

INTERNATIONAL STANDARD

Lampholders for tubular fluorescent lamps and starterholders

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INTERNATIONAL STANDARD

Lampholders for tubular fluorescent lamps and starterholders

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**LAMPHOLDERS FOR TUBULAR FLUORESCENT
LAMPS AND STARTERHOLDERS**

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International Standard IEC 60400 has been prepared by subcommittee 34B: Lamp caps and holders, of IEC technical committee 34: Lamps and related equipment.

This eighth edition cancels and replaces the seventh edition published in 2008, Amendment 1:2011 and Amendment 2:2014. This edition constitutes a technical revision.

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

- a) alignment with ISO/IEC drafting rules;
- b) renumbering of clauses, tables and figures.

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

FDIS	Report on voting
34B/1900/FDIS	34B/1911/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this standard, the following print types are used:

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

LAMPHOLDERS FOR TUBULAR FLUORESCENT LAMPS AND STARTERHOLDERS

1 Scope

This document states the technical and dimensional requirements for lampholders for tubular fluorescent lamps and for starterholders, and the methods of test to be used in determining the safety and the fit of the lamps in the lampholders and the starters in the starterholders.

This document covers independent lampholders and lampholders for building-in, used with tubular fluorescent lamps provided with caps as listed in Annex A, and independent starterholders and starterholders for building-in, used with starters in accordance with IEC 60155, intended for use in AC circuits where the working voltage does not exceed 1 000 V r.m.s.

This document also covers lampholders for single-capped tubular fluorescent lamps integrated in an outer shell and dome similar to Edison screw lampholders (e.g. for G23 and G24 capped lamps). Such lampholders are tested in accordance with the following clauses and subclauses of IEC 60238: 9.4; 9.5; 9.6; 10.3; 11.7; 12; 13.2; 13.5; 13.6; 13.7; 14; 16.3; 16.4; 16.5 and 16.9.

This document also covers lampholders which are integral with a luminaire or intended to be built into appliances. It covers the requirements for the lampholder only. For all other requirements, such as protection against electric shock in the area of the terminals, the requirements of the relevant appliance standard are applicable and tested after building into the appropriate equipment, when that equipment is tested according to its own standard. Lampholders for use by luminaire manufacturers only are not for retail sale.

This document also applies, as far as is reasonable, to lampholders and starterholders other than the types explicitly mentioned above and to lamp connectors.

Where the term "holder" is used in this document, both lampholders and starterholders are intended.

Where the term "bi-pin lampholder" is used, lampholders for wedged caps are also intended.

2 Normative references

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

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

IEC 60081, *Double-capped fluorescent lamps – Performance specifications*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*
IEC 60112:2003/AMD1:2009

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60352-1:1997, *Solderless connections – Part 1: Wrapped connections – General requirements, test methods and practical guidance*

IEC 60399, *Barrel thread for lampholders with shade holder ring*

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

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

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

IEC 60695-11-5:2016 *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

ISO 4046-4:2016, *Paper, board, pulps and related terms – Vocabulary – Part 4: Paper and board grades and converted products*

3 Terms and definitions

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

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

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

3.1

rated voltage

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

3.2

working voltage

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

3.3

flexible lampholders for linear double-capped fluorescent lamps

pair of lampholders in which the base of each holder is rigidly mounted in the luminaire but which has one or both of the lampholders so designed as to allow axial movement of the contacts to provide compensation for variations in lamp lengths and, where necessary, to permit insertion and removal of the lamp

Note 1 to entry: In case of doubt as to whether a lampholder G5, GX5 or G13 provides the required axial movement of the contacts, a test with the device shown in Figure 3 can be carried out.

3.4**inflexible lampholders for linear double-capped fluorescent lamps**

pair of lampholders intended for rigid mounting and in which no axial movement of the contacts is provided or is needed, either for the insertion and removal of the lamp or as compensation for variation in lamp lengths

3.5**flexibly mounted lampholders for linear double-capped fluorescent lamps**

pair of lampholders which do not in themselves provide for any axial movement of the contact system but which are intended to be mounted in a luminaire in a specified manner so that the combination provides the necessary axial movement of the contact system

Note 1 to entry: Lampholders of this type may or may not also be suitable for rigid mounting.

3.6**lamp connectors**

set of contacts mounted on flexible conductors which provide for electrical contact but do not support the lamp

3.7**holder for building-in**

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

3.7.1**unenclosed holder**

holder for building-in so designed that it requires additional means, for example an enclosure, to meet the requirements of IEC 60400 with regard to protection against electric shock

3.7.2**enclosed holder**

holder for building-in so designed that on its own it fulfils the requirements of IEC 60400 with regard to protection against electric shock and IP classification, if appropriate

3.8**independent holder**

holder so designed that it can be mounted separately from a luminaire and at the same time providing all the necessary protection according to its classification and marking

3.9**rated operating temperature**

highest temperature for which the holder is designed

3.10**rated lampholder rearside temperature**

rearside temperature for lampholders with T marking ascertained by test b) in 18.1 of IEC 60400, or a higher temperature as declared by the manufacturer

3.11**type test**

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

3.12**type test sample**

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

3.13

live part

conductive part which may cause an electric shock

3.14

rated ignition voltage

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

3.15

multilamp ballast

electronic mains ballast designed and declared to comply for the application of lamps with different keys

3.16

impulse withstand category

numeral defining a transient overvoltage condition

Note 1 to entry: 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.

3.17

primary circuit

circuit which is directly connected to the AC mains supply

Note 1 to entry: It includes, for example, the means for connection to the AC mains supply, the primary windings of transformers, motors and other loading devices.

3.18

secondary circuit

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

Note 1 to entry: *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 2 to entry: Mains transients in such a circuit are attenuated by the corresponding primary windings. In addition, 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.

3.19**basic insulation**

insulation applied to live parts to provide basic protection against electric shock

Note 1 to entry: Basic insulation does not necessarily include insulation used exclusively for functional purposes.

3.20**supplementary insulation**

independent insulation applied in addition to basic insulation in order to provide protection against electric shock in the event of a failure of basic insulation

3.21**double insulation**

insulation comprising both basic insulation and supplementary insulation

3.22**reinforced insulation**

single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified

Note 1 to entry: The term "insulation system" does not imply that the insulation shall be one homogeneous piece. It can comprise several layers which cannot be tested singly as supplementary or basic insulation.

3.23**enclosed reinforced insulated lampholder**

lampholder for building-in so designed that on its own it fulfils the requirements for double or reinforced insulated parts in class II applications

3.24**partly reinforced insulated lampholder**

lampholder for building-in, so designed that some parts of the lampholder require additional means to fulfil the requirements with regard to double or reinforced insulation

Note 1 to entry: In some cases, the dimensions might be achieved only after mounting into the luminaire.

3.25**rated current**

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

[SOURCE: IEC 60838-1:2016 3.3]

3.26**critical frequency**

f_{crit}

frequency at which the reduction of the breakdown voltage of a clearance begins (occurs)

Note 1 to entry: $f_{crit} \approx 0,2/d$ [MHz] where d (in mm) is the clearance according to Table 3 (basic or supplementary insulation and reinforced insulation respectively) disregarding the frequency.

[SOURCE: IEC 61347-1:2015, 3.40, modified — the note has been added]

3.27**ignition voltage**

peak voltage applied to ignite a discharge lamp

[SOURCE: IEC 61347-1:2015, 3.46]

3.27.1

ignition pulse voltage

peak ignition voltage with a total duration of $\leq 750 \mu\text{s}$ (summation of all pulse durations) within 10 ms, with the duration time (width) of each pulse being measured at the level of 50 % of the maximum absolute peak value

Note 1 to entry: Ignition pulse waveforms, which are considered as ignition pulse voltage, should not contain any dominant frequency above 30 kHz or should be usually highly damped (after 20 μs the peak voltage level should be less than one half of the maximum peak voltage). For the assessment of the dominant frequency IEC 60664-4:2005, Annex E should be consulted.

[SOURCE: IEC 61347-1:2015, 3.46.1]

3.28

maximum working voltage

U_{out}
maximum occurring working voltage (r.m.s.) between the output terminals of a controlgear or between the output terminals and earth, during normal or abnormal operating condition

Note 1 to entry: Transients and ignition voltages have to be neglected.

[SOURCE: IEC 61347-1:2015, 3.33, modified — "of a controlgear" has been added]

3.29

maximum working peak output voltage

$\hat{U}_{\text{out}}$
maximum repetitive occurring peak working voltage between the output terminals of a controlgear or between its output terminals and earth, during normal or abnormal operating condition and with transients neglected

[SOURCE: IEC 61347-1:2015, 3.45, modified — "of a controlgear" has been added]

3.30

equivalent transformed peak voltage

U_p
transformed output peak voltage, which is converted for the worst case peak voltage with its related frequency into an ignition pulse voltage

Note 1 to entry: The value of the declared equivalent transformed output peak voltage is the essential parameter for selecting the associated components.

Note 2 to entry: See 3.27.1.

Note 3 to entry: To determine the declared equivalent transformed output peak voltage for basic insulation U_p [basic] the worst case combination of the maximum occurring peak voltage and frequency has to be taken into account, which means the maximum clearance according to IEC 61347-1:2015, Table 10 for basic insulation.

Note 4 to entry: To determine the declared equivalent transformed output peak voltage for the reinforced insulation U_p [reinforced] the worst case combination of the maximum occurring peak voltage and frequency has to be taken into account, which means the maximum clearance according to IEC 61347-1:2015, Table 11 for reinforced insulation.

[SOURCE: IEC 61347-1:2015, 3.47]

4 General requirement

Holders 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.

In addition, the enclosure of independent holders shall comply with the appropriate requirements of IEC 60598-1, including the classification and marking requirements of that standard.

5 General conditions for tests

5.1 Tests according to this document are type tests.

NOTE The requirements and tolerances given in this document are related to testing of a type test sample submitted for that purpose.

Compliance of the type test sample does not ensure compliance of the whole production of a manufacturer with this safety standard.

In addition to type testing, conformity of production is the responsibility of the manufacturer and can include routine tests and quality assurance.

For further information, see IEC 60061-4 (inclusion of guidance on conformity testing during manufacture is in preparation).

5.2 *Unless otherwise specified, the tests are made at an ambient temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and with the holder in the most unfavourable position for normal use.*

5.3 *The tests shall be carried out in the order of the clauses, unless another succession of tests is specified.*

Holders intended to provide an IP classification greater than IP20 shall be subjected to the tests in 12.1 and 12.2 after the test in 18.1.

5.4 *The tests and inspections are carried out on a total of:*

- *eight pairs of matching lampholders intended for linear double-capped fluorescent lamps;*

NOTE If a pair of lampholders consists of identical holders, it is sufficient for one holder instead of one pair to be subjected to all the tests, except for the test of item d) in 11.5, where one pair is used.

- *eight specimens intended for single-capped fluorescent lamps and eight starter-holders;*

in the order of the clauses, as follows:

- *two pairs or two specimens: Clause 6 up to and including Clause 17 (except for 10.2 and 10.5);*

NOTE The tests of 10.2 are carried out on the number of separate specimens as required by the relevant standards.

- *three pairs or three specimens: 10.5 and 18.1;*
- *two pairs or two specimens: 18.2 up to and including 18.5 (of which one specimen for the test in 18.2 and the other for the tests in 18.4 and 18.5);*
- *one pair or one specimen: 18.6 and Clause 19.*

In the case of flexible and inflexible lampholders G5, GX5 or G13 (see 3.3 and 3.4 respectively), the specimens are mounted on two pairs of mounting sheets as specified in Figure 2.

One pair of holders is mounted so as to represent the minimum mounting distance for this pair of holders according to the manufacturer's mounting instructions; the other pair is mounted at the maximum distance. The matching mounting sheets are marked.

In special cases, it may be necessary to test more than the number of specimens specified above.

Together with these specimens, the manufacturer's mounting instructions (see 8.3) shall be supplied.

For holders intended to provide an IP classification greater than IP20 with detachable gaskets having a maximum operating temperature different from the values in 18.1, an additional set of gaskets shall be supplied with the specimen, together with information on their maximum operating temperature (this is part of the manufacturer's mounting instructions).

This does not refer to detachable gaskets on the mounting surface of the holder (see 18.1).

5.5 *Holders are deemed to comply with this document if no specimen fails in the complete series of tests specified in 5.4.*

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 to the number required in 5.4, all specimens of which shall then comply with the repeated tests and with the subsequent tests. Holders are deemed not to comply with this document if there are more failures than that of one specimen in one of the tests.

In general, it will only be necessary to repeat the relevant test, unless the specimen fails in the tests according to Clause 14 or Clause 15, in which case the tests shall be repeated from the test according to Clause 13 onwards.

NOTE A second type test sample, which can be required should one specimen fail, can be submitted together with the first sample.

If the additional type test sample is not submitted at the same time, a failure of one specimen entails a rejection.

5.6 For verification purposes, Annex D gives an overview of clauses containing new or more stringent requirements with respect to the previous edition of this document.

6 Electrical rating

The electrical rating shall be:

- not less than 125 V and not more than 1 000 V AC r.m.s.;
- not less than 1 A;
- not less than 2 A for lampholders GX5, G13, 2G8, 2G13, G20, Fa6, Fa8 and R17d.

In countries where marking of rated wattage is required in place of rated current, the rating of the G5 lampholder should be not less than 75 W.

7 Classification

Holders are classified as follows.

7.1 According to the protection against electric shock:

- unenclosed lampholders;
- enclosed lampholders;
- independent lampholders;
- partly reinforced insulated lampholders;
- enclosed reinforced insulated lampholders.

Where a lampholder is used with a working voltage of 50 % or less of its maximum rating, it may be regarded as equivalent to a reinforced insulated lampholder.

7.2 According to the degree of protection against ingress of dust or water in accordance with the system of classification (IP Code) explained in IEC 60529.

Symbols for the degrees of protection are given in 8.4 (independent and enclosed holders only).

7.3 According to the resistance to heat:

- holders for rated operating temperatures up to and including 80 °C;
- holders for rated operating temperatures over 80 °C.

NOTE The measuring point for the operating temperature is that area of the lampholder where it touches the lamp cap.

7.4 Moreover, starterholders are classified according to the possibility of accepting different types of starters:

- starterholders intended for starters according to IEC 60155;
- starterholders intended for starters according to IEC 60155, Annex B only.

8 Marking

8.1 Holders shall be marked with the following:

- a) mark of origin (this may take the form of a trade mark, a manufacturer's identification mark or the name of the responsible vendor);
- b) type reference;

Available technical documentation of the manufacturer like printed catalogues or online catalogues should allow a clear identification of a lampholder either by a unique catalogue number or by an identifying reference on the holder, specifying the essential characteristic features and the basic design of the product supplemented by a clear description. Variations of the basic design, for example different cable length, fixing means, colours, which do not affect safety or performance of the lampholder, may be disregarded in the type reference marked on the product. Variations included in the type testing procedure are listed in the corresponding test reports.

- c) – rated voltage in volts
- rated ignition voltage, in kilovolts, if applicable and higher than
 - 2,5 kV for lamp holders rated 250 V;
 - 4 kV for lamp holders rated 500 V.

For holders where, during dimming, i.e. reduction of the load, exceeding of the marked voltage rating is permissible (increased creepage distances and clearances), the maximum allowed value under these operating conditions should be given in the manufacturer's catalogue or the like (for example, maximum dimming voltage: ...V).

- d) rated current, in amperes (see note to Clause 6);
- e) rated operating temperature T if greater than 80 °C, in steps of 10 °C;
- f) degree of protection against ingress of dust and water, for drip-proof holders only (see 8.4);

Marking of IP20 on ordinary holders is not required;

- g) for holders protected against dust and moisture, the holder manufacturer shall indicate in his instructions the nominal diameter of the lamp(s) or starter for which the holder is intended.

Compliance is checked by inspection.

8.2 The following information shall be indicated in the manufacturer's catalogue or the like. The indication shall correspond to the type reference on the products:

- the temperature T_m for the rearside of the holder, for holders tested according to item b) in 18.1. This marking can additionally been given on the holder;
- the temperature measured for the screwless terminals, for holders tested according to item b) in 18.1. This marking can additionally been given on the holder;
- a declaration in compliance with 10.3 of the cross-section of the conductor(s) for which the holder terminals are suitable. This marking can additionally been given on the holder;
- information that for lampholders according to this document, the distances for impulse withstand category II are applicable;
- information that enclosed reinforced insulated lampholders offer an adequate level of protection for use in luminaires where they are accessible in normal use;
- information that for partly reinforced insulated lampholders, sufficient creepage distances and clearances to outer accessible surface will require additional protection to some parts of the lampholder by the luminaire design or by the use of additional attachment(s) or cover(s);
- information that if a single holder G5/G13 is declared to be suitable to be connected directly across the mains, it enables the application of G5/G13 capped LED lamps without external controlgear;

Compliance is checked by inspection.

8.3 The instructions supplied by the holder manufacturer or responsible vendor in order to ensure correct mounting and operation of a pair of holders for linear double-capped fluorescent lamps shall contain at least the following information:

- method of mounting. For flexibly mounted holders, it shall be clearly stated whether both or only one of the methods of mounting is intended;

NOTE A pair of flexible holders could consist of two holders each having a spring or one holder with and the second without a spring. The two methods of mounting are with and without a separate spring for flexible mounting.

- mounting distance, with tolerance or reference to standard sheets;
- which holders shall be used as a pair;
- required mounting plate thickness, if the holder is designed for screwless mounting.

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

Compliance is checked by inspection.

8.4 If symbols are used, these shall be as follows:

a) for electrical rating:

- volt: V
- ampere: A
- watt: W

NOTE Alternatively, for volt and ampere ratings, figures can 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 a line.

Therefore, the marking of current and voltage may be as follows:

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

b) for operating temperature: T ,

followed by the operating temperature in degrees Celsius (°C), for example T 200

c) for degrees of protection against ingress of dust or water:

- ordinary: IP20
- protected against dripping water (drip-proof): IPX1
- protected against dripping water when tilted up to 15°: IPX2
- protected against spraying water (rain-proof): IPX3
- protected against splashing water (splash-proof): IPX4
- protected against water jet (jet-proof): IPX5
- protected against the effects of immersion (watertight): IPX7
- protected against submersion (pressure watertight): IPX8
- protected against ingress of solid objects greater than 1,0 mm: IP4X
- dust-protected (dust-proof): IP5X
- dust-tight: IP6X

Where X is used in an IP number in 8.4, it is intended to indicate a missing numeral in the symbol, but both the appropriate numerals in accordance with IEC 60529 shall be marked on the holder.

d) for cross-section of conductors:

- the relevant value, or values in the case of a range, in square millimetres (mm²), followed by a small square (for example 0,5 □)

Compliance is checked by inspection.

8.5 Marking shall be suitably placed.

The marking of items a) to e) in 8.1 on holders, when installed as in normal use, shall be easily discernible, covers being removed if necessary. If item f) is marked on holders for building-in, it shall not be visible when the holder is installed as in normal use, in order to avoid the mark being applied to the complete luminaire.

Compliance is checked by inspection.

8.6 Marking shall be durable and easily legible.

Compliance is checked by inspection and, after the tests of 18.1 have been completed, 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.

The petroleum spirit used typically consists 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 density of approximately 0,68 g/cm³.

9 Protection against electric shock

9.1 Holders shall be so designed that their live parts are not accessible when the holder has been built-in or installed and wired as in normal use and is fitted with the appropriate lamp and/or starter.

For enclosed holders, compliance is checked by means of the standard test finger shown in Figure 41. This test finger is applied in every possible position with a force of 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.

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

Unenclosed holders are only tested after appropriate installation in a luminaire or other additional enclosure.

9.2 Protection against electric shock shall be provided when the holder is installed as in normal use, both without lamp or starter, and during insertion or removal of the lamp and starter.

The insertion of only one pin of the lamp (in case of caps with more than one pin) or starter to the first point of contact shall be prevented. This requirement is not applicable to G10q holders.

In the case of side entry lampholders for linear G5, GX5 and G13 capped lamps, compliance is checked:

- *for lampholders G5 by means of gauge II as per IEC 60061-3, standard sheet 7006-47C, and*
- *for lampholders GX5 by means of gauge II as per IEC 60061-3, standard sheet 7006-47E, and*
- *for lampholders G13 by means of gauge II as per IEC 60061-3, standard sheet 7006-60C, with the gauge face touching the lampholder face.*

NOTE 1 A side entry holder is a holder where the cap pins enter the insertion slot(s) of the holder in a direction perpendicular to the lamp axis. For further information, see Figures C.1a), C.1b) and C.1c)

Lampholders incorporating a rotating part shall be tested with this part in the position of normal lamp insertion.

Protection against electric shock shall be ensured when a lamp is inserted into a lampholder at an angle not greater than 5° from the axis of the normal inserted position of the lamp. This requirement does not apply to lampholders G20, Fa6, Fa8 and R17d.

