$A = 0,015 \Omega, \text{ if } n > 2$$

where  $n$  is the number of separate contact points between holder and cap which are included in the measurement.

Care should be taken that oxidation of the cable insulation will not influence the resistance measurement, for example by removing the insulation from the cable.

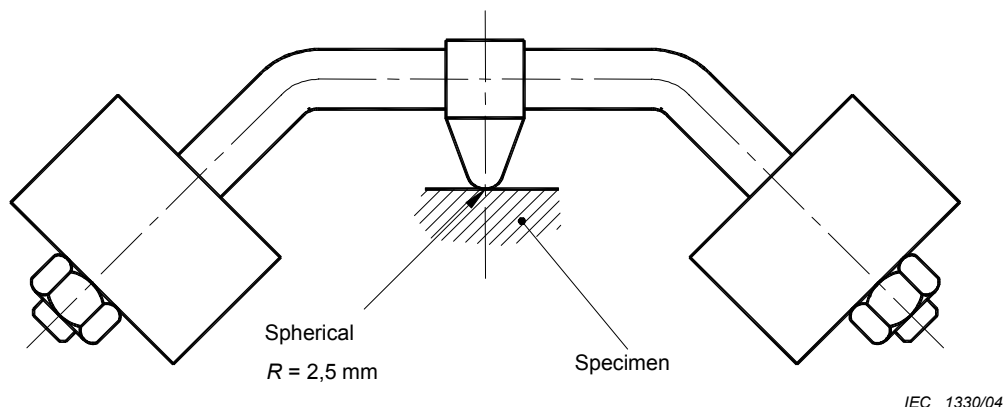
## 16 Resistance to heat and fire

**16.1** External parts of insulating material providing protection against electric shock and parts of insulating material retaining live parts or ELV parts in position shall be resistant to heat.

Compliance is checked by subjecting the parts to a ball-pressure test by means of the apparatus shown in figure 1.

All the tests required by clause 16 of this standard (except 16.6) are not performed on lampholders which are integral with a luminaire, as similar tests are required in section 13 of IEC 60598-1. However, the operating conditions of these tests will take into account the ones specific to lampholders and defined in clause 16 of this standard.





**Figure 1 – Ball-pressure test apparatus**

*The test is not made on parts of ceramic material or on the insulation of wiring.*

*The surface of the part under test is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against this surface by a force of 20 N.*

*The test is made in a heating cabinet having a temperature of  $25\text{ °C} \pm 5\text{ °C}$  in excess of the operating temperature (see 5.2) with a minimum temperature of  $125\text{ °C}$  when parts retaining live parts in position are tested.*

*The test load and the supporting means are placed within the heating cabinet for a sufficient time to ensure that they have attained the stabilized testing temperature before the test commences.*

*The part to be tested is placed in the heating cabinet for a period of 1 h, before the test load is applied.*

*If the surface under test bends, the part where the ball presses is supported. For this purpose, if the test cannot be made on the complete specimen, a suitable part may be cut from it.*

*The specimen should be at least 2,5 mm thick, but if such a thickness is not available on the specimen, then two or more pieces are placed together.*

*After 1 h the ball is removed from the specimen which is then immersed within 10 s in cold water for cooling down to approximately room temperature.*

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

NOTE In the event of curved surfaces, the shorter axis is measured if the indent is elliptical.

*In case of doubt, the depth of the impression is measured and the diameter  $\Phi$  calculated using the formula:  $\phi = 2\sqrt{p(5-p)}$ , in which  $p$  = depth of impression.*

**16.2** Parts of insulating material retaining live parts in position and external parts of insulating material providing protection against electric shock shall be resistant to flame and ignition.

*Compliance is checked by the tests of 16.3 or 16.4, as appropriate.*

These tests are not made on parts of ceramic material.

**16.3** External parts of insulating material, including those with a conductive exterior, providing protection against electric shock and parts of insulating material retaining ELV parts in position, are subjected to the glow-wire test in accordance with IEC 60695-2-11, subject to the following details.

