MALAYSIAN STANDARD

MS IEC 60360:2006

STANDARD METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE (FIRST REVISION) (IEC 60360 1998, IDT)

ICS: 29.140.10

Descriptors: standard method, measurement, lamp cap, temperature rise

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Committee representation

The Electrotechnical-2 Industry Standards Committee (ISC S) under whose authority this Malaysian Standard was adopted, comprises representatives from the following organisations:

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Department of Standards Malaysia
Federation of Malaysian Manufacturers
Jabatan Kerja Raya Malaysia
Malaysian Cable Manufacturers Association
Ministry of Domestic Trade and Consumer Affairs
Malaysian Electrical Appliances and Distributors Associations
Ministry of International Trade and Industry
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SIRIM QAS International Sdn Bhd (Product Certification and Inspection Section)
Suruhanjaya Komunikasi dan Multimedia Malaysia
Suruhanjaya Tenaga
Tenaga Nasional Berhad
The Electrical and Electronics Association of Malaysia
Universiti Multimedia
Universiti Tenaga Nasional

The Technical Committee on Lighting, Lamps and Accessories which recommends adoption of the IEC Standard consists of representatives from the following organisations:

Association of Consulting Engineers Malaysia
Federation of Malaysian Manufacturers
Jabatan Kerja Raya Malaysia
SIRIM Berhad (Secretariat)
SIRIM QAS International Sdn Bhd (Electrotechnical Testing Section)
SIRIM QAS International Sdn Bhd (Product Certification and Inspection Section)
Suruhanjaya Tenaga
Tenaga Nasional Berhad
The Electrical and Electronics Association of Malaysia
The Institution of Engineers, Malaysia
Universiti Teknologi Malaysia

NATIONAL FOREWORD

The adoption of the IEC Standard as a Malaysian Standard was recommended by the Technical Committee on Lighting, Lamps and Accessories under the authority of the Electrotechnical-2 Industry Standards Committee.

This Malaysian Standard is the first revision of MS IEC 60360:1999, *Standard method of measurement of lamp cap temperature rise.*

This Malaysian Standard is identical with IEC 60360:1998, *Standard method of measurement of lamp cap temperature rise*, published by the International Electrotechnical Commission (IEC). However, for the purposes of this Malaysian Standard, the following apply:

a) in the source text, “this International Standard” should read “this Malaysian Standard”;

b) the comma which is used as a decimal sign (if any), to read as a point; and

c) the basis IEC 60360 is printed in English and French languages. However, only the English version is retained in this Malaysian Standard.

This standard cancels and replaces MS IEC 60360:1999.

Compliance with a Malaysian Standard does not of itself confer immunity from legal obligations.

NOTE. IDT on the front cover indicates an identical standard i.e. a standard where the technical content, structure, and wording (or is an identical translation) of a Malaysian Standard is exactly the same as in an International Standard or is identical in technical content and structure although it may contain the minimal editorial changes specified in clause 4.2 of ISO/IEC Guide 21-1.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

STANDARD METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
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6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60360 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This third edition cancels and replaces the second edition published in 1987, amendment 1 (1993) and amendment 2 (1996), and constitutes a technical revision.

The text of this standard is based on the second edition, amendments 1 and 2 and the following documents:

FDIS	Report on voting
34A/814/FDIS	34A/828/RVD

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

In this standard, the following print types are used:

– requirements proper: in roman type;

– test specifications: in italic type;

– explanatory matter: in smaller roman type.

The contents of the corrigendum of March 1999 have been included in this copy.

INTRODUCTION

The temperature rise of the lamp cap is, in practice, very dependent on the mounting of the lamp and the condition of the cap. For this reason, it has been necessary to define a method of measurement based on the use of a standard test lampholder. The temperature rise Δt_s measured on the standard test lampholder is taken as the lamp cap temperature rise for the purpose of this standard.

Compared with the measurement of the temperature rise of the bare lamp cap, the measurement of the temperature rise of a standard test lampholder has the following advantages:

– a better approximation to actual operating conditions;

– improved reproducibility, as there is less influence from lamp cap material, finish and surface conditions (which also have little influence on actual operating conditions);

– levelling (or averaging) of the temperatures of various parts of the cap, giving a better overall picture of the heat transferred from the lamp to the luminaire;

– reduced duration of measurements, as the thermocouple is fixed permanently to the test lampholder.

STANDARD METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

1 General

1.1 Scope

This International Sandard describes the standard method of measurement of lamp cap temperature rise which is to be used when testing incandescent or discharge lamps for compliance with the limits. Temperature-rise limits for particular lamp types are, for example, listed in IEC 60432.