NOTE 2 For further information, see Figure C.1d).

Compliance is checked as follows:

- *for starterholders, by means of the standard test finger shown in Figure 41;*
- *for lampholders G5, by means of the gauge as per IEC 60061-3, standard sheet 7006-47A, and in conjunction with gauge II as per IEC 60061-3, standard sheet 7006-47C and the standard test finger shown in Figure 41;*

NOTE 3 To prevent electrical contact between the test finger and the metal body of gauge II, the "cap" face of the gauge is covered with insulating material, having a thickness not exceeding 0,1 mm.

- *for lampholders G13, by means of the gauge II as per IEC 60061-3, standard sheet 7006-60C and the standard test finger shown in Figure 41;*

NOTE 4 To prevent electrical contact between the test finger and the metal body of gauge II, the "cap" face of the gauge is covered with insulating material, having a thickness not exceeding 0,1 mm.

- *for lampholders GX5, by means of the gauge as per IEC 60061-3, standard sheet 7006-47A, and in conjunction with gauge II as per IEC 60061-3, standard sheet 7006-47E and the standard test finger shown in Figure 41;*

- for lampholders Fa8 and R17d, by means of a gauge having a cylindrical form with a hemispherical end radius of 5,2 mm;
- for all other lampholders, by means of the standard test finger shown in Figure 41.

9.3 Parts providing protection against electric shock shall have adequate mechanical strength and shall not work loose in normal use. It shall not be possible to remove these parts by hand.

Compliance is checked by inspection, by manual test and by the tests according to Clauses 14 and 15.

9.4 External parts of holders accessible after installation shall either be of insulating material or, if of conducting material, be adequately insulated from live parts of the holder.

Compliance is checked by inspection and by the relevant tests of this document.

10 Terminals

10.1 Holders 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).

Compliance is checked by inspection.

10.2 Terminals shall comply with the following requirements with the restriction that the requirements referring to internal wiring relate to wiring inside independent holders and to wiring inside luminaires for holders for building-in.

All terminal tests shall be made on separate specimens which have not been subjected to any other test:

- screw type terminals shall comply with Section 14 of IEC 60598-1;
- screwless terminals shall comply with Section 15 of IEC 60598-1; however, if the resistance to heat of the lampholder has to be tested in accordance with the test in 18.1 b), then the recorded screwless terminal temperature according to 18.1 b) shall apply for the test in Section 15 of IEC 60598-1;
- tabs or pins for push-on connections shall comply with Section 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 specified in 10.5.

10.3 Unless otherwise specified in Sections 14 and 15 of IEC 60598-1, terminals shall permit the connection of conductors with a cross-sectional core area from 0,5 mm² to 1,0 mm² for holders for building-in and from 1,0 mm² to 1,5 mm² for independent holders.

For lampholders exclusively designed to be built into a luminaire or other additional enclosure, deviations from this conductor size range are permitted but, in this case, the manufacturer shall state the conductor size(s) for which the terminal is designed.

It is recommended that lampholders employing spring or wedge type terminals be designed to accept connecting wires having stripped lengths ranging from a minimum of 8 mm to a maximum of 11,5 mm.

Compliance is checked by the appropriate tests in 10.2, with wires of the smallest and largest cross-sectional area fitted.

10.4 Any terminal shall be so located that the conductors can be easily introduced and connected and the cover, if any, can be fitted without any risk of damage to the conductors.

Compliance is checked by inspection and by manual test.

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

Leads shall be made of insulated conductors with a cross-sectional core area from 0,5 mm² to 1,0 mm².

Insulation of the free end of the leads may be stripped to expose the conductors.

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

Compliance is checked by inspection and by the following test which shall be made after the test in 18.1 on the same three specimens.

Each connecting lead is subjected to a pull of 50 N. The pull is applied without jerks for 1 min in the most unfavourable direction.

During the test, leads shall not move from their fixing.

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

10.6 Hinged lampholders shall be so constructed that wiring is not damaged.

For holders intended for wiring other than with flexible conductors, compliance is checked by the following test.

The holder is fitted with solid copper wires of the appropriate required cross-sectional area and fixed on a mounting plate in its intended operating position.

On the same mounting plate, a clamping device for the conductors is provided at a distance of 50 mm to the entrance opening of the terminals. The conductors are pulled taut and marked at the entrance opening of the clamping device.

An additional wire length measuring 30 mm is added to the length marked before clamping.

The holder is then moved over 45 cycles of operation. A cycle of operation is a movement from one extreme of the range to the other and back to the starting position. If no limitation is given, 90° is taken.

After the test, the holder shall comply with the following:

- *the measurement of the contact resistance shall be in accordance with Clause 14;*
- *the conductor shall show no deep or sharp indentations.*

11 Construction

11.1 Wood, cotton, silk, paper and similar hygroscopic materials are not allowed as insulation unless suitably impregnated.

Compliance is checked by inspection.

11.2 Holders shall be so designed that a lamp or starter as appropriate can be easily inserted and removed, and cannot work loose due to vibration or temperature variation.

Provisions for fixing holders shall be such that the fixed part of the holder cannot be turned.

NOTE Inflexible holders could also be flexibly mounted in the luminaire so that the assembly as a whole then acts as a pair of flexible holders.

Upon insertion of the lamp the pins shall not cause the lampholder contacts to be shorted.

Compliance is checked by inspection and by manual test, using a commercial lamp or starter, as appropriate.

Lampholders GX5 shall only be for side entry, requiring a single entry slot as shown in Figures C.3 and C.4.

Lampholders GX5 shall be of flexible type or flexibly mounted. The maximum mounting distance between a pair of GX5 lampholders without a lamp inserted shall be based on the minimum lamp length as given in IEC 60081. This information shall be given in the lampholder manufacturer's or responsible vendor's documents.

11.3 Holders shall be so designed that adequate contact force is provided.

Compliance is checked by inspection and by the tests in 11.3.1 to 11.3.4, as appropriate.

11.3.1 a) *For bi-pin lampholders G5, GX5, G13 and G20 making contact mainly along one side of each pin of the cap, the contact force is measured with a single-ended gauge having pin dimensions and pin distances according to the following sheets of IEC 60061-3:*

- *for lampholders G5: 7006-47B, gauges III and V;*
- *for lampholders GX5: 7006-47D, gauges IV and V;*
- *for lampholders G13: 7006-60B, gauges III and V;*
- *for lampholders G20: under consideration.*

The contact force is between:

- *2 N and 30 N for lampholders not providing support for the lamp pins;*
- *2 N and 35 N for lampholders G5 and GX5, when the lamp pins are supported by the holder construction;*
- *2 N and 45 N for lampholders G13 and G20, when the lamp pins are supported by the holder construction.*

First the maximum contact force is measured with a pin distance as shown for gauge V. This is followed by measurement of the minimum contact force with the pin distance of gauge III for lampholders G5 and G13 and with the pin distance of gauge IV for lampholders GX5.

b) For G5 and G13 lampholders, where contact is made by a tubular shaped contact, the contact force is checked with single pin gauge E according to standard sheet 7006-69E of IEC 60061-3.

Each contact of the lampholder shall retain the gauge with a force of at least 0,5 N (under consideration).

The test shall be carried out after the test with the "Go" gauges as mentioned in 11.5 d).

Contact making at the pin ends is not recommended for new lamp holder designs.

c) For lampholders G20: under consideration.

d) For bi-pin lampholders G5, GX5, G13 and G20 requiring a rotary motion for the insertion and removal of the lamp, the torque required shall be measured with single-ended gauges having pin dimensions and pin distances according to the following standard sheets of IEC 60061-3:

- for lampholders G5: 7006-47B, gauge V, and a second gauge of the same dimensions but with E and D changed to 2,44 mm and 4,4 mm respectively;
- for lampholders GX5: 7006-47D, gauge V, and a second gauge of the same dimensions but with E2 and D changed to 2,75 mm and 4,4 mm respectively;
- for lampholders G13: 7006-60B, gauge V, and a second gauge of the same dimensions but with E and D changed to 2,44 mm and 12,35 mm respectively;
- for lampholders G20: under consideration.

The torque required to insert the gauges until the position representing the operating position of the lamp is reached shall not exceed:

- 0,3 Nm for lampholders G5 and GX5;
- 0,5 Nm for lampholders G13 and G20.

The torque required to clear the gauges from the normal seated position shall be between:

- 0,02 Nm and 0,3 Nm for lampholders G5 and GX5;
- 0,1 Nm and 0,5 Nm for lampholders G13 and G20.

During complete removal of the gauges, the maximum values shall not be exceeded.

e) For bi-pin lampholders G5, G13, 2G13 and G20 requiring a lateral push-in motion for the insertion and the removal of the lamp, the force required is measured with single-ended gauges having pin dimensions and pin distances according to the following standard sheets of IEC 60061-3:

- for lampholders G5: 7006-47B, gauges IV and V and a third gauge of the same dimensions but with E and D changed to 2,44 mm and 4,4 mm respectively;
- for lampholders G13: 7006-60B, gauges IV and V and a third gauge of the same dimensions but with E and D changed to 2,44 mm and 12,35 mm respectively;
- for lampholders G20: under consideration.

The force required to insert and remove the gauges shall not exceed 50 N.

The force required to withdraw the gauges from the normal seated position shall be not less than 10 N.

During the torque and force testing, care should be taken that the front face of the gauges is kept parallel with the holder face.

As a preconditioning cycle, there shall be one clockwise and one anticlockwise rotation, or one insertion and withdrawal routine of each test device, before the initial measurement is taken.

In case this might influence the test results, conductors of the smallest and largest cross-sectional area for which the holder is designed are fitted to it.

11.3.2 *All other lampholders shall comply with the tests of the appropriate gauges in IEC 60061-3.*

11.3.3 *For lampholders R17d, contact with the lamp may be made either on the ends of the lamp contacts, or on the internal surfaces of the lamp contacts, or both. The electrical contacts shall be so designed that they make and maintain electrical contact with the minimum cap gauges, and will not prevent the acceptance of the maximum cap gauges (see 11.5).*

The resistance of the lampholder contacts and connections shall not exceed 0,2 Ω , when measured as follows:

- on lampholders equipped with leads, the resistance is measured between points 75 mm from where the leads come out of the holder;*
- on holders without leads, it is necessary to attach leads of the minimum size for which the holder was designed (but not less than 0,75 mm² copper wire). The resistance is measured between points 75 mm from where the leads come out of the holder;*
- the lamp cap used shall meet the dimensional requirements of standard sheet 7004-56 of IEC 60061-1 and shall have shorted contacts with overall resistance not in excess of 0,01 Ω ;*
- the cap shall be fully seated in the holder, irrespective of the position of the plunger;*
- the resistance measurement is made by the bridge method.*

The force required to fully compress the spring on the compressible end shall be not less than 35 N nor greater than 90 N.

11.3.4 *For starterholders making contact mainly along one side of each pin on the starter, the contact force is measured with a device made according to the dimensions of gauge A shown in Figure 11.*

The contact force shall be between 2 N and 25 N.

NOTE For starterholders where the contact is made at the pin ends, a test for checking the contact force is under consideration.

If a rotary motion is necessary for the removal of the starter from the starterholder, the torque required is measured; it shall be between 0,05 Nm and 0,3 Nm.

Compliance is checked by the use of gauge A of Figure 11.

11.4 *Lampholders shall be so constructed that the seating position of the lamp is clearly felt when inserting the lamp.*

The method of removing the lamp from the lampholder shall be simple and obvious or, if necessary, indicated by marking.

Compliance is checked by inspection and by manual test.

11.5 *Holder dimensions shall comply with IEC standards as far as they exist.*

a) *Lampholders shall comply with the following standard sheets of IEC 60061-2 with regard to the dimensions of the holders:*

- 7005-50: *Mounting of combined pair of inflexible lampholders G13*
- 7005-51: *Mounting of combined pair of inflexible lampholders G5*
- 7005-51A: *Mounting of combined pair of lampholders GX5*
- 7005-55: *Lampholder for tubular fluorescent lamps Fa6*
- 7005-56: *Lampholder for circular fluorescent lamps G10q*
- 7005-57: *Lampholder for recessed double contact cap R17d*
- 7005-68: *Lampholder GR8*
- 7005-77: *Lampholder GR10q*
- 7005-69: *Lampholder G23*
- 7005-82A: *Lampholder 2GX11*
- 7005-86: *Lampholder GX23*
- 7005-84: *Lampholder GX10q*
- 7005-85: *Lampholder GY10q*
- 7005-87: *Lampholders G32, GX32 and GY32*
- 7005-78: *Lampholders G24, GX24 and GY24 (see Note 1 below)*
- 7005-82: *Lampholder 2G11*
- 7005-33: *Lampholder 2G13*
- 7005-58: *Lampholder Fa8*
- 7005-115: *Lampholder W4.3x8.5d*
- 7005-123: *Lampholder GU10q*
- 7005-124: *Lampholder GZ10q*
- 7005-125: *Lampholder 2GX13*
- 7005-131: *Lampholder GRZ10d*
- 7005-132: *Lampholder GRZ10t*
- 7005-141: *Lampholder 2G8*
- 7005-142: *Lampholder GX53*
- 7005-156: *Lampholder GR14q*
- 7005-160: *Lampholder G28d*

Lampholders G24q and GX24q, allowing insertion of lamps with keys -3 and -4 are intended for sale to luminaire or equipment manufacturers only. For such two-key lampholders, insertion of "No Go" gauges F (see IEC 60061-3, sheet 7006-78F) for keys -3 and -4 is accepted.

NOTE 1 Subclause 4.3 and Annexes F and H of IEC 61199 provide background information regarding the need for keys.

b) *Starterholder dimensions shall comply with the standard sheet shown in Figure 10a.*

c) *Starterholders intended for starters according to Annex B of IEC 60155 only shall comply with the standard sheet shown in Figure 10b.*

d) *Compliance is checked as follows:*

- *For lampholders G5, GX5 and G13, with two pairs of matching holders mounted in the mounting jig shown in Figure 1 and by use of the specified gauges, that is:*
 - *for lampholders G5: "Go" gauges 7006-47C and the gauges for testing contact-making 7006-47B;*

- for lampholders GX5: "Go" gauges 7006-47E and the gauges for testing contact-making 7006-47D;
 - for lampholders G13: "Go" gauges 7006-60C and the gauges for testing contact-making 7006-60B.
- Lampholders which, due to their design, do not allow testing in the mounting jig, and flexibly mounted lampholders (see 3.5) shall be tested together with the relevant luminaire and by use of the above gauges adapted to the specific lamp length according to IEC 60081.

When testing holders, the force required to insert the "Go" gauge shall not exceed:

- | | | |
|--|--|------|
| – for lampholders | G5 | G13 |
| – force in the direction of the lamp axis: | 15 N | 30 N |
| – force in the direction perpendicular to the lamp axis: | under consideration ¹ under consideration | |

When testing contact-making, the gauges are pushed in the direction of each of the holder faces in turn with a force of:

- for lampholders G5 and GX5: 2 N;
- for lampholders G13: 5 N.

When testing in the mounting jig, this force can be achieved by vertical position of the gauge.

For lampholders intended for use with more than one lamp at the same time, additional mass according to the number of lamps is placed on the lampholder face.

- for lampholders R17d, by means of the gauges shown in standard sheets 7006-57A and 7006-57B of IEC 60061-3;
- for lampholders Fa8, by means of the gauges shown in standard sheets 7006-58 and 7006-58G of IEC 60061-3;
- for lampholders 2G13, by means of the gauges shown in standard sheets 7006-33A and 7006-33B of IEC 60061-3;
- for all other lampholders by means of the relevant gauges shown in IEC 60061-3;
- for starterholders, by means of the gauges shown in Figures 11, 12 and 13;
- for starterholders intended for accepting only starters for class II luminaires, dimensions V and W indicated in Figure 10b are measured in addition.

The manufacturer's mounting instructions shall show all information necessary for the correct mounting of the holders.

For (multi-key) lampholders G24q and GX24q, allowing insertion of lamps with keys –3 and –4, the lampholder manufacturer's documents shall include a warning notice about the restricted application, stating that these holders may only be used with ballasts which are approved for the operation of lamps with keys –3 and –4 (multilamp ballast).

It is essential that the relevant safety and performance requirements are met with every lamp key.

11.6 Contact-making in the area of crimp zones on single-capped fluorescent lamps as defined in the appropriate cap datasheet of IEC 60061-1 shall only be allowed on the condition that contacts acting on both sides of the lamp contact pin, opposing each other, are

¹ Not applicable for lampholders where the final seating position of the cap within the holder is reached without an additional turning motion. These holders are already tested under 11.3.1 with single-ended gauges.

used and at least one part of the holder contact is always in contact with the non-crimped side of the lamp contact.

The lampholder contact shall be so designed that it cannot intrude into the crimp of the lamp pin and thus hamper removal of the lamp.

NOTE Due to flexibility in manufacturing, no-crimp zones on cap contacts in IEC 60061-1 are mostly defined symmetrically. However, crimping in practice is only done on one side as to maintain required minimum pin diameter.

11.7 Lampholders designed with a barrel thread for shade holder rings and shade holder rings shall comply with IEC 60399.

Compliance is checked by means of the gauges given in IEC 60399.

12 Resistance to dust and moisture

12.1 In the case of holders provided with IP code marking, the enclosure shall provide the degree of protection against dust or moisture in accordance with the classification of the holders after installation.

Compliance is checked by testing in accordance with the relevant requirements of IEC 60598-1 appropriate to the holder marking.

The insulation resistance and electric strength are checked in accordance with Clause 13.

The holders are mounted as in normal use and fitted either with test probes of minimum and maximum diameter according to Figure 46 for which the holders are designed or, if available, with lamps of the smallest and largest diameters as required by Figure 46.

Before the test, the holders are heated and brought to a stable operating temperature either by operating the lamp or with the test probes by heating within the heating cabinet at a temperature according to the T-marking or T_m-marking of the holder.

NOTE This test is for type test approval of the lampholder only and does not replace luminaire testing.

12.2 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) for holders classified IPX0;
- seven days (168 h) for all other holders.

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

13 Insulation resistance and electric strength

13.1 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 13.2 and by an electric strength test according to 13.3 made immediately after the humidity treatment in the humidity cabinet or the room in which the holder was brought to the prescribed temperature.

13.2 *The insulation resistance is measured with a DC 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
Between live parts of different polarity	2 ^a
Between live parts and external metal parts, including fixing screws and metal foil covering external parts of insulating material	2
^a If a lampholder is not declared to be suitable to be connected directly across the mains, the minimum insulation resistance between the lamp contacts shall not be less than 0,5 MΩ.	

For holders designed for use in class II luminaires, compliance is checked in accordance with the conditions of Section 10 of IEC 60598-1 when the luminaire is complete with the lamp(s) and starter(s) inserted.

13.3 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 AC voltage of substantially sinewave form, with a frequency of 50 Hz or 60 Hz and with an r.m.s. value as follows:

- *for lamp holders which are not declared to be suitable to be connected directly across the mains, the long term voltage between the contacts is expected to be ELV and therefore the electrical strength test voltage between the contacts shall be 500 V;*
- *the electrical strength test voltage between the contacts shall be $(2 U + 1\,000)$ V (where U is the maximum for the mains supply voltage as declared by the manufacturer);*
- *for all other cases, the electric strength test voltage is equal to $(2 U + 1\,000)$ V (where U is the rated voltage);*
- *for enclosed and unenclosed reinforced insulated lampholders, the test voltage shall be determined from Table 10.2 of IEC 60598-1.*

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

No flashover or breakdown shall occur during the test.

The high voltage transformer used for the test should be so designed that, when the output terminals are short-circuited after the output voltage has been adjusted to the appropriate test voltage, the output current is at least 200 mA.

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

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

Glow discharges without drop in voltage are ignored.

14 Endurance

Holders shall be so constructed as to prevent, in extended normal use, any electrical or mechanical failure impairing their compliance with this document. The insulation shall not be affected and connections shall not work loose by heating, vibration, etc.

Compliance is checked by the following test.

A commercial cap or starter, as appropriate, having its contacts bridged, is inserted 30 times into and removed 30 times from the holder at a rate of about 30 times a minute; the holder is connected to an AC supply at rated voltage and the circuit arranged to pass the rated current, the power factor being approximately 0,6 inductive.

After the test, the holder shall show no damage within the meaning of this document and, being fitted with a solid brass test cap or starter, complying with the corresponding Figures 6, 14 to 29, 39, 40 and 42 to 46, it is loaded for 1 h with rated current in an AC circuit of not more than 6 V.

The figures show only the dimensions essential for the test. For dimensions not shown in the figures, see the relevant cap sheets of IEC 60061-1.

The test cap does not need to have keys if these keys have only a keying function.