- *The test specimen is a complete holder. It may be necessary to take away parts of the holder to perform the test, but care should be taken to ensure that the test conditions are not significantly different from those occurring in normal use.*
- *The test specimen is mounted on the carriage and pressed against the glow-wire tip with a force of 1 N, preferably 15 mm, or more, from the upper edge, into the centre of the surface to be tested. The penetration of the glow-wire into the specimen is mechanically limited to 7 mm.*

*If it is not possible to make the test on a specimen as described above because the specimen is too small, the above test is made on a separate specimen of the same material 30 mm x 30 mm square and with a thickness equal to the smallest thickness of the specimen and manufactured by the similar process.*

- *The temperature of the tip of the glow-wire is 650 °C. After 30 s the specimen is withdrawn from contact with the glow-wire tip.*

*The glow-wire temperature and heating current are constant for 1 min prior to commencing the test. Care should be taken to ensure that heat radiation does not influence the specimen during this period.*

*The glow-wire tip temperature is measured by means of a sheathed fine-wire thermocouple constructed and calibrated as described in IEC 60695-2-11.*

- *Any flame or glowing of the specimen shall extinguish within 30 s of withdrawing the glow-wire and any flaming drops shall not ignite a piece of five-layer tissue paper, specified in definition 4.187 of ISO 4046-4, spread out horizontally 200 mm ± 5 mm below the test specimen.*

**16.4** Parts of insulating material retaining live parts or ELV lamp contacts in position, are subjected to the needle-flame test in accordance with IEC 60695-2-2, subject to the following details.

- *The specimen is a complete lampholder. It may be necessary to take away parts of the holder to perform the test, but care should be taken to ensure that the test conditions are not significantly different from those occurring in normal use.*
- *The test flame is applied to the centre of the surface to be tested.*
- *The duration of application is 10 s.*
- *Any self-sustaining flame shall extinguish within 30 s of removal of the gas flame and any flaming drops shall not ignite a piece of five-layer tissue paper, specified in definition 4.187 of ISO 4046-4 spread out horizontally 200 mm ± 5 mm below the test specimen.*

**16.5** Insulating parts retaining live parts or ELV parts in position, or which are in contact with such parts shall be of material resistant to tracking if they are exposed to excessive deposit of moisture or dust.

*For materials other than ceramic, compliance is checked by the proof-tracking test in accordance with IEC 60112 subject to the following details.*

- *If the specimen has no flat surface of at least 15 mm x 15 mm, the test may be carried out on a flat surface with reduced dimensions provided drops of liquid do not flow off the specimen during the test. No artificial means should, however, be used to retain the liquid on the surface. In case of doubt the test may be made on a separate strip of the same material, having the required dimensions and manufactured by the same process.*
- *If the thickness of the specimen is less than 3 mm, two, or if necessary more, specimens shall be stacked to obtain a thickness of at least 3 mm.*

- The test shall be made at three places of the specimen or on three specimens.
- The electrodes shall be of platinum and test solution A, described in 7.3 of IEC 60112, shall be used.
- The specimen shall withstand 50 drops without failure at a test voltage of PTI 175.
- A failure has occurred if a current of 0,5 A or more flows for at least 2 s in a conducting path between the electrodes on the surface of the specimen, thus operating the overcurrent relay or if the specimen burns without releasing the overcurrent relay.
- Clause 9 of IEC 60112 regarding determination of erosion, does not apply.

**16.6** The resistance to heat of insulating material and/or outer parts of the lampholder is tested in a heating cabinet at a temperature of  $115\text{ °C} \pm 5\text{ °C}$  or  $(T + 35)\text{ °C} \pm 5\text{ °C}$  in the case of T-marked holders.

If the heat resistance of insulating material and/or outer parts deviates from the temperature marking of the holder, the test temperature is adjusted to  $35\text{ K} \pm 5\text{ K}$  above the heat resistance stated in the manufacturer's catalogue for these parts.

This test is not made on lampholders which are integral with the luminaire as a similar test is already given in IEC 60598-1.

The holder is fitted with a solid steel test cap or a dummy lamp made of steel as mentioned in clause 15.

The holder is placed in a heating cabinet having approximately half the test temperature. This temperature is raised to the required test temperature within  $1\text{ h} \pm 15\text{ min}$ . Following this, the test is continued for 168 h without interruption. The test temperature is maintained with a tolerance of  $\pm 5\text{ K}$ .

During the test, the holder shall not undergo any change impairing its further use, especially in the following respects:

- there is no reduction of protection against electric shock;
- there is no loosening of electrical contacts;
- there are no cracks, swelling or shrinking;
- the holder complies with the gauges of IEC 60061-3 as far as they exist.

The use of the gauges is not intended for checking the reality of the contact, but only for checking the possible deformation of moulded materials.

In addition, the holder shall withstand the mechanical strength test made under conditions specified in clause 12, the height of fall, however, being reduced to 50 mm.

The sealing compound shall not flow to such an extent that live parts are exposed; a mere displacement of the compound is neglected.