It covers the method of test and the specifications for test lampholders for lamps fitted with various sizes of Edison screw (ES) and Bayonet (BC) caps. This method has been used widely for incandescent lamps but its application is not limited to that kind of lamp.

1.2 Normative reference

The following normative document contains provisions which, through reference in this text, constitutes provisions of this International Standard. At the time of publication, the edition indicated was valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60432: Safety specification for incandescent lamps

2 Definitions

For the purposes of this International Sandard, the following definitions apply:

2.1
temperature rise of cap
surface temperature rise of a standard test lampholder fitted to the lamp cap, when measured under conditions specified in this standard

2.2
equilibrium temperature (t_m)
steady-state temperature of a standard test lampholder reached after a sufficient lamp operating time

NOTE – The measuring accuracy should be ±1 °C.

3 General conditions for measurements

3.1 Ageing and stabilizing

For these measurements, no previous ageing of the lamp is required. Sufficient stability of the lamp is achieved during the time necessary to reach the equilibrium temperature in the test enclosure.

3.2 Supply voltage

a) For lamps intended to be connected directly to the supply, measurement shall be made at rated voltage, the supply voltage being maintained constant within ±0,5 %.

b) For lamps intended to be connected to the supply through a ballast, measurements shall be made at the rated voltage of the ballast, the supply voltage being maintained constant within ±0,5 %. Measurements shall be made using a reference ballast or a production ballast which at the calibration current has an impedance within ±1 % of the reference ballast.

If the lamp is marked with a voltage range the test procedure of IEC 60432 shall apply, unless a different procedure is called for in another publication.

3.3 Ambient and reference temperatures

The reference temperature for defining cap temperature rise is 25 °C. However, it is possible for the measurements to be made at an ambient temperature (t_{amb}) within the range of 15 °C to 40 °C unless otherwise specified in the relevant lamp data sheet; that is, the temperature within the test enclosure, during the measurement cycle, shall remain within this range for the results to be meaningful. A special test enclosure, described in 4.1, is used to maintain the ambient temperature at a sufficiently constant value.

If the temperature in the test enclosure differs from 25 °C, the value Δt_m measured shall be converted to a temperature rise relevant to an ambient of 25 °C in accordance with the following formula:

$$\Delta t_{25} = \Delta t_m + 1/3(t_{amb} - 25)\left(\frac{\Delta t_m}{100}\right)^{1/2}$$

where

Δt_{25} is the temperature rise corrected to 25 °C;

Δt_m is the difference between the final equilibrium temperature and the ambient temperature, $t_m - t_{amb}$;

t_{amb} is the ambient temperature.

NOTE – The above formula is valid for any ambient temperature between 15 °C and 40 °C.

4 Test requirements

Temperature measurements shall be made in a draught-free test enclosure.

4.1 Test enclosure

The draught-proof enclosure is rectangular, with a double skin on the top and on at least three sides, and with a solid base. The double skins are of perforated metal, spaced apart approximately 150 mm, with regular perforations of 1 mm to 2 mm diameter, occupying about 40 % of the whole area of each skin.

The internal surfaces are painted with a matt paint.

The dimensions of the enclosure shall be such that the ambient temperature within the test enclosure will not exceed 40 °C while the test is being run. To achieve this condition, the three principal internal dimensions shall be preferably at least 900 mm. There should be a clearance of at least 200 mm between any part of the lamp and the inside of the enclosure. Alternative constructions for draught-proof enclosures are suitable if it is established that similar test results are obtained.

NOTE – For production surveillance conditions, a smaller enclosure of 500 mm × 500 mm × 500 mm may be used, providing the internal ambient temperature does not exceed 40 °C during temperature measurement, the lamp being mounted in the centre of the enclosure.

The internal ambient temperature shall be measured with a thermometer screened from direct radiation from the test lamp. The thermometer is to be placed level with the lamp about halfway between the lamp and the wall.

4.2 Suspension methods

The standard measurement position shall be cap-up unless another operating position is specified for the relevant lamp. The suspension of the lamp shall not affect the convection around the lamp in any adverse manner.

4.2.1 Cap-up

The test-lamp, assembled in the test lampholder as described in clause 8, shall be suspended from the top of the enclosure directly by the supply leads.