At the end of this period, the measured resistance shall not exceed the values given below:

- *holders for single-pin caps:*
maximum resistance = $0,03 \Omega$
- *other holders:*
maximum resistance = $0,045 \Omega + (A \times n)$

Holders for single-pin caps Fa8 shall be checked by means of the gauge shown in Figure 20.

For flexible holders Fa8, the maximum resistance shall be $0,07 \Omega$ when measured with the gauge fully seated in the holder, irrespective of the position of the contact and with the holder equipped with a lead with a length of 75 mm and a minimum size of $0,75 \text{ mm}^2$,

where

$A = 0,01 \Omega$ if $n = 2$,

$A = 0,015 \Omega$ if $n > 2$;

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

The measurement is carried out at the rated current of the holder and in the following way.

- *Holders for single-pin caps*

On holders equipped with a lead, the resistance is measured between the lead, at a point 75 mm from where it comes out of the holder, and the test cap.

On holders without a lead, it is necessary, before making the above measurement, to attach a lead of the minimum size for which the holder was designed.

– *Other holders*

On holders equipped with leads, the resistance is measured between the leads, 75 mm from where they come out of the holder.

On holders without leads, it is necessary, before making the above measurement, to attach two leads of the minimum size for which the holder was designed.

The test cap or starter is carefully cleaned and polished for the measurement.

The test cap or starter is fully seated in the holder.

Lampholders R17d are not measured because they are already tested under 11.3.3.

15 Mechanical strength

15.1 Holders shall have adequate mechanical strength.

Compliance is checked by the following tests.

NOTE The mechanical strength of lampholders used in luminaires or other equipment can be checked by means of the spring operated impact apparatus.

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.

15.2 *The mechanical strength of lampholders exclusively designed for building into a luminaire or other additional enclosure is checked by means of the pendulum hammer test specified in IEC 60068-2-75:2014, subject to the following details (see Clause 4 of IEC 60068-2-75:2014), and Figures 5 and 8.*

a) Method of mounting

The sample shall be mounted as in normal use on the adapter shown in Figure D.5 of IEC 60068-2-75:2014. The thickness of the metal sheet shall be in accordance with the manufacturer's instructions.

Lampholders which, due to their construction, cannot be mounted on the adapter shown in Figure D.5 of IEC 60068-2-75:2014 shall be mounted on an appropriate support conforming with the luminaire for which they have been specially designed.

b) Height of fall

The striking element shall fall from one of the following heights:

- *100 mm ± 1 mm, for lampholders G5 and lampholders for building-in intended to be used in a luminaire providing adequate protection;*
- *150 mm ± 1,5 mm, for lampholders for building-in intended to be used in a luminaire not providing adequate protection.*

c) Number of impacts

Three blows shall be applied to the weakest point, paying special regard to insulation material enclosing live parts and to bushings of insulation material, if any.

No blows shall be applied in the recess of a starterholder.

d) Pre-conditioning

Cable entries shall be left open, knock-outs opened, and cover fixing and similar screws tightened with a torque equal to two thirds of that specified in Clause 16.

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 document, in particular:

- 1) Live parts shall not have become accessible and the holder shall not have become detached from its support.

Damage to the finish, small dents which do not reduce creepage distances or clearances below the values specified in Clause 17 and small chips which do not adversely affect the protection against electric shock, dust 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 document even if that part is omitted.

i) *Recovery*

Not applicable.

j) *Final measurements*

See h) above.

Starterholders for building-in are not tested because they are normally used in a protected position.

NOTE The mechanical strength of lampholders used in luminaires or other equipment can be checked by means of the spring hammer specified in IEC 60068-2-75:2014. 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.

15.3 A gauge shall be inserted in the lampholder. Lampholders with the gauge in position are subjected for 1 min to a force of 50 N applied to the gauge in the direction of its axis. In addition, lampholders with a fixed stop for the rotary motion when inserting the lamp are subjected to a torque of 1 Nm for 1 min. For this test the holder shall be in the unmounted position and be rigidly supported.

Gauges shall comply with the following standard sheets (see IEC 60061-3):

- 7006-47C, gauge I for lampholders G5;
- 7006-47E, gauge I for lampholders GX5;
- 7006-60C, gauge I for lampholders G13;
- 7006-33A: for lampholders 2G13;
- 7006-58: for lampholders Fa8;
- 7006-115, for lampholders W4.3x8.5d;
- gauges for other lampholders are under consideration.

After these tests, the lampholder shall show no damage.

15.4 Gauge A shown in Figure 11 shall be inserted in the starterholder. Starterholders with the gauge in position are subjected for 1 min to a compressive force of 20 N applied to the gauge in the direction of the axis. For this test, the holder shall be in the unmounted position and be rigidly supported.

After the test, the starterholder shall show no damage.

16 Screws, current-carrying parts and connections

16.1 Screws 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 by the following test.

Screws which may be operated when connections are made to the holders are tightened and loosened

- *five times for screws operating in a female thread in metal,*
- *ten times for screws operating in a female thread in insulating material,*

by means of a suitable test screwdriver applying a torque as indicated in Table 2. Column 1 applies to screws without heads if the screw, when tightened, does not protrude from the hole. Column 2 applies to other screws.

Screws operating in a female thread in insulating material are completely removed each time and reinserted.

The test shall cause no damage impairing the further use of the screwed connections.

Table 2 – Torque tests on screws

Nominal diameter of screw mm	Torque Nm	
	1	2
Up to and including 2,8	0,2	0,4
Over 2,8 up to and including 3,0	0,25	0,5
Over 3,0 up to and including 3,2	0,30	0,6
Over 3,2 up to and including 3,6	0,40	0,8
Over 3,6 up to and including 4,1	0,70	1,2
Over 4,1 up to and including 4,7	0,80	1,8
Over 4,7 up to and including 5,3	0,80	2,0
Over 5,3 up to and including 6,0	–	2,5
Over 6,0 up to and including 8,0	–	8,0
Over 8,0 up to and including 10,0	–	17,0
Over 10,0 up to and including 12,0	–	29,0
Over 12,0 up to and including 14,0	–	48,0
Over 14,0 up to and including 16,0	–	114,0

Screws to be operated when connections are made to the holder include, for example, screws for fixing covers when they have to be loosened for making connections. Conduit thread connections and screws to fasten the holders to their supports are excluded.

The shape of the blade of the test screwdriver shall suit the slot of the screw to be tested. The screw shall not be tightened in jerks.

Nuts are tested in a similar manner.

16.2 Spaced threaded screws shall not be used for the connection of current-carrying parts, unless they clamp these parts directly in contact with each other and are provided with a suitable means of locking.

Thread-cutting screws may be used for the interconnection of current-carrying parts provided that they are not of metal which is soft or liable to creep, such as zinc or aluminium.

Spaced threaded screws may be used to provide earth continuity, provided it is not necessary to disturb the connection in normal use and at least two screws are used for each connection.

Compliance is checked by inspection.

16.3 In the case of screws operating in a thread in insulating material, the length of the thread shall be not less than 3 mm plus one-third of the nominal screw diameter, except that this length need not exceed 8 mm. Correct introduction of the screw into the thread shall be ensured.

Compliance is checked by inspection, by measurement and by manual test.

The requirement with regard to the correct introduction is met if introduction of the screw in a slanting manner is prevented, such as by guiding the screw by the part to be fixed, by a recess in the female thread or by the use of a screw with the leading thread removed.

16.4 Electrical connections shall be so designed that contact pressure is not transmitted through insulating material other than ceramic or other material with characteristics no less suitable, unless there is sufficient resiliency in the metal parts to compensate for any possible shrinkage of the insulating material.

Screws shall not be of metal which is soft or liable to creep, such as zinc or aluminium.

Screws transmitting contact pressure and screws with a nominal diameter less than 2,8 mm, which may be operated when connections are made to the holder, shall screw into a metal nut or metal insert.

Compliance is checked by inspection.

This requirement does not apply to contacts between detachable parts, such as lamps and starters and their holders, for which adequate spring action is required.

16.5 Screws and rivets which serve as electrical as well as mechanical connections shall be locked against loosening.

Compliance is checked by inspection and by manual test.

NOTE Spring washers can provide satisfactory locking. For rivets, a non-circular shank or an appropriate notch can be sufficient for locking.

Sealing compound which softens on heating provides satisfactory locking only for screw connections not subject to torsion during normal use.

16.6 Current-carrying parts shall be of copper, of an alloy containing at least 50 % copper, or of a material having characteristics at least equivalent.

This requirement does not apply to screws which do not contribute essentially to the current conduction, such as terminal screws.

Compliance is checked by inspection and, if necessary, by chemical analysis.

The tests of Clause 19 will show whether current-carrying parts are equivalent to copper with respect to current-carrying capacity, mechanical strength and resistance to corrosion likely to be met in normal service.

NOTE Special care should be taken with regard to corrosion and mechanical properties.

17 Creepage distances and clearances

Creepage distances and clearances shall be not less than the values shown in Tables 3 and 4.

The distances specified in Table 3 apply to impulse withstand category II in accordance with IEC 60664-1 and refer to pollution degree 2, where normally only non-conductive pollution occurs but occasionally a temporary conductivity caused by condensation is to be expected. For information on distances for other impulse withstand categories or higher pollution degrees, IEC 60598-1 and IEC 60664-1 should be consulted.

Attention is drawn to the fact that the values for creepage distance and clearance given in Clause 17 are the absolute minimum.

NOTE 1 The voltages shown in Table 3 are rated voltages, not ignition voltages.

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Table 3 – Minimum distances for AC sinusoidal voltages up to 30 kHz – Impulse withstand category II

Distances mm	Rated voltage V			
	50	150	250	500
Basic insulation				
1 Distances between live parts of different polarity, and				
2 Between live parts and external metal parts, mounting surfaces, loose metal cover, if any, the outer surface of parts of insulating material which are permanently fixed to the holder ^a , including screws or devices for fixing covers or fixing the holder to its support:				
– Creepage distances				
insulation PTI ≥ 600 ^b				
PTI < 600 ^b				
– Clearances ^c				
Reinforced Insulation				
Between live parts and external metal parts, mounting surfaces, loose metal cover, if any, the outer surface of parts of insulating material which are permanently fixed to the holder ^a , including screws or devices for fixing covers or fixing the holder to its support:				
– Creepage distances				
insulation PTI ≥ 600 ^b				
PTI < 600 ^b				
– Clearances ^c				
Values for creepage distances can be found for intermediate values of rated voltages by linear interpolation between tabulated values. No values are specified for rated voltages below 25 V AC and 60 V DC ripple free as the voltage test of 13.3 is considered sufficient. Creepage distances shall not be less than the required minimum clearance.				
In Japan, the values given in this table are not applicable. Japan requires larger values than the values given in this table.				
NOTE Information on standard ratings for specific holder types is given in Clause 6.				
^a 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. The distances for starter holders shall be in accordance with Figures 10a and 10b.				
^b PTI (proof tracking index) in accordance with IEC 60112:2003 and IEC 60112:2003/AMD1:2009.				
– 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 (independently of the real PTI).				
– For creepage distances, the equivalent DC voltage is equal to the r.m.s. value of the sinusoidal AC voltage.				
^c For clearances, the equivalent DC voltage is equal to the peak of the AC voltage.				

NOTE 2 In case of combination of voltage and frequency (> 30 kHz) requiring higher creepage distances than the values required in Table 3, the controlgear is marked with the details of this combination ($\hat{U}_{out}$ and its corresponding frequency f_{Uout}), see IEC 61347-1:2015 7.1, item w). For details and the required values for creepage distances see IEC 61347-1:2015, 16.2.

The clearances for the rated ignition voltage of the holder shall not be less than the values given in Table 4.

NOTE 3 Lampholders can be subjected to a working voltage higher than the rated voltage under the following conditions:

- the nominal voltage and the overvoltage category of the supply voltage does not exceed the rated values of the lampholder;
- the working voltage (r.m.s.) and the maximum repetitive peak working voltage ($\hat{U}_{out}$) marked on the controlgear respectively do not specify a higher creepage distance than the rated voltage of the lampholder;
- the working voltage does not specify a higher clearance than the rated voltage and the rated ignition voltage of the lampholder.

Table 4 – Minimum distances for rated ignition voltages or equivalent peak voltage U_p

Rated ignition voltage	kV	2	2,5	3	4	5	6	8
Minimum clearance	mm							
Basic insulation		1	1,5	2	3	4	5,5	8
Reinforced insulation		2,2	3	3,8	6	8	10,4	15
For distances subjected to both sinusoidal voltages and non-sinusoidal pulse voltages, the minimum required distance shall not be less than the highest value indicated in either Table 3 or Table 4.								
Creepage distances shall not be less than the required minimum clearance.								

NOTE 3 Ignition pulse voltages having total pulse duration of $> 750 \mu s$ or having a higher frequency than f_{crit} can require higher clearances although its peak value is lower than the rated ignition voltage of the lampholder. Therefore, the respective controlgear is marked with an equivalent peak voltage (U_p) which is directly comparable to the rated ignition voltage of the lampholder.

For holders designed for use in class II luminaires, compliance with this requirement is checked in accordance with the conditions of Section 11 of IEC 60598-1 when the luminaire is complete with the lamp(s) and starter(s) inserted.

For lamp holders which are not declared to be suitable to be connected directly across the mains, the creepage distance or clearance between the lamp contacts shall not be less than:

- for lampholder G10q: 1,5 mm;
- for other lampholders: 2 mm.

Compliance is checked by measurement, made on the holder with and without external conductors of the largest cross-sectional area required in 10.3 connected to its terminals.

Completely sealed-off or compound-filled distances are exempted from these requirements.

The contribution to the creepage distance of any groove less than 1 mm wide is limited to its width.

Creepage distances are measured in air, along the surface of the insulating material.

18 Resistance to heat, fire and tracking

18.1 Holders shall be sufficiently resistant to heat.

For lampholders for double-capped fluorescent lamps, for 2G13 and G10q lampholders, and for starterholders, compliance is checked by one of the following tests a) or b) at the discretion of the manufacturer.

Unless otherwise specified, the test of item a) shall be carried out.

For lampholders for single-capped fluorescent lamps (with the exception of 2G13 and G10q lampholders), compliance is checked by the test of item c).

- a) The specimen is tested in a heating cabinet at a temperature of $100\text{ °C} \pm 5\text{ °C}$ or $(T + 20) \pm 5\text{ °C}$ for T-marked holders; the duration of the test shall be 168 h (seven days).

In the case of holders intended to provide an IP classification greater than IP20 where the maximum operating temperature of the gaskets is different from the above temperatures, the separate set of gaskets (see 5.4) shall be tested at the same time in a heating cabinet set at the temperature given in the manufacturer's mounting instructions.

After the test, the gaskets of the holders shall be replaced by those tested separately.

- b) G13 lampholders are placed either on a steel test cap A (for lampholders intended for lamps with a nominal tube diameter of 25 mm – see IEC 60081), or on a test cap B (for lampholders intended for lamps with a nominal tube diameter of 38 mm – see IEC 60081) with dimensions according to Figure 9a.

The tubes shown in Figure 9a are intended for testing lampholders with protection tubes. They shall be removed for the testing of holders not intended for use with a protection tube.

G5 and GX5 lampholders are placed on a steel test cap with dimensions according to Figure 9b.

The test cap carrier is provided with an internal heat source and a thermocouple by which the actual temperature of the surface of the test cap between the pins can be ascertained.

A second thermocouple is placed on the back of the holder, in the area just over the cap pins at the hottest point. This thermocouple is attached to a copper disk (approximately 5 mm in diameter, 1 mm thick and with a matt black finish), sunk level with the surface of the copper disk. On this copper disk, a weight of 100 g is added. Care shall be taken that the weight is thermally insulated from the copper disk.

Care should be taken that the front side of the lampholder and the test cap are in close contact.

Lampholders incorporating a rotating part, having a protrusion in the middle to create an air gap between the cap face and the holder face, shall be fixed by a separate mounting device on the test cap of Figure 9a or Figure 9b, according to the manufacturer's instructions (see 8.3).

During the test, there shall be no clearance between the protrusion of the rotating part and the test cap.

For lampholders with screwless terminals, thermocouples are attached to each clamping part of the screwless terminal(s). The complete assembly is placed in a cabinet in which the interior is at an even temperature, so that the temperature difference between any two points is negligible.

The test cabinet has the following features:

- material: 10 mm (nominal) plywood;
- internal finish: matt black paint;
- internal dimensions: 500 mm x 500 mm x 500 mm, with a tolerance of ± 10 mm for each dimension; one wall shall be removable to provide access.

Test cabinets should not be subjected to heating or cooling from adjacent surfaces, and air movements should be avoided.

The heating source within the test cap is then adjusted in such a way that the temperature at the surface of the test cap between the pins is $25\text{ K} + 5\text{ K}$ higher than the value of the T marking on the lampholder.

When thermal equilibrium has been reached, the temperature T_m at the rear surface of the lampholder is read and recorded. T_m is taken as the reference temperature when testing the rear part of the holder. If, however, in the manufacturer's instructions a higher temperature is given, this becomes the reference temperature.

The highest temperature measured at the screwless terminals is also recorded. This temperature is the temperature to apply in testing the screwless terminals in accordance with Section 15 of IEC 60598-1. If, however, the temperature measured at the screwless terminals is less than 100 °C , then the screwless terminals shall be tested at $100\text{ °C} \pm 5\text{ °C}$.

The duration of the test is 168 h (seven days).

During test a) or b), the specimen shall not undergo any change impairing its further use, in particular there shall be:

- no reduction of the protection against electric shock;*
- no reduction of the protection against ingress of dust or moisture;*
- no loosening of electrical contacts.*

Detachable gaskets at the mounting surface of the holder are not included in this test, and are tested in the luminaire.

c) For lampholders for single-capped fluorescent lamps (with the exception of 2G13 and G10q lampholders), compliance is checked by the following tests, which are each time carried out on one of the three holders to be submitted to the test.

A test cap complying with the relevant Figures 30, 31, 32, 33, 34, 35, 36, 37 or 38 or, if not available, a test cap with nominal dimensions corresponding to the relevant cap sheets of IEC 60061-1 shall be inserted in two of the holders, the third holder being left empty.

NOTE 1 The test cap does not need to have keys if these keys have only a keying function.

The three holders are then placed for 168 h in a heating cabinet at a temperature of:

(maximum cap temperature + 20 °C) $\pm 5\text{ °C}$.

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 20 K , with a tolerance of $\pm 5\text{ °C}$.

NOTE 2 For information on the maximum cap temperatures, see Annex C of IEC 61199.

The test cap shall be mounted in the cabinet in the vertical holder-up position because the weight of the test cap shall not bear on the holder. A bending moment of $0,3\text{ Nm}$ in relation to the reference plane shall be exerted on one of these holders during the whole test.

This requirement does not apply to lampholders 2G11, 2GX13, GU10q and GZ10q.

The test with a bending moment is not applicable where additional means of fixing independent from the lampholder are compulsory for the lamp.

The point of application of the bending moment is the test cap axis.

The bending moment shall act in the direction of the plane through the means of retention (retaining springs or catches).

During the test, the holders shall not undergo any change impairing their further use.

After the test, the lampholders shall be removed from the heating cabinet and allowed to cool down without the test caps.

The holders shall comply with the following requirements:

- the lampholders which were left empty during the heating period shall comply with all the relevant lampholder gauges of IEC 60061-3;*
- the lampholders which were provided with the test caps during the heating period shall comply with the corresponding minimum retention force.*

18.2 Enclosures and other external parts of insulating material providing protection against electric shock, and parts of insulating material retaining live parts in position, shall be subjected to a ball-pressure test by means of the apparatus shown in Figure 7.

None of the tests required by Clause 18 (except 18.1) are 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 conditions specific to lampholders and defined in this Clause 18.

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 with a force of 20 N. The test is made in a heating cabinet having a temperature of 25 °C ± 5 K in excess of the operating temperature (see 6.3), with a minimum temperature of 125 °C when parts retaining live parts in position are tested.

The test load and the supporting means are placed in 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 shall 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.

For lampholders with T marking tested according to item b) in 18.1, the temperature in the heating cabinet is (T + 25) ± 5 °C when testing the front of the holder and T_m ± 5 °C when testing the rear of the holder, but with a minimum temperature of 125 °C when parts retaining live parts in position are tested.

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.

The test is not made on parts of ceramic material.

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 *p* is measured and the diameter $\varnothing$ calculated using the formula:

$$\varnothing = 2 \sqrt{p(5 - p)}$$

18.3 External parts of insulating material providing protection against electric shock and parts of insulating material retaining live parts in position shall be resistant to flame and ignition.

For materials other than ceramic, compliance is checked by the tests in 18.4 or 18.5.

18.4 External parts of insulating material providing protection against electric shock are subjected to the glow-wire test in accordance with IEC 60695-2-11, subject to the following details.

- *The 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 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 perform the test described above because the specimen is too small, the test is performed on a separate specimen of the same material, 30 mm x 30 mm, and with a thickness equal to the smallest thickness of the specimen.