## **17 Resistance to excessive residual stresses (season cracking) and to rusting**

**17.1** Contacts and other parts of rolled sheet of copper or copper alloy, the failure of which might cause the holder to become unsafe, shall not be damaged due to excessive residual stresses.

*Compliance is checked by the following test.*

*The surfaces of the specimens are carefully cleaned, varnish being removed by acetone, grease and finger prints by petroleum spirit or the like.*

*The specimens are placed for 24 h in a test cabinet, the bottom of which is covered by an ammonium chloride solution having a pH value of 10 (for details of the test cabinet, the test solution and the test procedure see annex C).*

*After this treatment, the specimens are washed in running water; 24 h later they shall show no cracks when inspected at an optical magnification of 8 x.*

**17.2** Ferrous parts, the rusting of which may endanger the safety of the holder, shall be adequately rust-protected.

*Compliance is checked by the following test.*

*All grease is removed from the parts to be tested by immersion in a suitable degreasing agent for 10 min.*

*The parts are then immersed for 10 min in a water solution of 10 % ammonium chloride at a temperature of  $20\text{ °C} \pm 5\text{ °C}$ . Without drying, but after shaking off drops of water, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of  $20\text{ °C} \pm 5\text{ °C}$ .*

*After the specimens have been dried for 10 min in a heating cabinet at a temperature of  $100\text{ °C} \pm 5\text{ °C}$ , any traces of rust on sharp edges and yellowish film may be removed by rubbing, after which their surfaces shall show no signs of rust.*

*For small helical springs and the like and for ferrous parts exposed to abrasion, a layer of grease is deemed to provide sufficient rust protection. Such parts are not subjected to the test.*

**Annex A**  
(normative)

**Examples of lampholders covered by this standard**

Built-in lampholders used with general purpose light sources, projection lamps, floodlighting lamps and street lighting lamps provided with the caps listed below are covered by this standard (see 1.1).

This list is not exhaustive.

<b>Lampholders</b>	<b>Lampholder sheet (see IEC 60061-2)</b>
B22d-3	7005-10A
BY22d	7005-17
Fa4	7005-..
Fc2	7005-114
G1.27, GX1.27	7005-..
GUX2.5d, GUY2.5d, GUZ2.5d	7005-137
G2.54, GX2.54	7005-..
G3.17	7005-..
G4	7005-72
GU4	7005-108
GZ4	7005-67
G5.3	7005-73
G5.3-4.8	7005-126
GU5.3	7005-109
GX5.3	7005-73A
GY5.3	7005-73B
G6.35, GX6.35, GY6.35	7005-59
GZ6.35	7005-59A
GU7	7005-113
GZX7d-., GZY7d-., GZZ7d	7005-136
G8.5	7005-122
G9	7005-129
G9.5	7005-70
GX9.5	7005-70A
GY9.5, GZ9.5	7005-70B
GU10	7005-121
GZ10	7005-120
G12	7005-63
GY16	7005-..
G17q, GX17q, GY17q	7005-45
G22	7005-75
G38	7005-76
PG12 & PGX12	7005-64
PG22-6.35	7005-..
P28s	7005-42
P30s-10.3	7005-44
P40	7005-43
R7s, RX7s	7005-53/53A
SX4s	7005-..
SY4s	7005-..

**Annex B**  
(normative)

**Examples of suitable metals**

Examples of suitable metals for current-carrying parts, referred to in clause 13, when used within the permissible temperature range and under normal conditions of chemical pollution are

- copper; an alloy containing at least 58 % copper for parts made from rolled sheet (in cold condition) or at least 50 % copper for other parts;
- stainless steel; containing at least 13 % chromium and not more than 0,09 % carbon;
- steel; provided with an electroplated coating of zinc, according to ISO 2081, with coating having a thickness of at least 5 µm ISO service condition No. 1 (for ordinary equipment);
- steel; provided with an electroplated coating of nickel and chromium according to ISO 1456, the coating having a thickness of at least 20 µm ISO service condition No. 2 (for ordinary equipment);
- steel; provided with an electroplated coating of tin, according to ISO 2093, the coating having a thickness of at least 12 µm ISO service condition No. 2 (for ordinary equipment);
- pure nickel (at least 99 %).
- silver (at least 90 %).

## Annex C (normative)

### Season cracking/corrosion test

NOTE In the interest of environmental protection, the following requirements relating to test solution, volume and volume of vessel may be modified at the discretion of the test laboratory. In this event, the test vessel should retain a volume in the range 500 to 1 000 times larger than the volume of the sample and the volume of test solution should be such that the ratio of vessel volume to solution volume is in the range of 20:1 to 10:1. In case of doubt, however, the conditions of C.1 apply.