4.2.2 Cap-down

This position requires a special bulb supporting system attached to the enclosure. This shall consist of three equally spaced points which are intended to support the bulb of the test lamp, assembled in the test lampholder as described in clause 8, in the transition area between the major bulb diameter and the neck.

a) The support points shall be at least 5 mm away from the cap.

b) The material of the support points shall be a suitable thermal insulating material.

c) The area of a point that contacts the lamp bulb should be kept as small as possible to minimize heat loss errors.

d) For cap-down suspension of tubular lamps, spring loading of the contact points will be necessary to provide a holding force.

5 Test lampholders

5.1 General construction

Test lampholders consisting of a metallic sleeve fitted with a thermocouple have been standardized for lamps provided with various types of caps. The various test lampholders shall be as specified in the relevant figures.

Each test lampholder shall have a permanently attached stranded flexible wire which in the case of ES caps and single contact bayonet caps serve as one of the supply leads. A thermocouple shall be permanently attached to the lampholder sleeve (see 7.3). In addition, a spring wire shall be used around the outside of the sleeve to assure good physical contact between the sleeve and the cap of the lamp. Figure 1 shows the general construction features and assembled position of a lampholder for an ES cap. Figure 2 shows supplementary information.

5.2 Test lampholder sleeve material specification

5.2.1 Composition

Nickel: 99 % min.

NOTE – Examples of the above material may be found in the following standards: Germany, DIN 17750, Werkstoff 2.4068.26; North America, UNS N02201, ASTM B162.

5.2.2 Structure and properties

The material shall be finely grained and of regular structure.

Grain size: ASTM 8 min. (approximately 0,019 mm max.).

Vickers hardness: 135 ± 15.

5.2.3 Thickness

0,5 mm ± 0,02 mm.

5.2.4 Quality and finish

The material shall be uniform in composition and properties. The strip shall be rolled smooth, with a clean bright surface. It shall be cut straight and be free from kinks, waviness, dents, inclusions, lubricants and other defects.

5.3 Spring material specification

Spring steel wire: (under consideration).

Diameter: approximately 0,8 mm.

Length: approximately 1 to 1,5 turns around sleeve.

6 Supply conductors

Material: copper.

Size: 0,56 mm^2 to 0,71 mm^2 effective cross-sectional area. (This is equivalent to a diameter range of 0,85 mm to 0,95 mm for solid conductors.)

Length: approximately 110 mm.

When attached to the eyelets of a BC cap or to the centre contact of ES or single contact BC caps, the wire shall be solid and attached by solder.

The stranded wire attached to the test lampholder shall be connected to the neutral of the supply.

7 Thermocouple

7.1 Materials

The materials recommended for the thermocouple are NiCr/NiAl (Chromel/Alumel) or Fe/Constantan. The size of the wires shall be sufficiently thin so as not to influence the temperature of the test lampholder. The maximum thickness of the wire shall be 200 µm. The wires shall be provided with an insulating outer layer (enamel, heat resisting sheathing, etc.).

7.2 Junction

The following method is preferred for making the junction of the two thermocouple wires.

After the ends of the wires have been stripped of their insulation, the two wires shall be set on end at an angle of approximately 150° and butt-welded. Any projecting leads are cut off close to the weld and by pulling the wires taut by hand they will form in line at the junction and the welding will automatically flatten.

7.3 Attachment to lampholder sleeve

The hot junction of the thermocouple shall be attached to the test lampholder, by means of a minimum of solder, so that it is in direct mechanical contact. The junction shall be located diametrically opposite the lampholder slit, 1 mm to 2 mm from the edge as indicated in the relevant figure. See figures 1 to 14. The use of a cement at the hot junction is deprecated. The wires shall be insulated right up to the junction. The two leads are then stretched parallel to the edge along the lampholder over at least 20 mm (if feasible), at which point the leads are secured with the minimum of cement (see notes 1 and 2).

NOTE 1 – For B15 and smaller size test holders, a compromise of the minimum lead stretching distance should be made to avoid placing the leads and cement joints too close to the lampholder slit.

NOTE 2 – Suitable cement composition comprises one part by weight of sodium silicate and two parts by weight of powdered talc.

7.4 Equipment

The temperature or millivolt indicating equipment shall be calibrated to be accurate within ±0,5 %.

7.5 Calibration

The thermocouple shall be calibrated at fixed points; namely, the boiling point of water and the solidification point of tin, lead and zinc.

NOTE – If it is desired to calibrate the thermocouple after it has been mounted on the sleeve, only the boiling point of water should be used (in order to avoid melting the solder).

8 Assembly of the lamp and the test lampholder in the enclosure

The test lampholder shall be pushed up to the rim of the cap of the lamp to be tested. See figure 1 for the typical relationship of the lampholder and lamp.