- *The temperature of the tip of the glow-wire shall be 650 °C.*

After 30 s, the specimen is withdrawn from contact with the glow-wire tip.

The glow-wire temperature and the 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 tissue paper, as specified in ISO 4046-4:2016, 4.187, spread out horizontally 200 mm ± 5 mm below the specimen.*

18.5 Parts of insulating material retaining live parts in position shall be subjected to the needle-flame test in accordance with IEC 60695-11-5, 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 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 test flame, and any flaming drops shall not ignite a piece of tissue paper spread out horizontally 200 mm ± 5 mm below the test specimen.*

18.6 For holders other than ordinary holders, insulating parts retaining live parts in position shall have adequate resistance to tracking.

For materials other than ceramic, compliance is checked by the proof-tracking test in accordance with IEC 60112:2003 and IEC 60112:2003/AMD1:2009, 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 should 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 the test solution A described in 7.3 of IEC 60112:2003 and IEC 60112:2003/AMD1:2009 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 60112:2003 and IEC 60112:2003/AMD1:2009 regarding determination of erosion does not apply.*

19 Resistance to excessive residual stresses (season cracking) and to rusting

19.1 Contacts and other parts of rolled sheets 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 surface of the specimens is carefully cleaned, varnish being removed by acetone, grease and fingerprints 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 B).

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 8x.

NOTE In order not to influence the results of the test, the specimens should be handled with care.

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

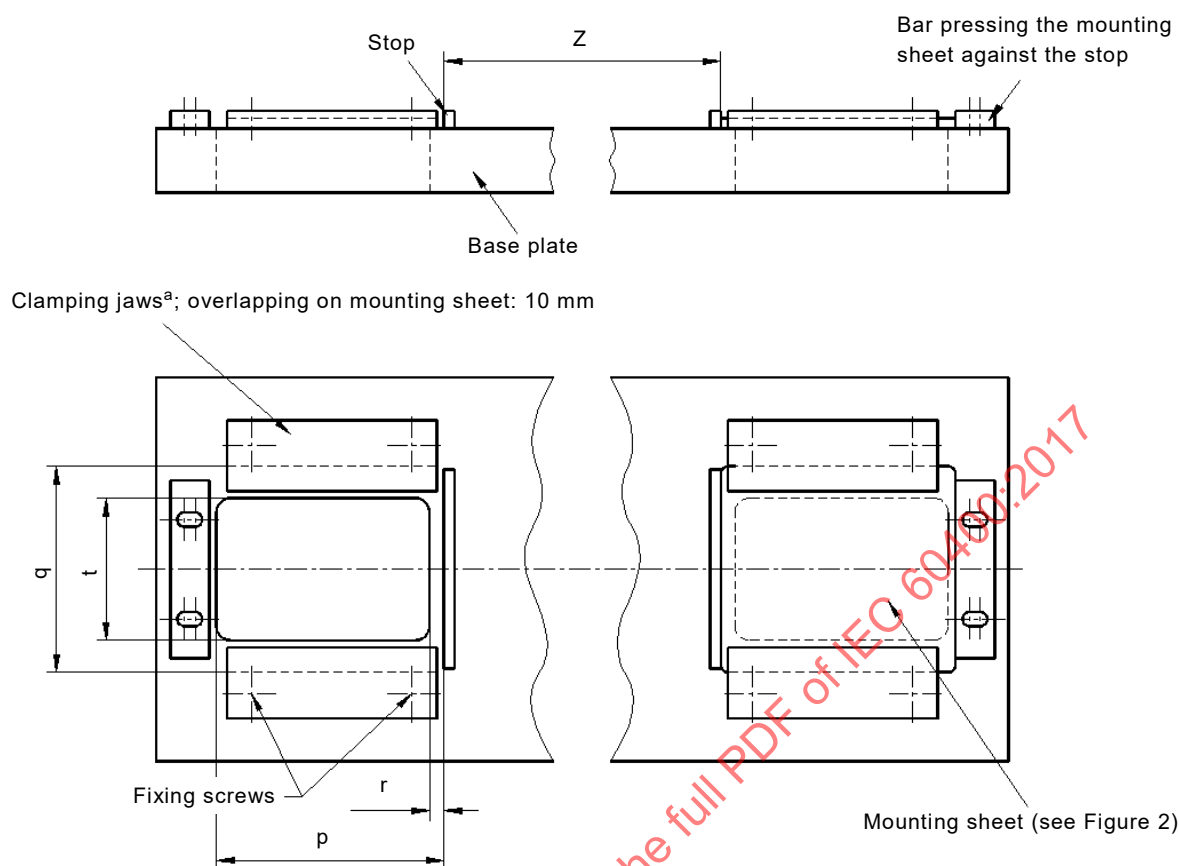
Compliance is checked by the following test.

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 °C ± 5 °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 °C ± 5 °C.

After the specimens have been dried for 10 min in a heating cabinet at a temperature of 100 °C ± 5 °C, 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.



The drawing is intended only to illustrate the essential dimensions of the jig.

^a For certain lampholders, e.g. twin-lampholders, it may be necessary to use two-piece clamping jaws.

Reference	Dimension	Tolerance
	mm	mm
Z	b	$\pm 0,05$
p	65	$\pm 0,1$
q	60,2	$+ 0,1$ $- 0,0$
r	5	$\pm 0,1$
t	40	$\pm 0,1$

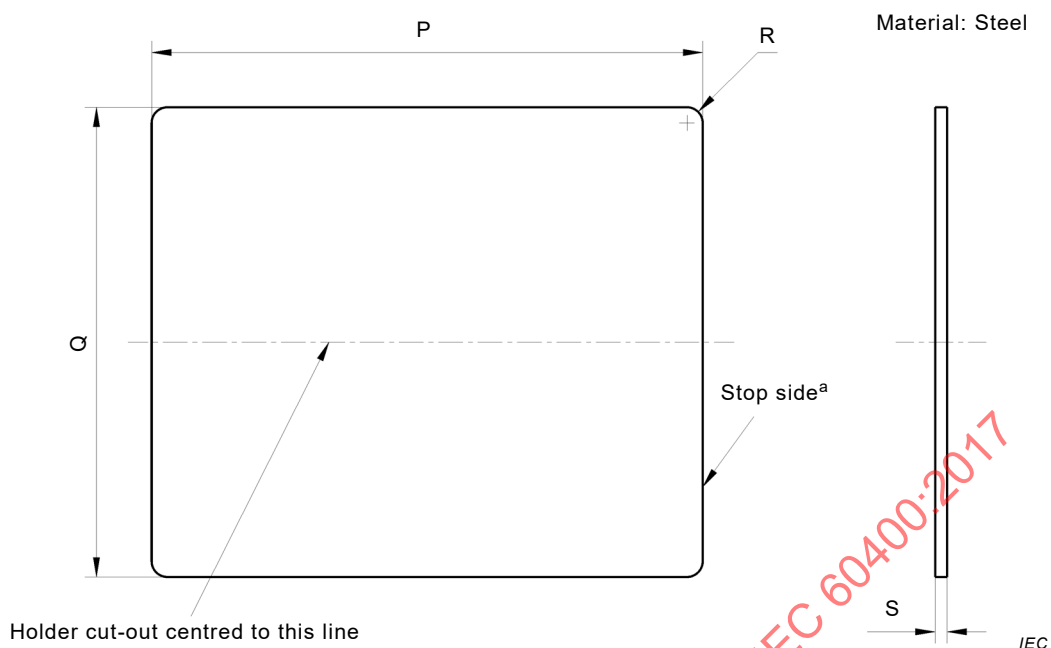
^b Z = 69,5 mm for testing lampholders G5 (derived from dimension Amax of a 4 W lamp, see IEC 60081). This dimension is also applicable for testing GX5 lampholders.

Z = 367,4 mm for testing lampholders G13 (derived from dimension Amax of a 15 W lamp, see IEC 60081).

PURPOSE: Testing of a combined pair of holders regarding compliance with the specified “Go” gauges and those for testing contact-making.

TESTING: The mounting sheets with a matching pair of holders are inserted into the mounting jig, pressed against the stop and fixed by use of the clamping jaws. In this position the gauges are applied.

Figure 1 – Mounting jig for the testing of lampholders



^a This side shall be marked.

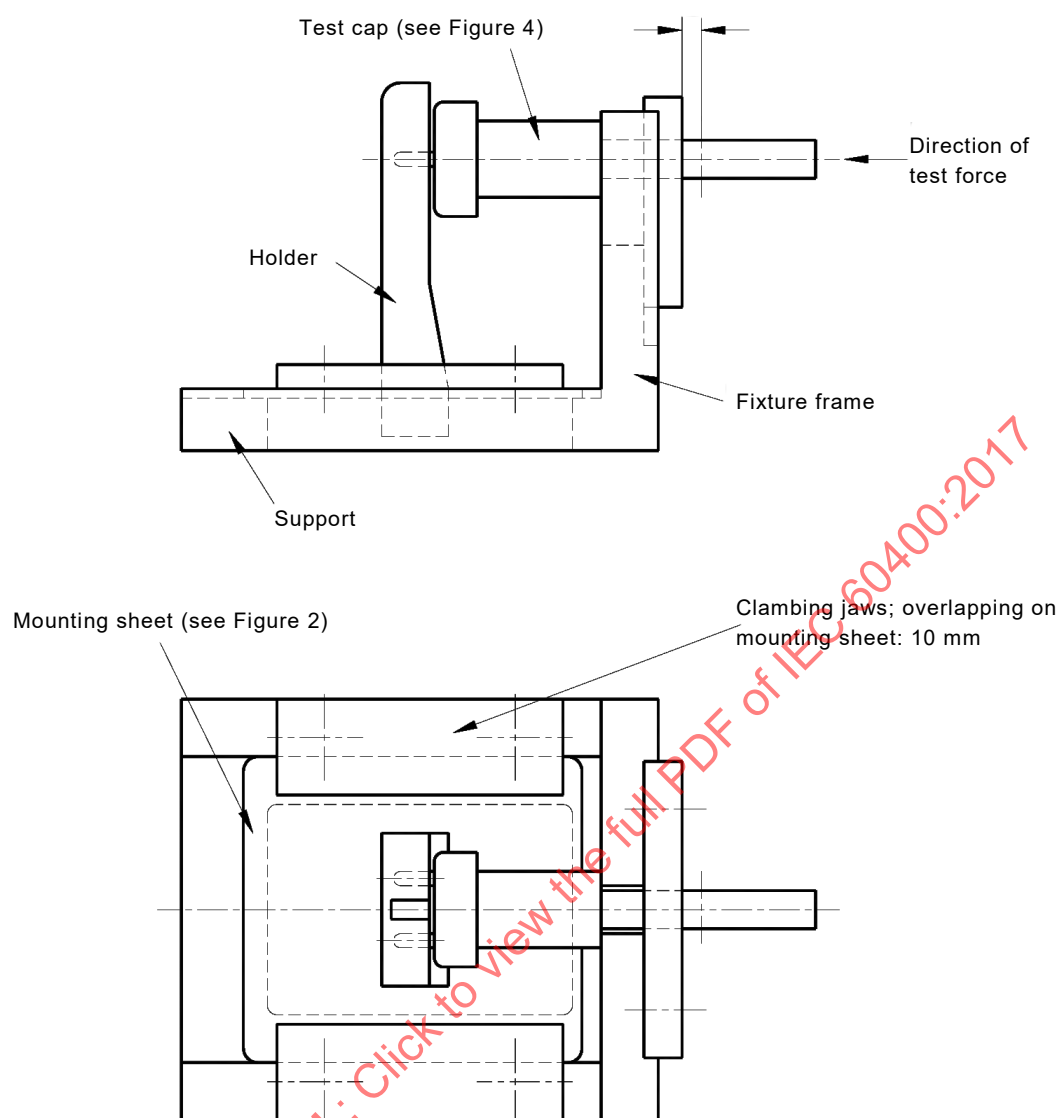
For holders requiring a vertical mounting surface, a steel angle shall be added to the mounting sheet.

When applying a force of 50 N to this angle in the height and in the direction of the lampholder axis, the lampholder shall not deviate by more than 0,2 mm from its original position.

The drawing is intended only to illustrate the essential dimensions of the mounting sheet.

Reference	Dimension mm	Tolerance mm
P	70	$\pm 0,1$
Q	60	$\pm 0,1$
R	2	$\pm 0,5$
S ^a	1,0	$\pm 0,05$
^a If the holder is designed for a lower material thickness, only the area required for the mounting of the holder is reduced to this specific value.		

Figure 2 – Mounting sheet



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The fixture shown is intended for testing single lampholders. For testing twin-lampholders, modifications will be necessary.

PURPOSE: To check, in case of doubt, whether the lampholder shall be considered as a flexible or an inflexible one.

TESTING: The holder, mounted on the mounting sheet, is placed on the support and the test cap is inserted into the holder. The mounting sheet is then moved in such a way that the test cap^c is fixed between holder and fixture frame without clearance. In this position the mounting sheet is fixed by the use of the clamping jaws. A force is applied via the plunger to the test cap until the specified plunger travel^a is achieved. The force required shall not exceed 15 N for lampholders G5, GX5 and 30 N for lampholders G13. This procedure is repeated 10 times.

After this test, no clearance shall exist between test cap and fixture frame, nor between test cap and holder. If the holder complies, it is deemed to be a flexible lampholder; if not it is an inflexible one.

^a The plunger travel is equal to the required minimum axial contact movement, which is:

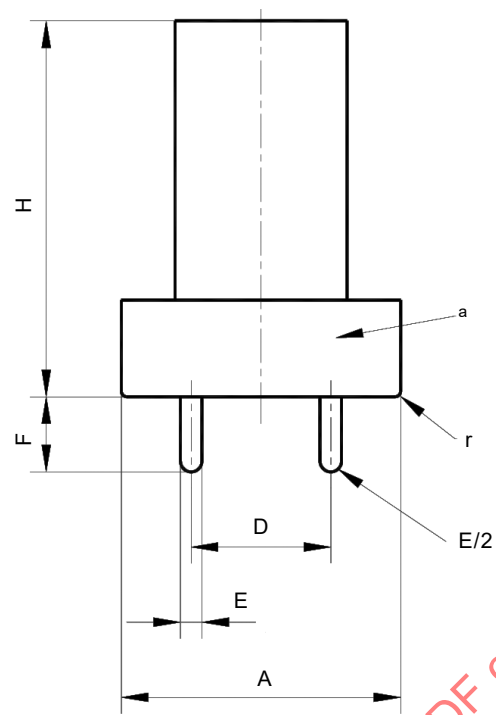
- for a pair of holders for side entry: 3 mm + mounting tolerance^b;
- for a pair of holders for axial insertion: 3 mm + maximum cap pin length (= 7,62 mm; under consideration) + mounting tolerance^b.

If the combined pair of holders consists of two flexible holders, each holder has to provide half of the required contact movement.

^b According to the manufacturer's instructions (see 8.3).

^c The relevant test caps are described in Figure 4.

Figure 3 – Fixture for the testing of lampholder flexibility

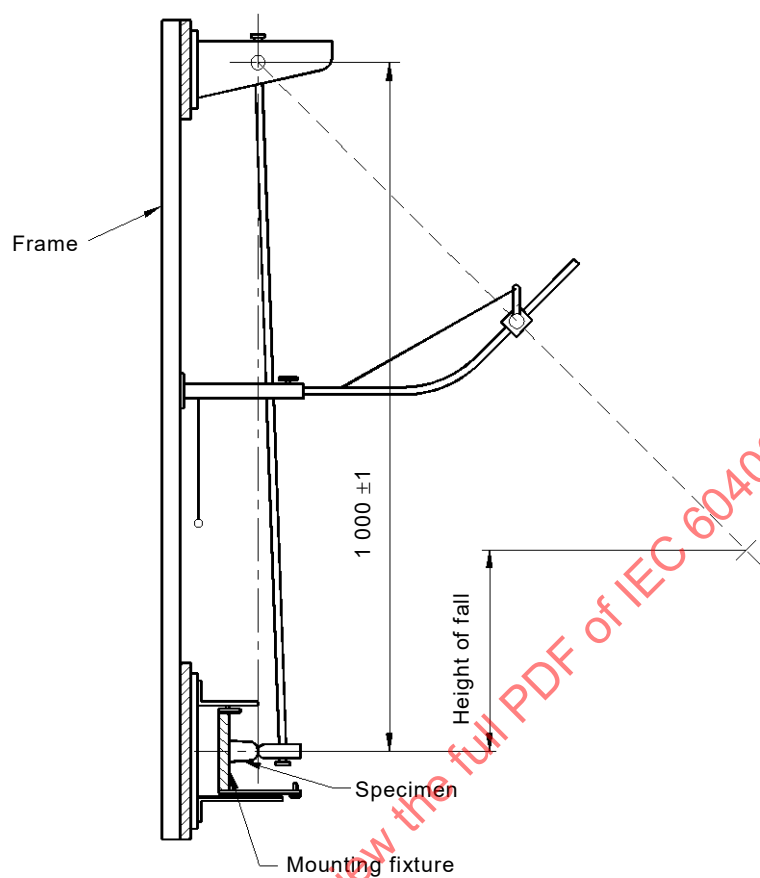


Reference	Dimension mm		Tolerance mm
	G5 and GX5	G13	
A ^b	15,5	25,6	± 0,1
D	4,75	12,7	± 0,05
E	2,37		± 0,02
F	7,1		± 0,05
H ^b	35,0		± 0,1
r ^b	0,5		+ 0,3 - 0,0

^b These test caps differ from the test caps used in Clause 15 by the material and the additional dimensions A, H and r.

^a This part of the gauge and the cap pins shall be of hardened steel.

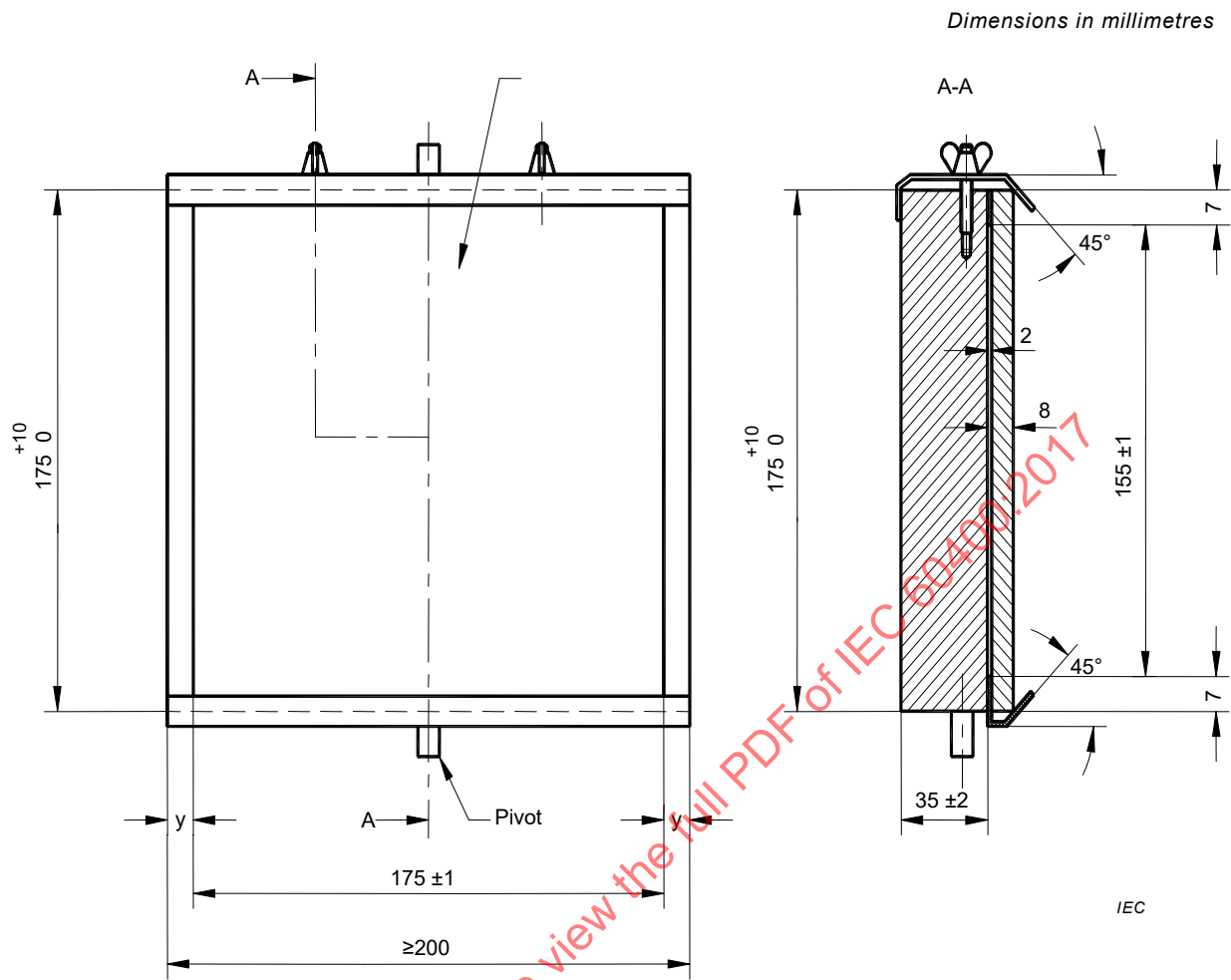
Figure 4 – Test caps G5, GX5 and G13

Dimensions in millimetres

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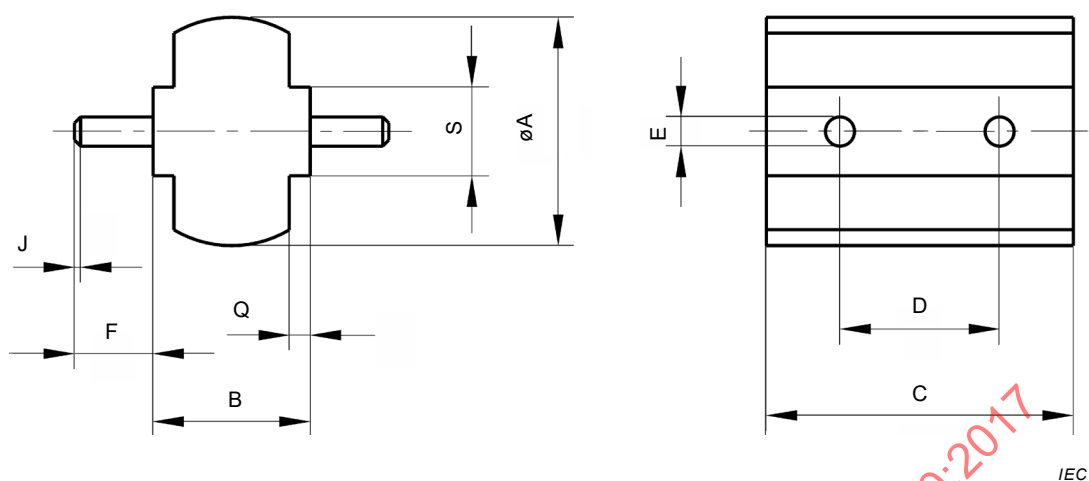
NOTE This drawing has been retained in this document for information, although a basic standard exists. In case of doubt regarding the drawing, refer to IEC 60068-2-75:2014.