#### C.1 Test cabinet

*Closable glass vessels shall be used for the test. These may, for example, be desiccator vessels or simple glass troughs with ground rim and lid. The vessels' volume shall be at least 10 l. A certain ratio of test space to volume of test solution shall be maintained (20:1 to 10:1).*

#### C.2 Test solution

*Preparation of 1 l of solution*

*Dissolve 107 g ammonium chloride (reagent grade NH<sub>4</sub>Cl) in about 0,75 l of distilled or fully demineralized water and add as much of 30 % sodium hydroxide solution (prepared from reagent grade NaOH and distilled or fully demineralized water) as is necessary to reach a pH value of 10 at 22 °C. For other temperatures, adjust this solution to the corresponding pH values specified in the following table.*

Temperature °C	Test solution pH
22 ± 1	10,0 ± 0,1
25 ± 1	9,9 ± 0,1
27 ± 1	9,8 ± 0,1
30 ± 1	9,7 ± 0,1

*After the pH adjustment, make up to 1 l with distilled or fully demineralized water. This does not change the pH value any further.*

*Keep the temperature constant in any event to within ±1 °C during the pH adjustment, and carry out the pH measurement using an instrument which permits an adjustment of the pH value to within ±0,02.*

*The test solutions may be used over a prolonged period, but the pH value, which represents a measure of the ammonia concentration in the vapour atmosphere, shall be checked at least every three weeks and adjusted if necessary.*

### **C.3 Test procedure**

*Introduce, preferably suspended, the specimens in the test cabinet in such a way that the ammonia vapour can take effect unhindered.*

*The specimens shall not dip into the test solution nor touch each other.*

*Supports or suspension devices shall be made of materials which are not susceptible to attack by ammonia vapour, e.g. glass or porcelain.*

*Testing shall be carried out at a constant temperature of  $(30 \pm 1)$  °C to exclude visible condensed water formation caused by temperature fluctuations, which could severely falsify the test result.*

*Prior to testing, the test cabinet containing the test solution shall be brought to a temperature of  $(30 \pm 1)$  °C. The test cabinet shall subsequently be filled as quickly as possible with the specimens pre-heated to 30 °C and closed.*

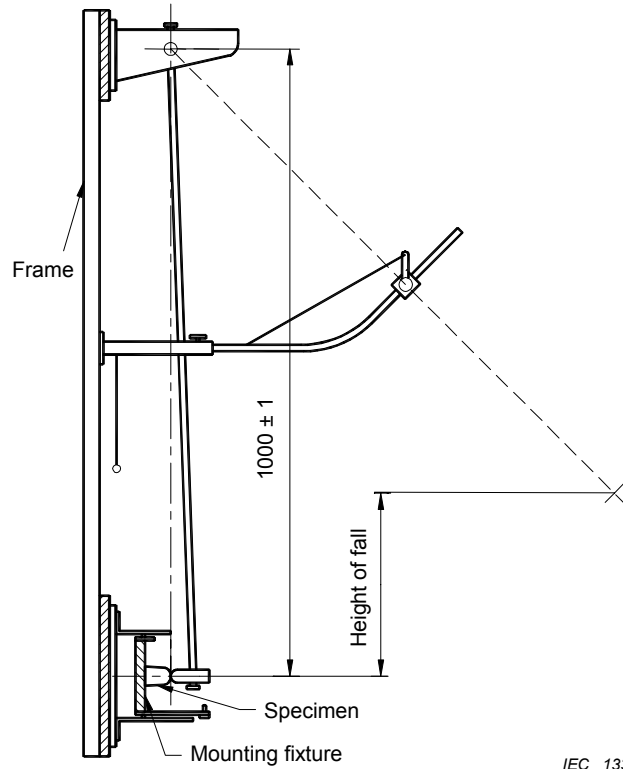
*This moment is to be considered the beginning of the test.*