5a) – Impact test apparatus



5b) – Mounting support

Figure 5 – Impact test apparatus and mounting support



Reference	Dimension mm	Tolerance mm
A	18,5	$\pm 0,01$
B	12,8	$\pm 0,05$
D	13,0	$\pm 0,05$
E	2,37	$\pm 0,02$
F	6,4	$\pm 0,05$
J	0,5	$\pm 0,1$
Q	1,7	$\pm 0,05$
S	7,2	$\pm 0,05$
C	25,0	$\pm 0,2$

Figure 6 – Test cap for the test of Clause 14 for lampholders 2GX13

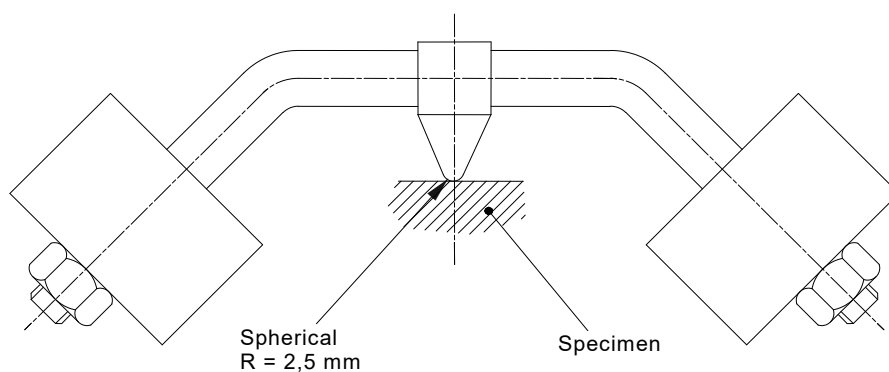
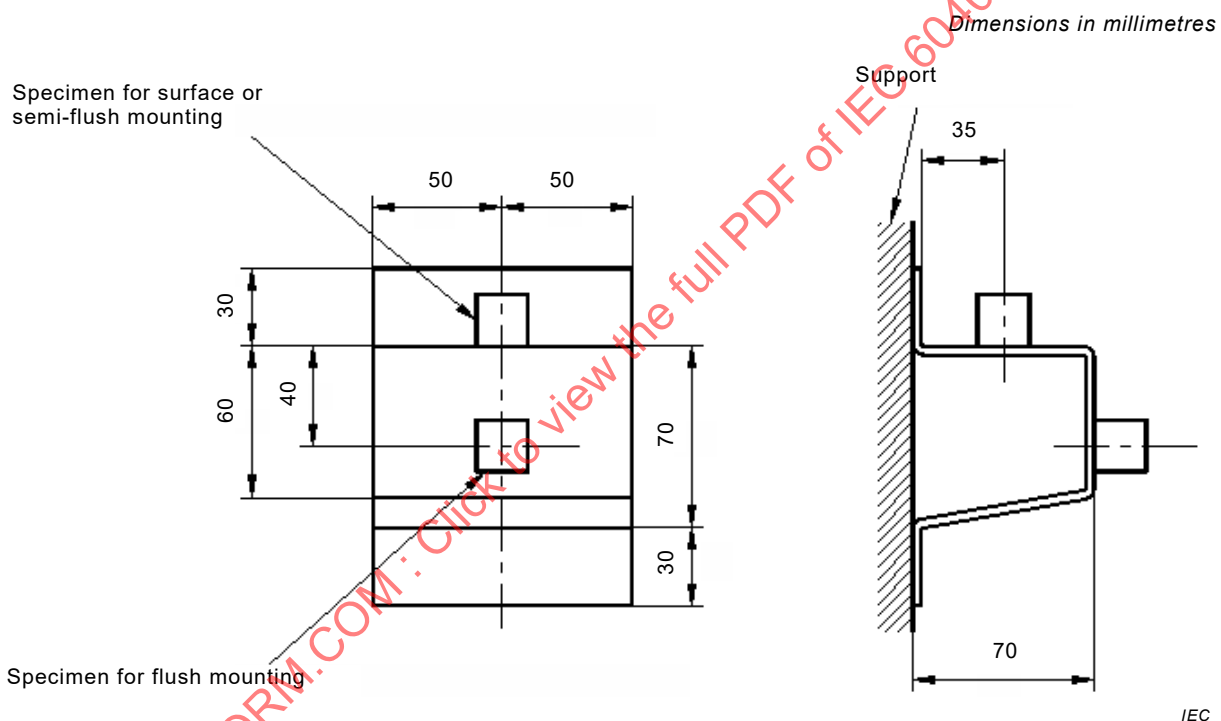
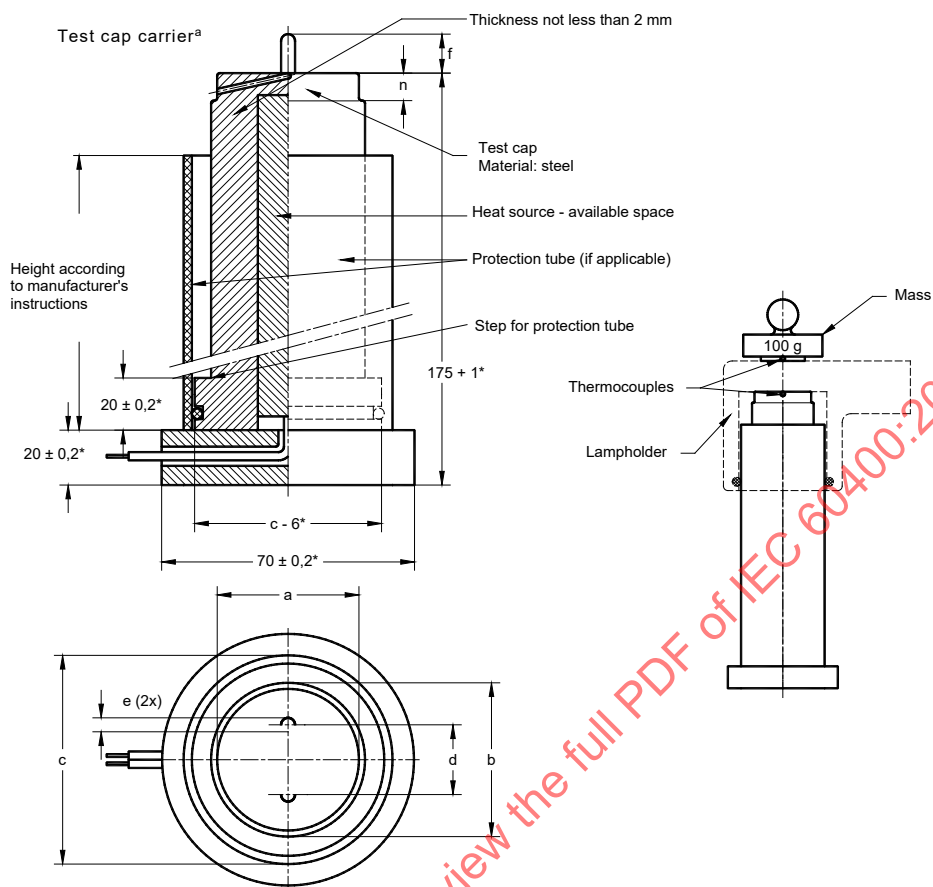


Figure 7 – Ball-pressure apparatus



NOTE This drawing has been retained in this document for information. In case of doubt regarding the drawing, refer to the base standard IEC 60068-2-75.

Figure 8 – Bracket for fixing lampholders for the impact test



Reference	Test cap mm		Tolerance mm
	A	B	
a	25,8	36,5	+ 0,0 - 0,1
b ^b	26	38	+ 0,0 - 0,1
c	38 ^c	50	± 0,1
d	12,7		± 0,05
e	2,5		± 0,05
f	7,1		+ 0,0 - 0,1
n	8,71		+ 0,1 - 0,0

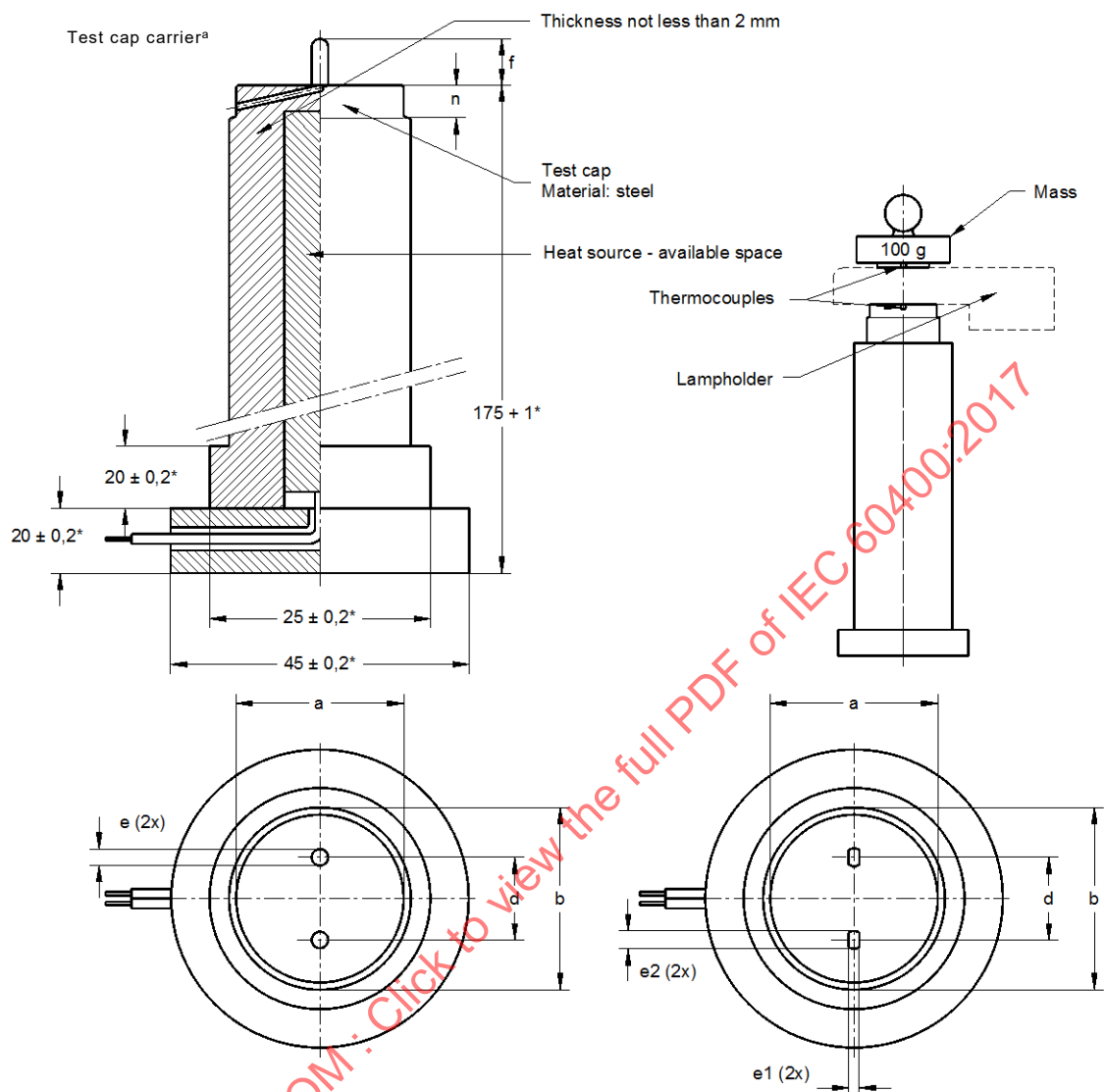
The test cap shall be provided with an internal heat source, e.g. a cartridge heater which provides equal heat distribution over the front side of the test cap.

- a Test cap and test cap carrier need not be separated parts.
- b Dimensions b refer to the nominal lamp diameters. They do not take into account the possible eccentricity of the caps referred to the lamp tube.
- c Other diameters can also be used (e.g. diameters of 40 mm and 50 mm) by means of interchangeable rings.

* Recommended design values for the test cap carrier. Adoption of these values will serve the unification of test devices.

IEC

9a) – Lampholders G13 with T marking (see 18.1)



Reference	Test cap mm	Tolerance mm
a	15,75	+ 0,0 - 0,1
b ^b	16,0	+ 0,0 - 0,1
d	4,75	+ 0,05 - 0,05
e1	1,6	+ 0,05 - 0,05
e2	2,75	+ 0,05 - 0,05
e	2,5	+ 0,05 - 0,05
f	7,1	+ 0,0 - 0,1
n	8,71	+ 0,1 - 0,0

The test cap shall be provided with an internal heat source, for example a cartridge heater which provides equal heat distribution over the front side of the test cap.

- a Test cap and test cap carrier need not be separated parts.
- b Dimension b refers to the nominal lamp diameters. It does not take into account the possible eccentricity of the caps referred to the lamp tube.

* Recommended design values for the test cap carrier. Adoption of these values will serve the unification of test devices.

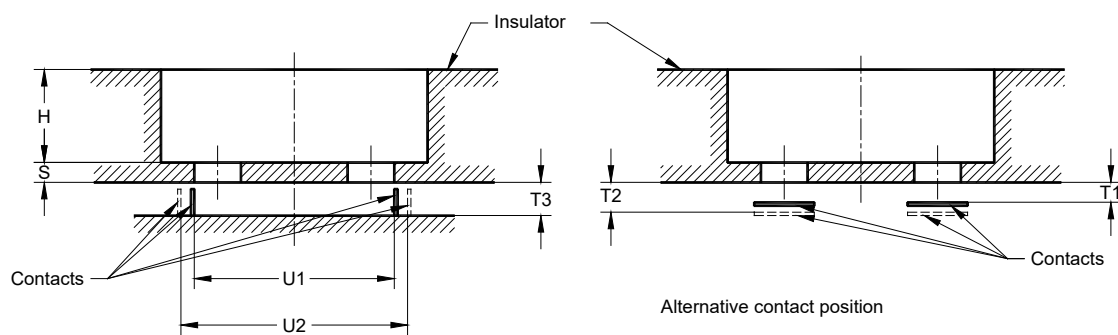
IEC

Lampholders G5

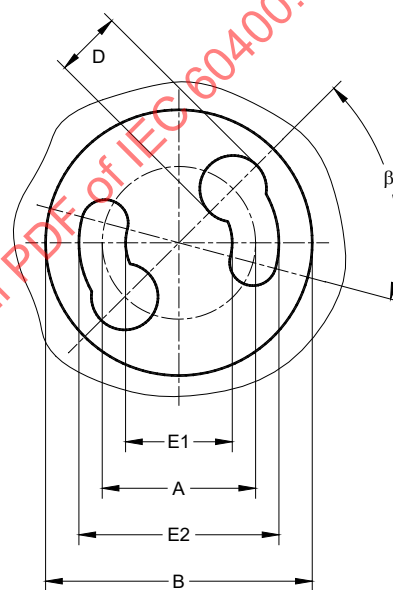
Lampholders GX5

9b) – Lampholders G5 and GX5 with T marking (see 18.1)

Figure 9 – Test cap and test assembly for testing of resistance to heat of lampholders G13, G5 and GX5 with T marking



Reference	Min. mm	Max. mm
A	12,5	12,9
B	21,7	–
D	5,4	–
E1	8,7	9,2
E2	16,2	16,7
H	–	28,0
S	–	1,5
T1 ^a	–	1,5
T2 ^b	2,5	–
T3	2,3	–
U1 ^a	–	17,0
U2 ^b	18,0	–
β	45°	
^a Rest position of contacts.		
^b Contacts fully depressed.		

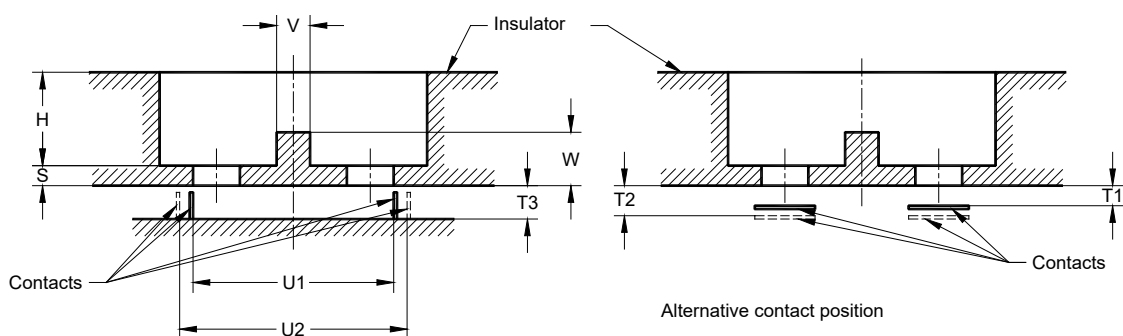


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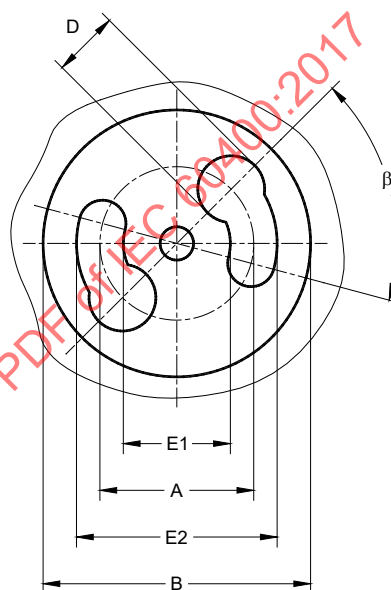
The drawing is intended only to indicate the dimensions to be checked.

Dimensions in millimetres

10a) – Dimensions of starterholder



Reference	Min. mm	Max. mm
A	12,5	12,9
B	21,7	–
D	5,4	–
E1	8,7	9,2
E2	16,2	16,7
H	–	28,0
S	–	1,5
T1 ^a	–	1,5
T2 ^b	2,5	–
T3	2,3	–
U1 ^a	–	17,0
U2 ^b	18,0	–
V	2,2	2,5
W	3,6	4,1
β	45°	–
^a Rest position of contacts.		
^b Contacts fully depressed.		

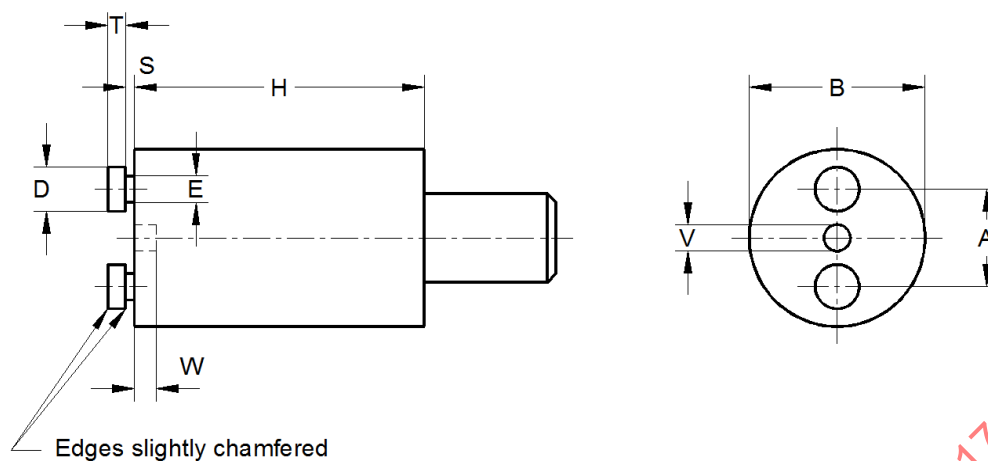


IEC

The drawing is intended only to indicate the dimensions to be checked.

10b) – Dimensions of holder intended for accepting only starters according to Annex B of IEC 60155

Figure 10 – Dimensions of starterholder and holder



The drawing is intended only to illustrate the essential dimensions of the gauges.

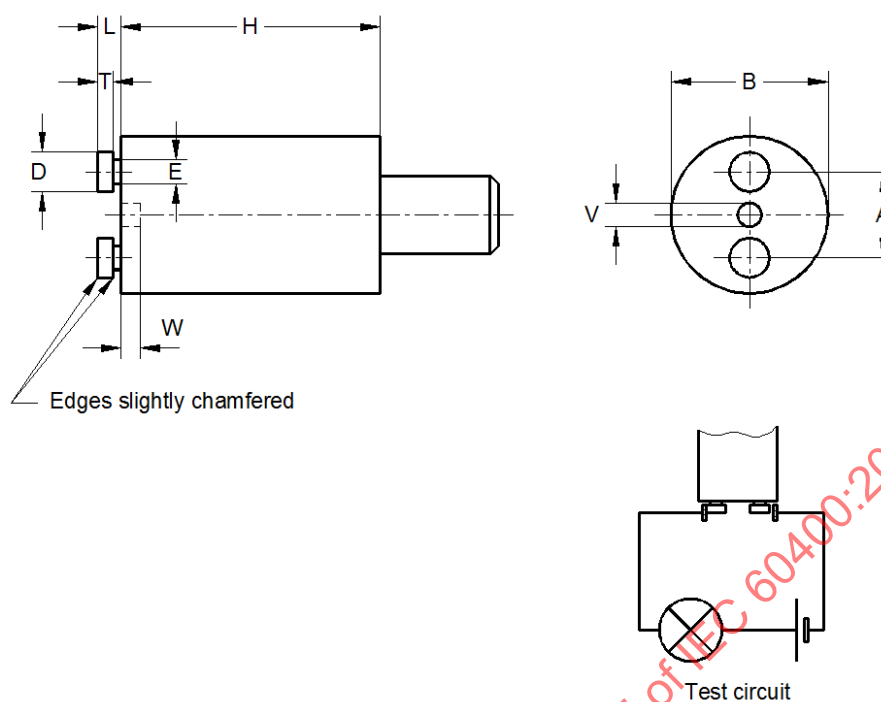
Reference	Dimension mm		Tolerance mm
	Gauge A	Gauge B	
A	12,90	12,50	$\pm 0,005$
B	21,5	21,5	$+ 0,01$ $- 0,0$
D	5,0	5,0	$+ 0,01$ $- 0,0$
E	3,2	3,2	$+ 0,01$ $- 0,0$
H	38	38	$\pm 0,2$
S	1,7	1,7	$+ 0,0$ $- 0,01$
T	2,2	2,2	$+ 0,01$ $- 0,0$
V	2,7	2,7	$+ 0,0$ $- 0,01$
W	2,5	2,5	$+ 0,0$ $- 0,01$

PURPOSE: To check starterholders with regard to the fit of a "maximum" starter.

Gauge A is also used for the torsion test.

TESTING: Each of the gauges A and B shall in turn enter the starterholder smoothly until it reaches the normal operating position of the starter.

Figure 11 – "Go" plug gauges for starterholders



The drawing is intended only to illustrate the essential dimensions of the gauge.

Reference	Dimension mm	Tolerance mm
A	12,70	$\pm 0,005$
B	20,0	$\pm 0,1$
D	4,5	$+ 0,0$ $- 0,01$
E	2,6	$+ 0,0$ $- 0,01$
H	38,0	$\pm 0,2$
L	4,3	$+ 0,01$ $- 0,0$
T	1,9	$+ 0,0$ $- 0,01$
V	3,0	$\pm 0,01$
W	4,0	$+ 0,1$ $- 0,0$

NOTE Mass of the gauge: approximately 75 g.

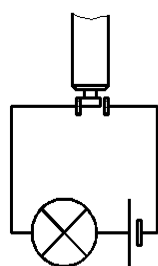
PURPOSE: To check the retention and contact-making of a "minimum" starter in a starterholder, the contact force being determined *inter alia* by the starter-pin spacing.

For starterholders in which the contact force is practically independent from the starter-pin spacing, the special plug gauge shown in Figure 13 should be used.

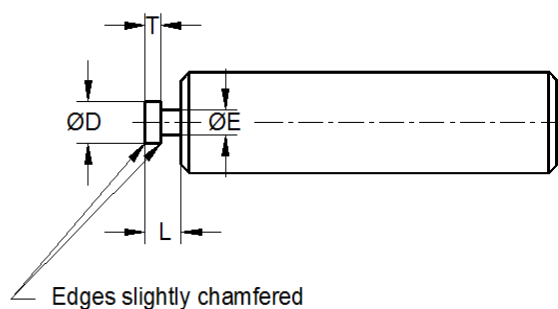
TESTING: The starterholder shall be assumed to be correct if the indicator lamp lights up when the gauge is inserted in the normal operating position of the starter. In this position, the gauge shall be retained by the starterholder. This test shall be made after checking with the gauges shown in Figure 11.

IEC

Figure 12 – Plug gauge for starterholders for testing contact making and retention



Test circuit



IEC

The drawing is intended only to illustrate the essential dimensions of the gauge.

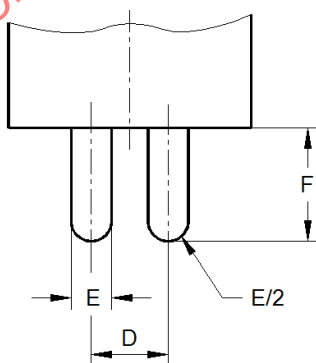
Reference	Dimension mm	Tolerance mm
D	4,7	+ 0,0 – 0,01
E	2,8	+ 0,0 – 0,01
L	4,3	+ 0,01 – 0,0
T	1,9	+ 0,0 – 0,01

PURPOSE: To check contact-making in starterholders in which the contact force is practically independent from the starter-pin spacing.

TESTING: When the gauge is inserted in both contacts in turn, the indicator lamp shall light without flickering in all possible positions of the gauge.

The test shall be made after checking with the gauges shown in Figure 11.

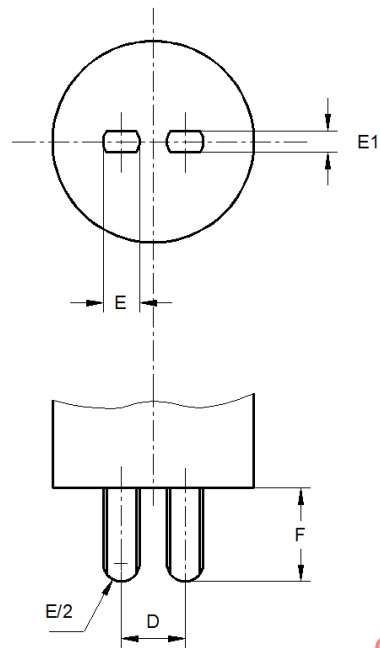
Figure 13 – Special plug gauge for starterholders for testing contact making



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Reference	Dimension mm	Tolerance mm
D	4,75	± 0,05
E	2,37	± 0,02
F	7,1	± 0,05

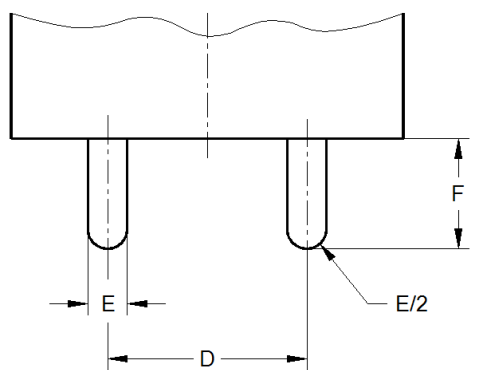
14a) – Test cap for the test of Clause 14 for lampholders G5



Reference	Dimension mm	Tolerance mm
D	4,75	$\pm 0,05$
E	2,69	$\pm 0,02$
E1	1,6	$\pm 0,05$
F	7,1	$\pm 0,05$

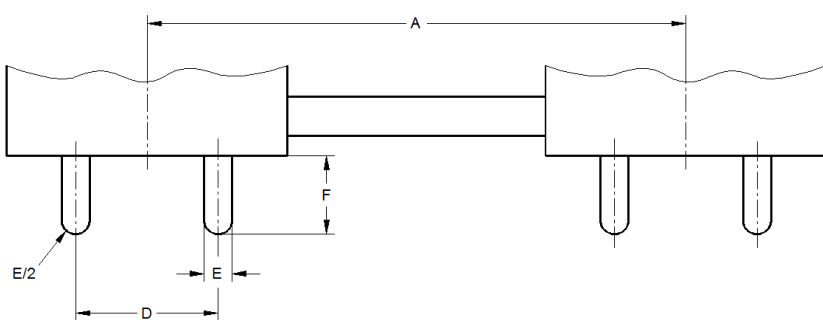
14b) – Test cap for the test of Clause 14 for lampholders GX5

Figure 14 – Test cap for the test of Clause 14 for lampholders G5 and GX5



Reference	Dimension mm	Tolerance mm
D	12,7	$\pm 0,05$
E	2,37	$\pm 0,02$
F	7,1	$\pm 0,05$

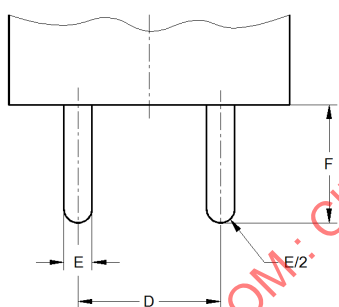
Figure 15 – Test cap for the test of Clause 14 for lampholders G13



IEC

Reference	Dimension mm				Tolerance mm
	2G13-41	2G13-56	2G13-92	2G13-152	
A	41	56	92	152	$\pm 0,1$
D	12,7				$\pm 0,05$
E	2,37				$\pm 0,02$
F	7,1				$\pm 0,05$

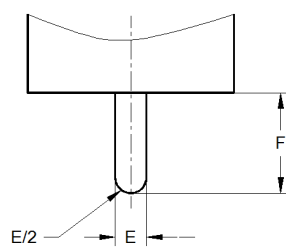
Figure 16 – Test cap for the test of Clause 14 for lampholders 2G13



IEC

Reference	Dimension mm	Tolerance mm
D	19,84	$\pm 0,05$
E	3,32	$\pm 0,02$
F	15,88	$\pm 0,05$

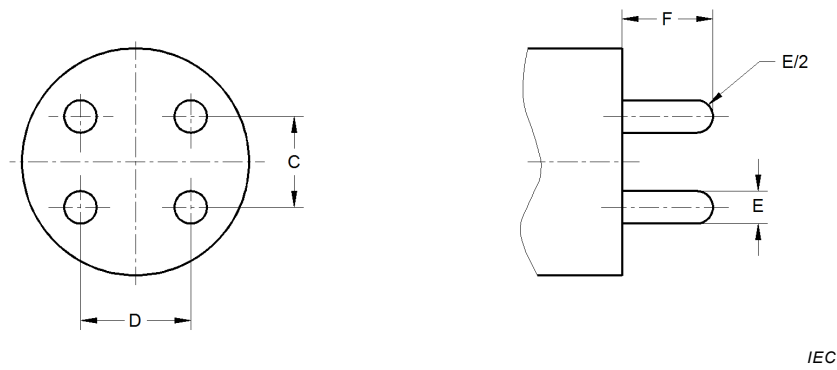
Figure 17 – Test cap for the test of Clause 14 for lampholders G20



IEC

Reference	Dimension mm	Tolerance mm
E	5,96	$\pm 0,02$
F	18,0	$\pm 0,05$

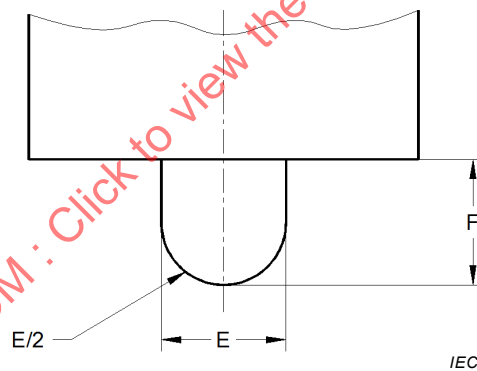
Figure 18 – Test cap for the test of Clause 14 for lampholders Fa6



IEC

Reference	Dimension mm	Tolerance mm
C	6,35	$\pm 0,05$
D	7,92	$\pm 0,05$
E	2,37	$\pm 0,02$
F	7,1	$\pm 0,05$

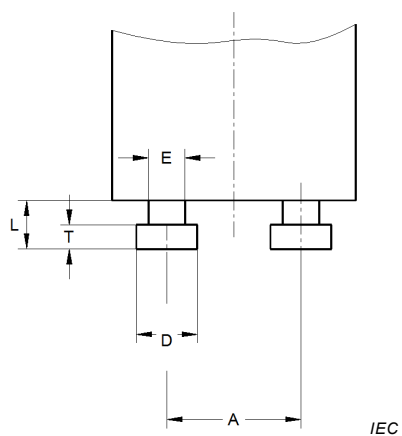
Figure 19 – Test cap for the test of Clause 14 for lampholders G10q, GU10q and GZ10q



IEC

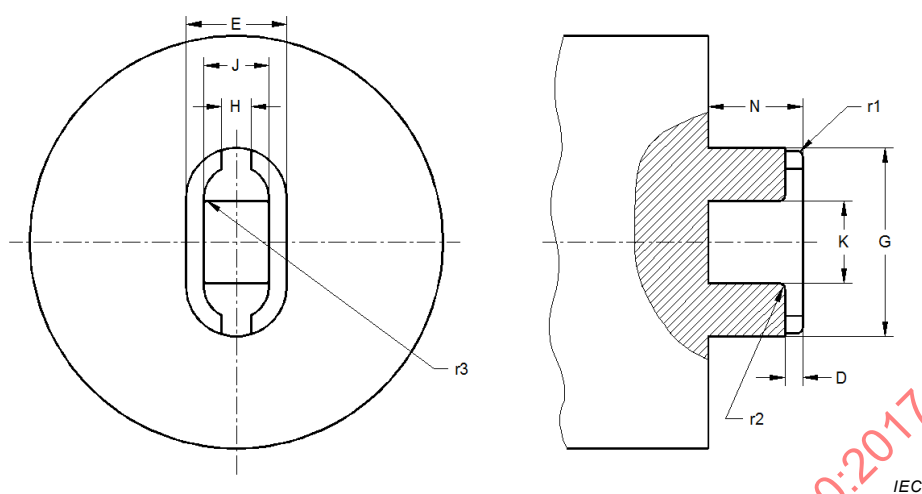
Reference	Dimension mm	Tolerance mm
E	7,94	$\pm 0,02$
F	8,25	$\pm 0,05$

Figure 20 – Test cap for the test of Clause 14 for lampholders Fa8



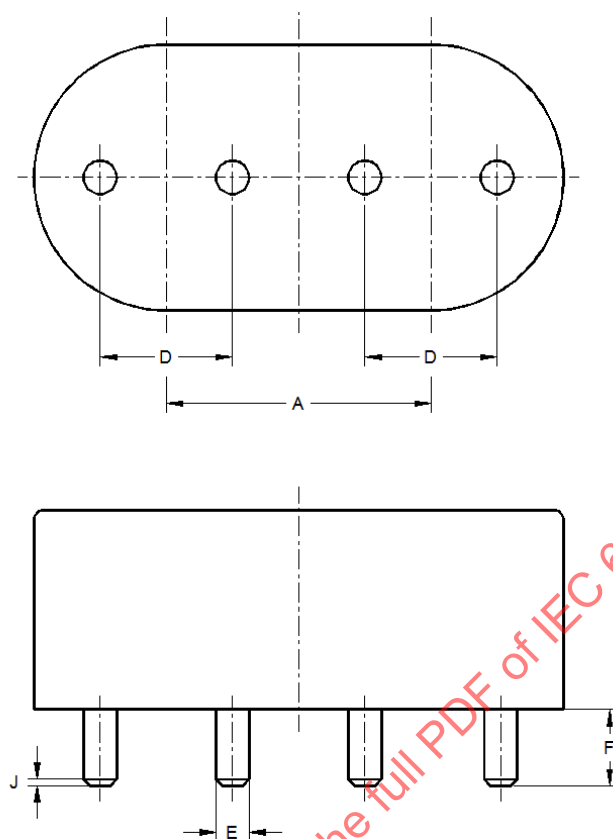
Reference	Dimension mm	Tolerance mm
A	12,7	$\pm 0,05$
D	4,85	$\pm 0,02$
E	2,9	$\pm 0,02$
L	4,1	$\pm 0,05$
T	2,05	$\pm 0,05$

Figure 21 – Test starter for the test of Clause 14



Reference	Dimension mm	Tolerance mm
D	1,41	$\pm 0,05$
E	8,7	$\pm 0,05$
G	16,49	$\pm 0,05$
H	2,6	$\pm 0,05$
J	5,3	$\pm 0,05$
K	7,08	$\pm 0,05$
N	8,0	$\pm 0,1$
r1	0,85	$\pm 0,05$
r2	0,89	$\pm 0,05$
r3	Max. 0,9	

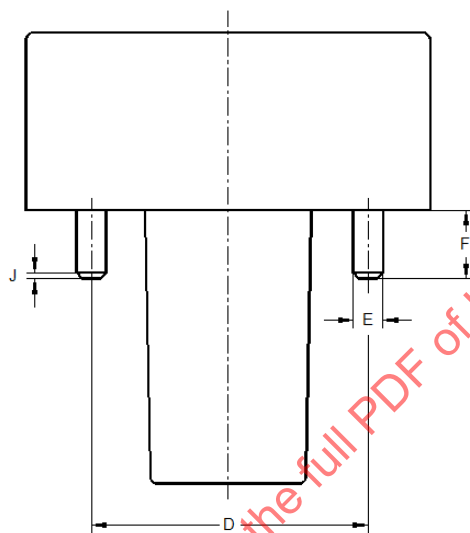
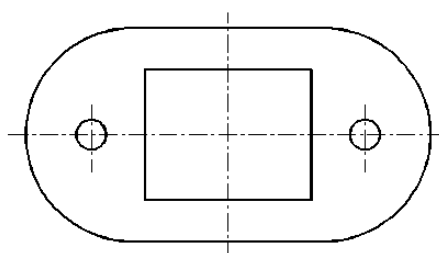
Figure 22 – Test cap for the test of Clause 14 for lampholders R17d



IEC

Reference	Dimension mm	Tolerance mm
A	22,0	$\pm 0,05$
D	11,0	$\pm 0,05$
E	2,37	$\pm 0,02$
F	6,4	$\pm 0,05$
J	0,5	$\pm 0,1$

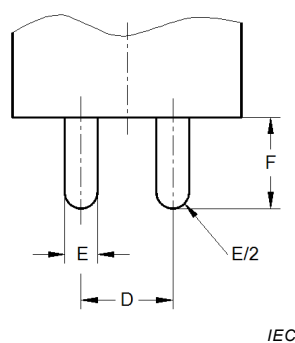
Figure 23 – Test cap for the test of Clause 14 for lampholders 2G11