**Annex D**  
 (normative)

**Pendulum impact test apparatus**

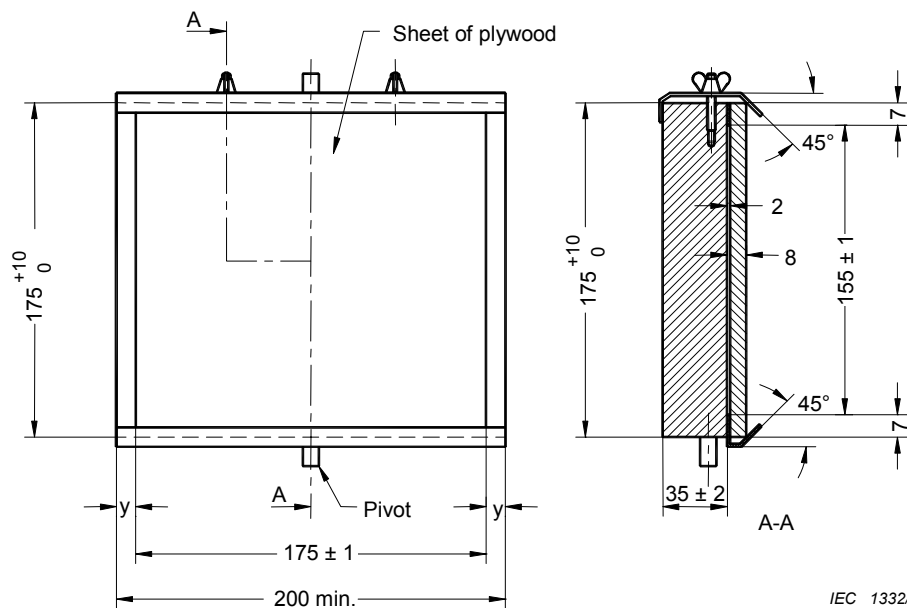
*Dimensions in millimetres*



NOTE For information this drawing has been retained in this standard, although there is a basic standard. In case of doubt regarding the drawing refer to IEC 60068-2-75.

**Figure D.1 – Impact test apparatus**

*Dimensions in millimetres*



**Figure D.2 - Mounting fixture**

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE Where 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 60061 (mod)	Series	Lamp caps and holders together with gauges for the control of interchangeability and safety	EN 60061	Series
IEC 60061-1 (mod)	- <sup>1)</sup>	Part 1: Lamp caps	EN 60061-1	1993 <sup>2)</sup>
IEC 60061-2 (mod)	- <sup>1)</sup>	Part 2: Lampholders	EN 60061-2	1993 <sup>2)</sup>
IEC 60061-3 (mod)	- <sup>1)</sup>	Part 3: Gauges	EN 60061-3	1993 <sup>2)</sup>
IEC 60068-2-20	1979	Basic environmental testing procedures Part 2: Tests - Test T: Soldering	HD 323.2.20 S3 <sup>3)</sup>	1988
IEC 60068-2-75	1997	Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	1997
IEC 60112	1979	Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions	HD 214 S2 <sup>4)</sup>	1980
IEC 60227 <sup>5)</sup>	Series	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V	-	-
IEC 60238	2004	Edison screw lampholders	EN 60238	2004
IEC 60245 <sup>6)</sup>	Series	Rubber insulated cables - Rated voltages up to and including 450/750 V	-	-

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1) Undated reference.

2) Valid edition at date of issue.

3) HD 323.2.20 S3 includes A2:1987 to IEC 60068-2-20.

4) HD 214 S2 is superseded by EN 60112:2003, which is based on IEC 60112:2003.

5) The HD 21 series, which is related to, but not directly equivalent with the IEC 60227 series, applies instead.

6) The HD 22 series, which is related to, but not directly equivalent with the IEC 60245 series, applies instead.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60352-1	- <sup>1)</sup>	Solderless connections Part 1: Wrapped connections - General requirements, test methods and practical guidance	EN 60352-1	1997 <sup>2)</sup>
IEC 60399	- <sup>1)</sup>	Barrel thread for lampholders with shade holder ring	EN 60399	2004 <sup>2)</sup>
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
A1	1999		+ corr. May A1	1993 2000
IEC 60598-1 (mod)	- <sup>1)</sup>	Luminaires Part 1: General requirements and tests	EN 60598-1	2004 <sup>2)</sup>
IEC 60664-1	1992	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests		
+ A1	2000			
+ A2	2002		EN 60664-1	2003
IEC 60695-2-2	- <sup>1)</sup>	Fire hazard testing Part 2: Test methods – Section 2: Needle-flame test	EN 60695-2-2	1994
IEC 60695-2-11	- <sup>1)</sup>	Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	2001 <sup>2)</sup>
ISO 1456	2003	Metallic coatings - Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium	-	-
ISO 2081	1986	Metallic coatings - Electroplated coatings of zinc on iron or steel	-	-
ISO 2093	1986	Electroplated coatings of tin - Specification and test methods	-	-
ISO 4046-4	2002	Paper, board, pulps and related terms - Vocabulary Part 4: Paper and board grades and converted products	-	-

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