IEC

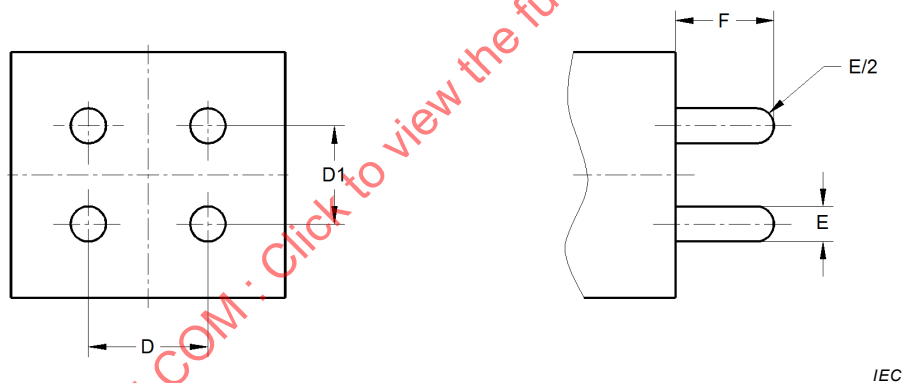
Reference	Dimension mm	Tolerance mm
D	23,0	$\pm 0,05$
E	2,37	$\pm 0,02$
F	6,4	$\pm 0,05$
J	0,5	$\pm 0,1$

Figure 24 – Test cap for the test of Clause 14 for lampholders G23 and GX23



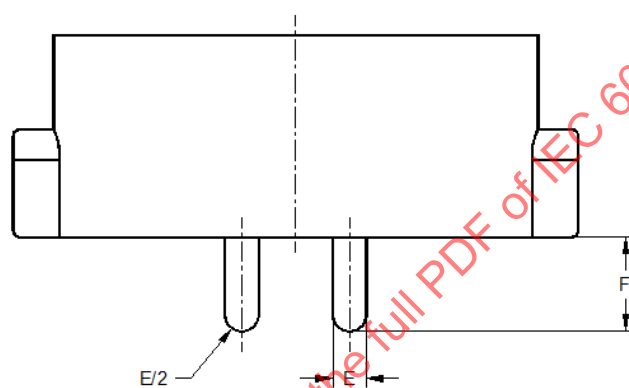
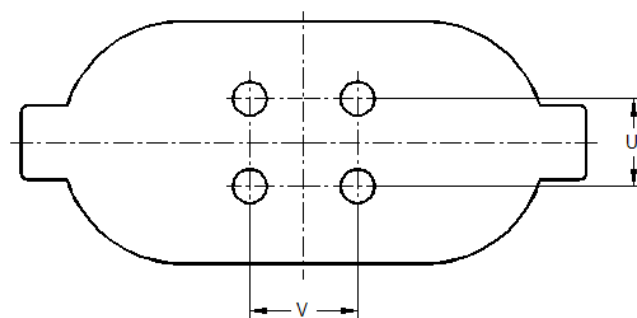
Reference	Dimension mm	Tolerance mm
D	8,0	$\pm 0,05$
E	2,37	$\pm 0,02$
F	7,1	$\pm 0,05$

Figure 25 – Test cap for the test of Clause 14 for lampholders GR8



Reference	Dimension mm	Tolerance mm
D	8,0	$\pm 0,05$
D1	6,35	$\pm 0,05$
E	2,37	$\pm 0,02$
F	7,1	$\pm 0,05$

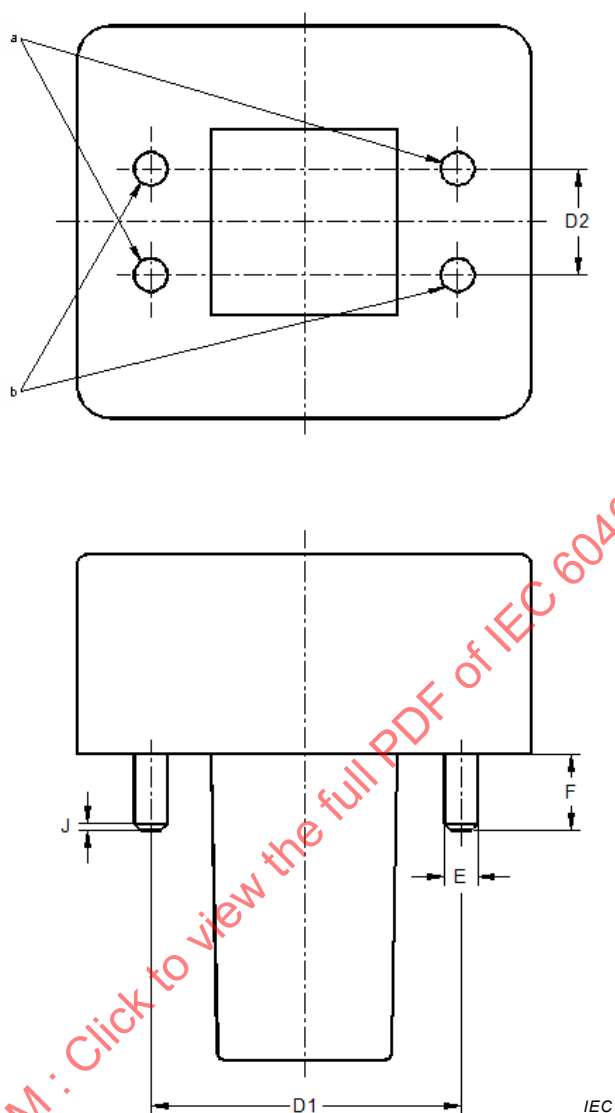
Figure 26 – Test cap for the test of Clause 14 for lampholders GR10q



IEC

Reference	Dimension mm	Tolerance mm
E	2,37	$\pm 0,02$
F	7,10	$\pm 0,05$
U	6,35	$\pm 0,05$
V	7,92	$\pm 0,05$

Figure 27 – Test cap for the test of Clause 14 for lampholders GX10q and GY10q

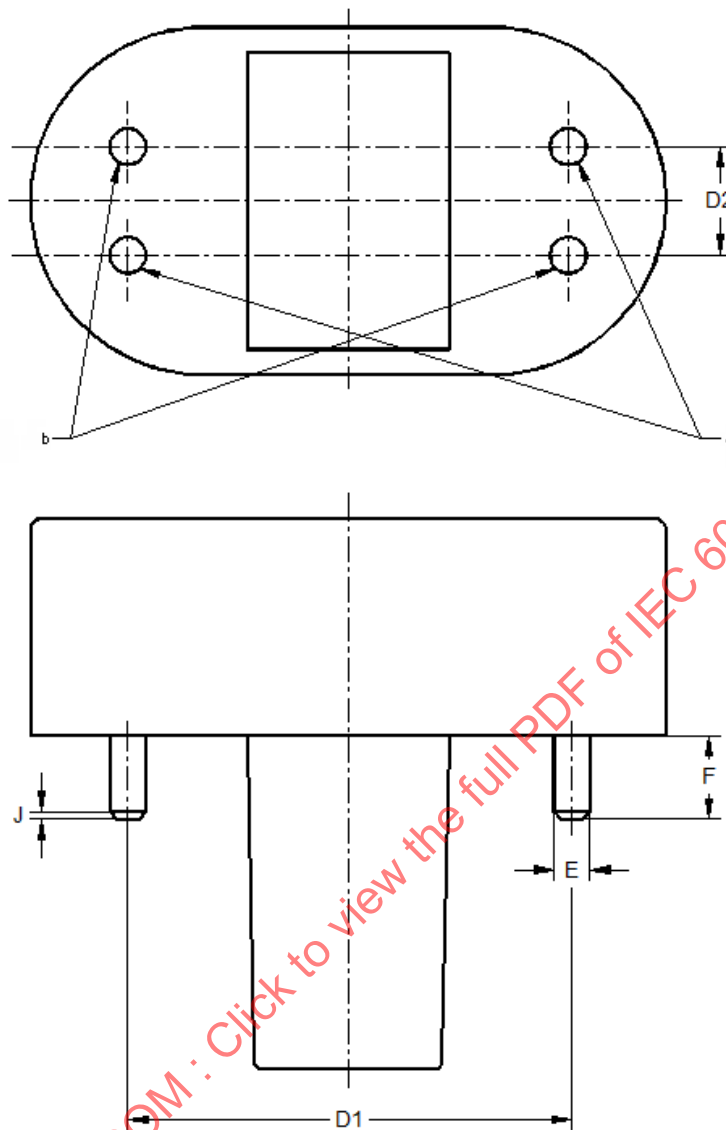


Reference	Dimension mm	Tolerance mm
D1	23,0	$\pm 0,05$
D2	8,0	$\pm 0,05$
E	2,37	$\pm 0,02$
F	6,4	$\pm 0,05$
J	0,5	$\pm 0,1$

^a These pins shall be removed for testing lampholders G24d-1, G24d-2 and G24d-3.

^b These pins shall be removed for testing lampholders GY24d-1, GY24d-2 and GY24d-3.

Figure 28 – Test cap for the test of Clause 14 for lampholders G24, GX24 and GY24



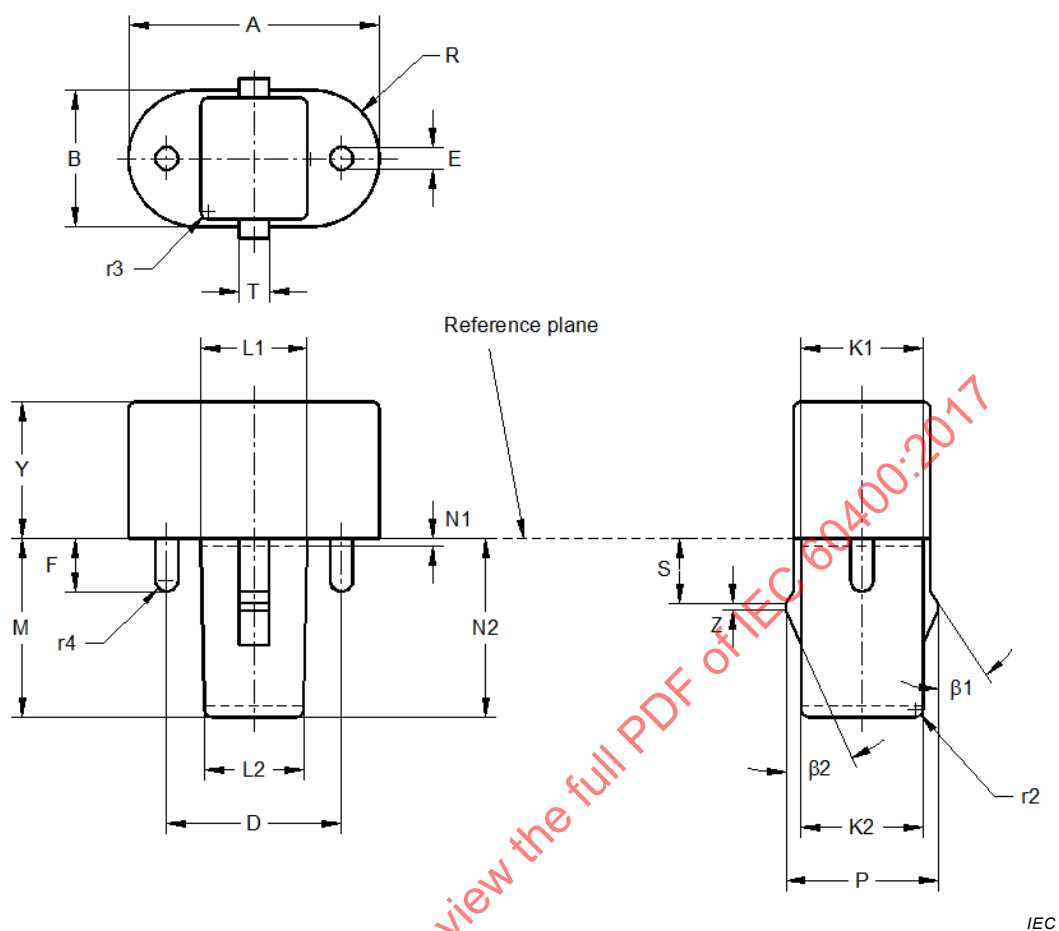
IEC

Reference	Dimension mm	Tolerance mm
D1	31,0	$\pm 0,05$
D2	8,0	$\pm 0,05$
E	2,37	$\pm 0,02$
F	6,4	$\pm 0,05$
J	0,5	$\pm 0,1$

^a These pins shall be removed for testing lampholders G32d-1, G32d-2, G32d-3, G32d-4 and G32d-5.

^b These pins shall be removed for testing lampholders GY32d-1, GY32d-2, GY32d-3, GY32d-4 and GY32d-5.

Figure 29 – Test cap for the test of Clause 14 for lampholders G32 and GY32

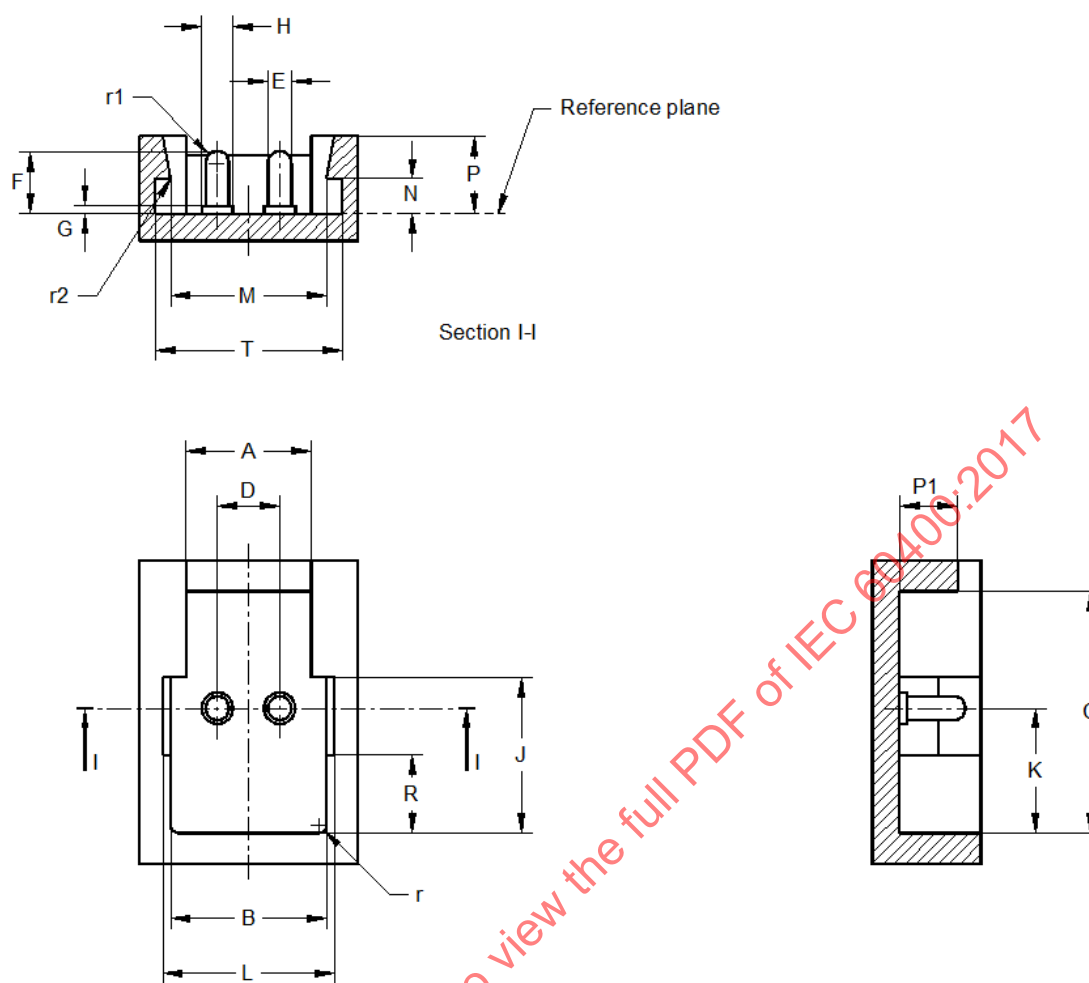


IEC

Reference	Dimension mm	Tolerance mm
A	32,5	± 0,02
B	18,1	± 0,02
D	23,0	± 0,01
E	2,67	± 0,02
F	6,8	± 0,02
K1 ^a	16,3	± 0,02
K2 ^b	15,75	± 0,02
L1 ^a	13,9	± 0,02
L2 ^b	13,35	± 0,02
M	23,0	+ 0,02 – 0,05
N1	0,5	–
N2	21,0	–
^a Measured at distance N1		
^b Measured at distance N2.		

Reference	Dimension mm	Tolerance mm
P	21,0	± 0,02
R	B/2	–
S	9,0	± 0,05
T	4,5	± 0,02
Y	18	± 0,2
Z	0,5	± 0,05
r2	0,8	± 0,05
r3	0,5	± 0,05
r4	E/2	–
β1	35°	± 1°
β2	30°	± 1°

Figure 30 – Test cap for the test of 18.1 for lampholders G23

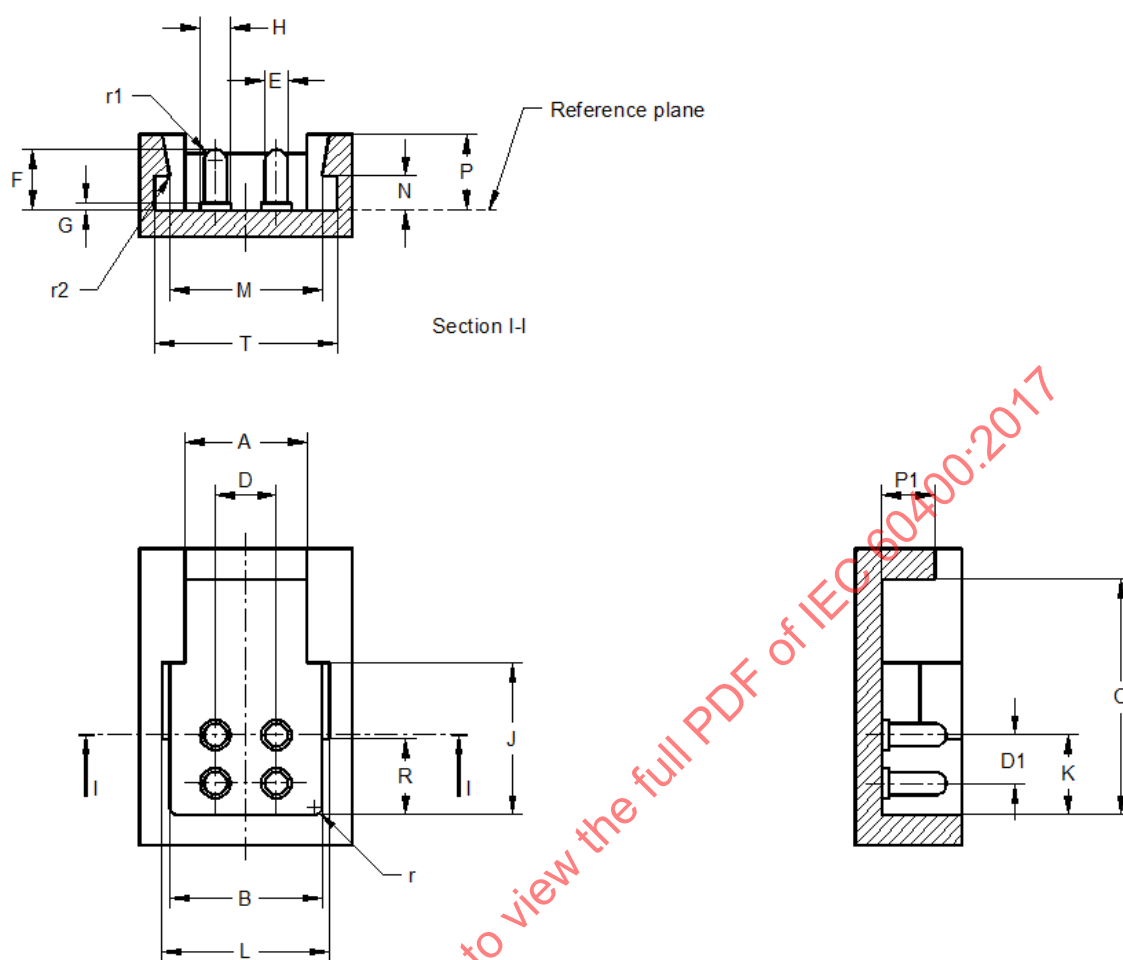


IEC

Reference	Dimension mm	Tolerance mm
A	15,5	$\pm 0,02$
B	20,4	$\pm 0,02$
C	31,0	$\pm 0,2$
D	8,0	$\pm 0,01$
E	2,54	$\pm 0,02$
F	7,77	$\pm 0,01$
G	1,27	$\pm 0,02$
H	3,3	$\pm 0,02$
J	19,3	$\pm 0,02$
K	16,2	$\pm 0,01$

Reference	Dimension mm	Tolerance mm
L	22,0	$\pm 0,02$
M	20,3	$\pm 0,02$
N	3,5	$\pm 0,02$
P	9,9	$\pm 0,02$
P1	7,0	$\pm 0,02$
R	9,0	$\pm 0,02$
T	22,0	$\pm 0,1$
r	0,8	$\pm 0,05$
r1	E/2	–
r2	0,3	$\pm 0,2$

Figure 31 – Test cap for the test of 18.1 for lampholders GR8

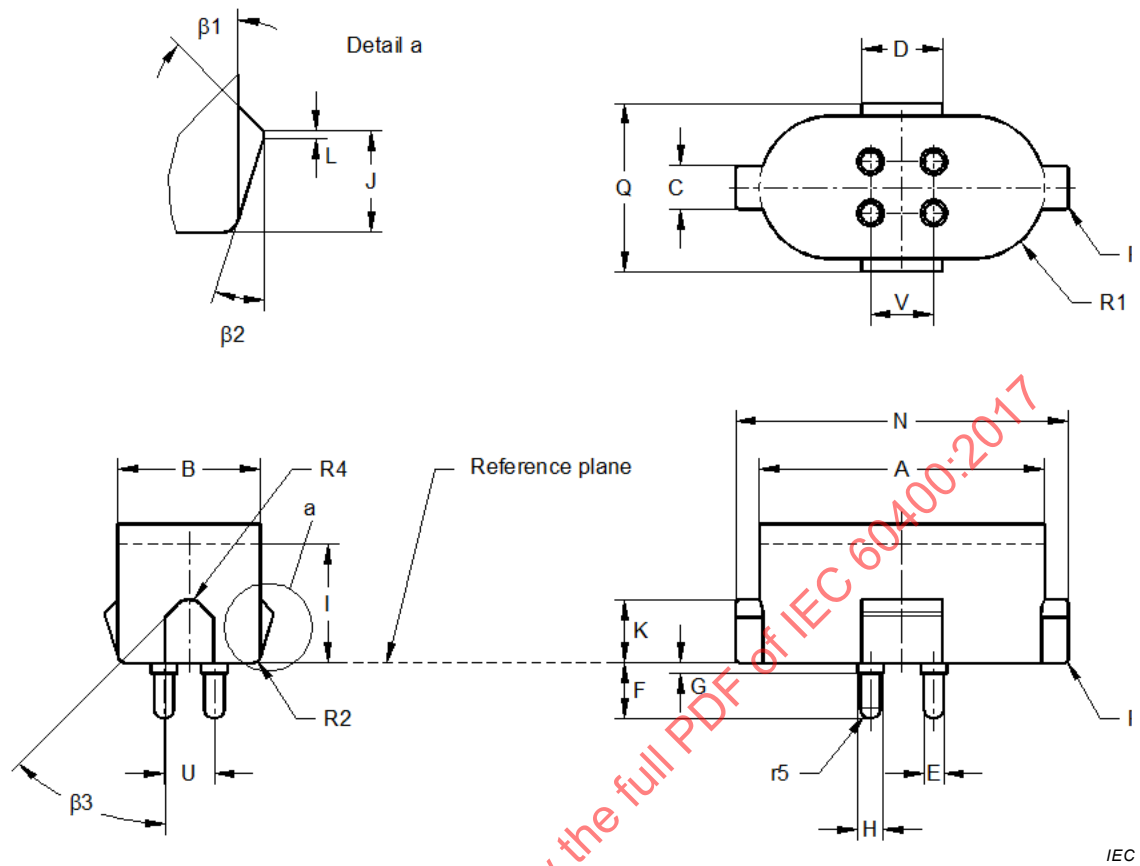


IEC

Reference	Dimension mm	Tolerance mm
A	15,5	$\pm 0,02$
B	20,4	$\pm 0,02$
C	31,0	$\pm 0,2$
D	8,0	$\pm 0,01$
D1	6,35	$\pm 0,01$
E	2,54	$\pm 0,02$
F	7,77	$\pm 0,01$
G	1,27	$\pm 0,02$
H	3,3	$\pm 0,02$
J	19,3	$\pm 0,02$
K	16,2	$\pm 0,01$

Reference	Dimension mm	Tolerance mm
L	22,0	$\pm 0,02$
M	20,3	$\pm 0,02$
N	3,5	$\pm 0,02$
P	9,9	$\pm 0,02$
P1	7,0	$\pm 0,02$
R	9,0	$\pm 0,02$
T	22,0	$\pm 0,1$
r	0,8	$\pm 0,05$
r1	E/2	–
r2	0,3	$\pm 0,2$

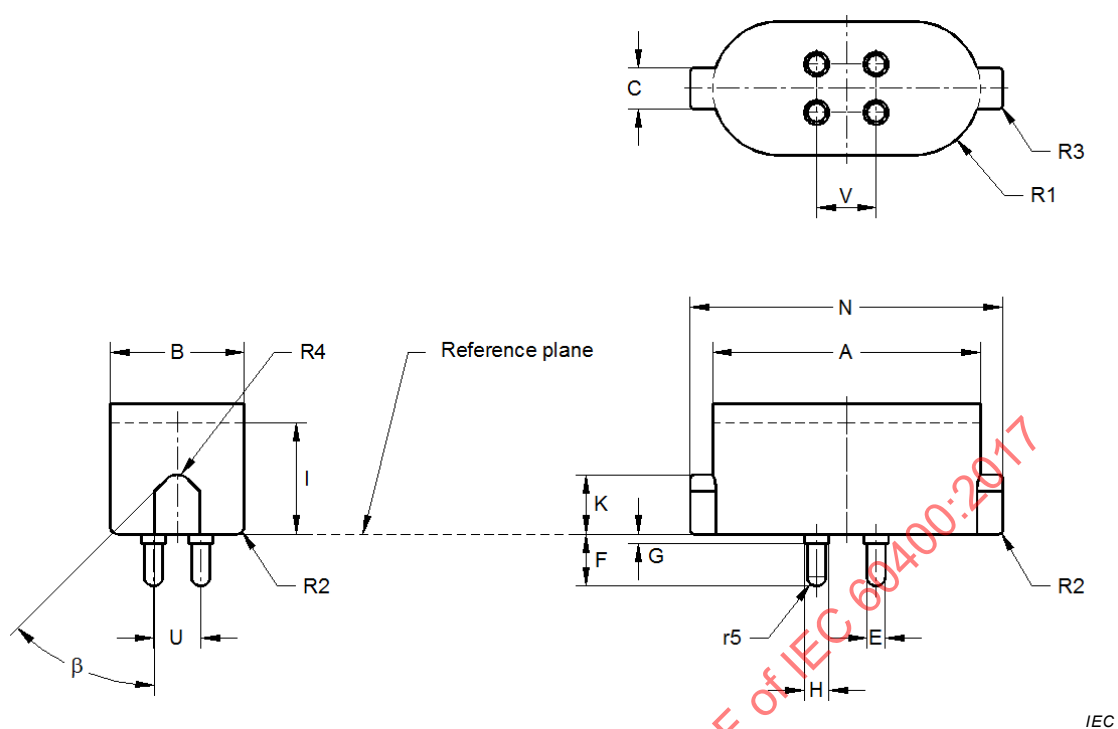
Figure 32 – Test cap for the test of 18.1 for lampholders GR10q



Reference	Dimension mm	Tolerance mm
A	36,2	± 0,02
B	18,0	± 0,02
C	6,1	± 0,02
D	10,2	± 0,02
E	2,54	± 0,02
F	7,62	± 0,02
G	1,27	± 0,02
H	3,3	± 0,02
I	15,0	± 0,2
J	6,4	± 0,05
K	8,15	± 0,02
L	0,5	± 0,05

Reference	Dimension mm	Tolerance mm
N	42,2	± 0,02
Q	21,2	± 0,02
R1	B/2	–
R2	1,0	± 0,05
R3	0,5	± 0,05
R4	2,0	± 0,05
U	6,35	± 0,01
V	7,92	± 0,01
r5	E/2	–
β1	45°	± 1°
β2	15°	± 1°
β3	45°	± 1°

Figure 33 – Test cap for the test of 18.1 for lampholders GX10q

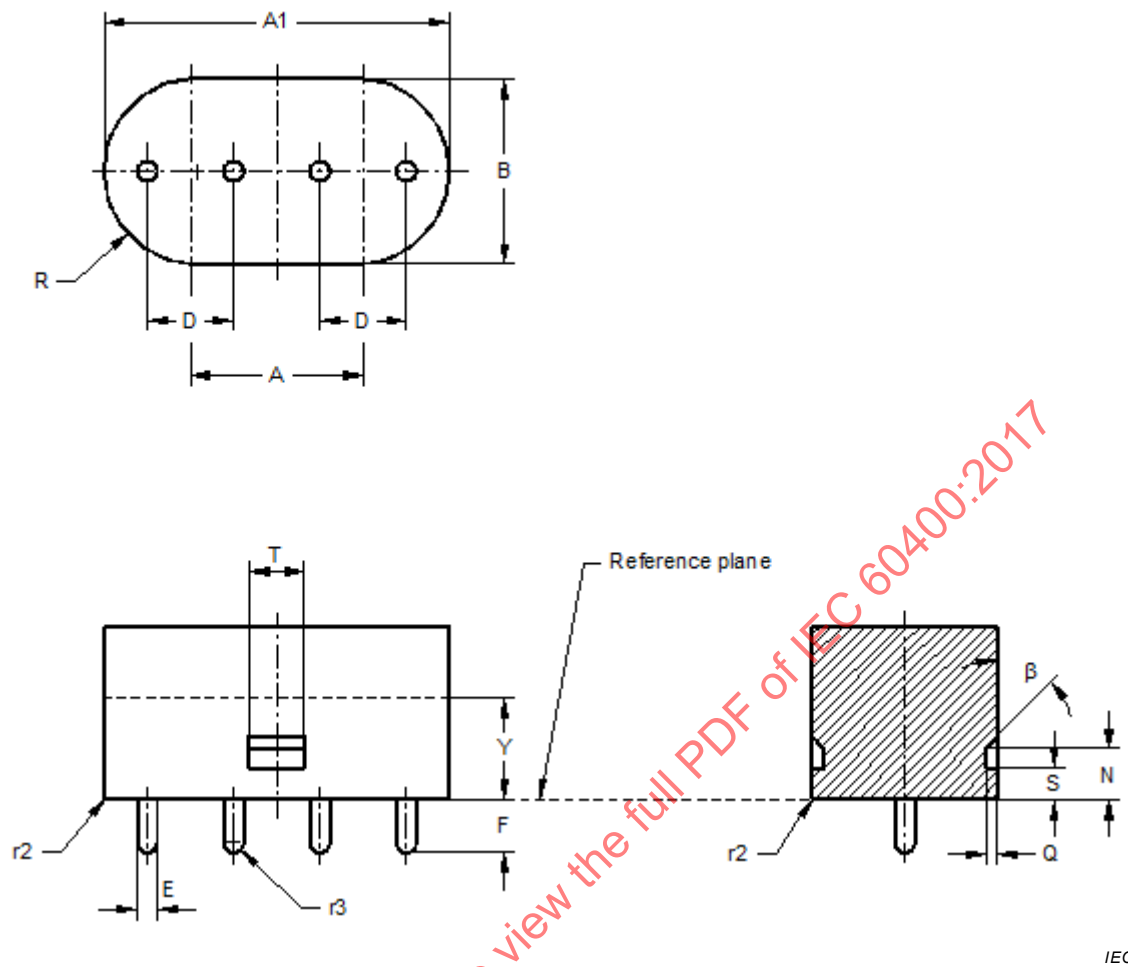


IEC

Reference	Dimension mm	Tolerance mm
A	47,5	$\pm 0,02$
B	24,8	$\pm 0,02$
C	7,1	$\pm 0,02$
E	2,54	$\pm 0,02$
F	7,62	$\pm 0,02$
G	1,27	$\pm 0,02$
H	3,3	$\pm 0,02$
I	17	$\pm 0,2$
K	10,05	$\pm 0,02$

Reference	Dimension mm	Tolerance mm
N	54,2	$\pm 0,02$
R1	B/2	–
R2	2,0	$\pm 0,05$
R3	1,0	$\pm 0,05$
R4	2,0	$\pm 0,05$
U	6,55	$\pm 0,01$
V	7,92	$\pm 0,01$
r5	E/2	–
β	45°	$\pm 1^\circ$

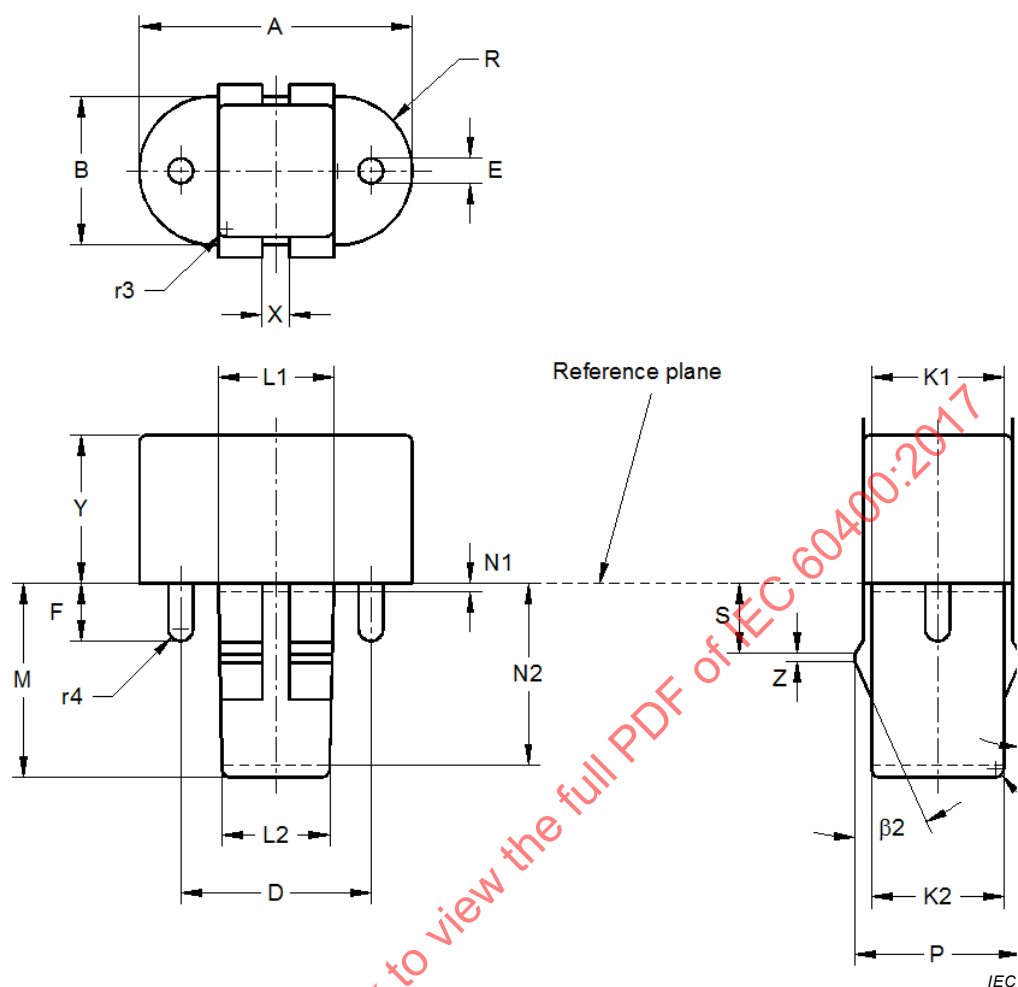
Figure 34 – Test cap for the test of 18.1 for lampholders GY10q



Reference	Dimension mm	Tolerance mm
A	22,0	± 0,01
A1	43,9	± 0,02
B	23,6	± 0,02
D	11,0	± 0,01
E	2,54	± 0,02
F	6,8	± 0,02
N	6,5	± 0,02
Q	1,5	± 0,02

Reference	Dimension mm	Tolerance mm
R	B/2	–
S	3,9	± 0,02
T	7,0	± 0,02
Y	12,9	± 0,2
r2	0,2	± 0,05
r3	E/2	–
β	45°	± 1°

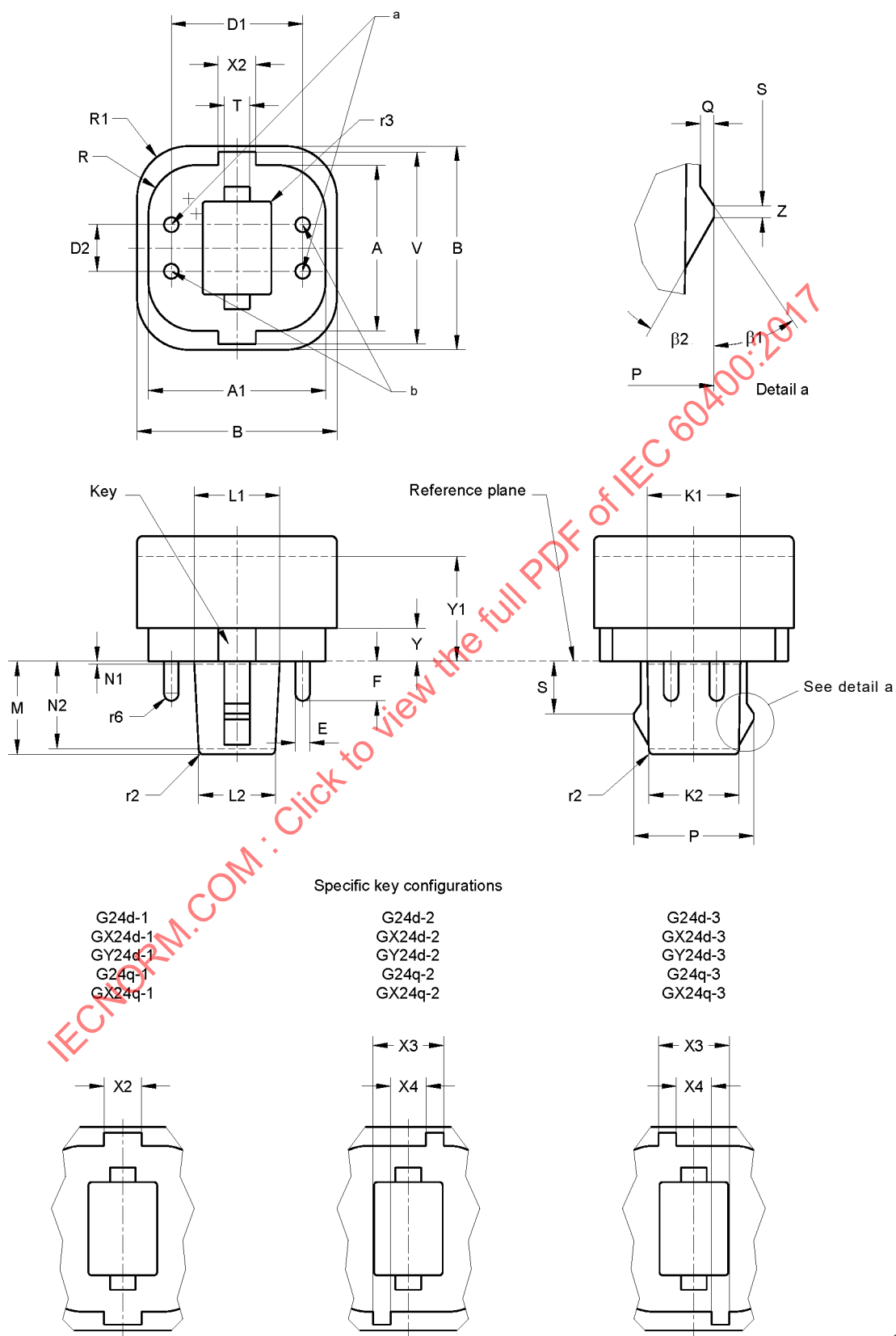
Figure 35 – Test cap for the test of 18.1 for lampholders 2G11



Reference	Dimension mm	Tolerance mm
A	32,5	± 0,02
B	18,1	± 0,02
D	23,0	± 0,01
E	2,54	± 0,02
F	6,8	± 0,02
K1 ^a	16,3	± 0,02
K2 ^b	15,75	± 0,02
L1 ^a	13,9	± 0,02
L2 ^b	13,35	± 0,02
M	23,0	+ 0,02 – 0,05
N1	0,5	–
N2	21,0	–
^a Measured at distance N1		
^b Measured at distance N2.		

Reference	Dimension mm	Tolerance mm
P	21,0	± 0,02
R	B/2	–
S	9,0	± 0,05
X	3,3	± 0,02
Y	18	± 0,2
Z	0,5	± 0,05
r2	0,8	± 0,05
r3	0,5	± 0,05
r4	E/2	–
β1	35°	± 1°
β2	30°	± 1°

Figure 36 – Test cap for the test of 18.1 for lampholders GX23



IEC

Only the test cap for testing lampholders G24q-1 is shown.

Figure 37 – Test cap for the test of 18.1 for lampholders G24, GX24 and GY24 (1 of 2)