For screw caps, the orientation of the lampholder with respect to the cap is determined by the side solder.

Special instructions apply for the assembly of test lampholders on to various skirted caps.

a) For the medium size skirted caps, such as E27/51 × 39, the rim of the lampholder sleeve shall be located in the same plane as the borderline of the screw shell and the insulation between the shell and the skirt.
b) For E14 skirted caps special test lampholders shall be used. These lampholders shall be installed on the skirt with the rim of the lampholder sleeve located at the rim of the skirt.

For bayonet caps, two circumferential positions of the test lampholder with respect to the cap are possible; measurements shall be made with the thermocouple junction as near as possible to the filament.

It is important that the lamp is placed approximately in the centre of the enclosure with its axis as near to vertical as possible.

For cap-up measurement, it is recommended that an arrangement adjustable in the vertical direction and mounted on the ceiling of the enclosure be used for the supply leads (see 4.2.1).

For cap-down measurement, a special fixture shall be used (see 4.2.2).

9 Measurement of temperature rise

The minimum operating time for each lamp before measurement shall be 30 min. The operator may then take a series of preliminary measurements to verify that the temperature is no longer rising. When the equilibrium temperature has been reached, the test lampholder temperature and the ambient temperature are read and recorded. The measurement results for individual lamps shall be rounded off to the nearest degree centigrade. Then a calculation of cap temperature rise shall be made, using the corrective equation of 3.3 if necessary.

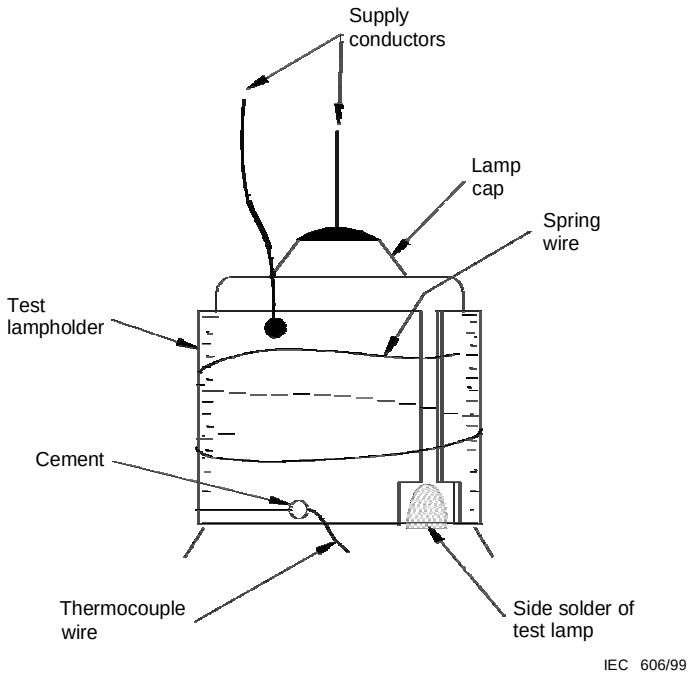
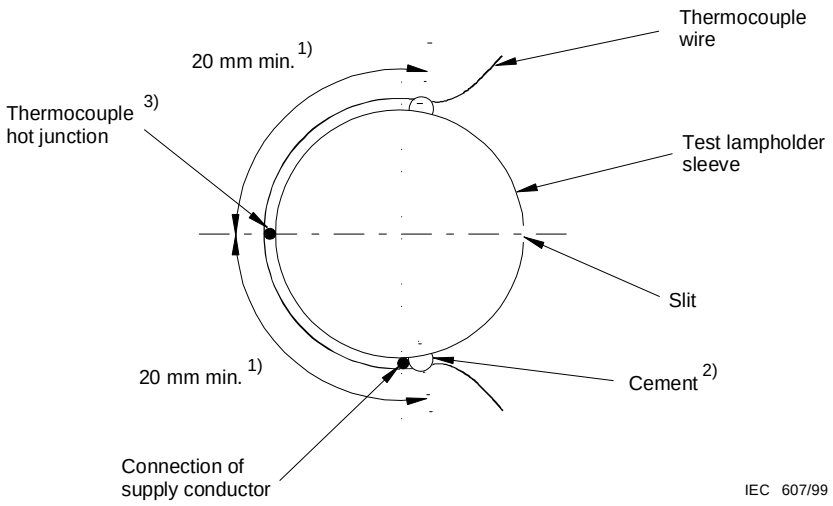


Figure 1 – Typical test lampholder parts (ES capped lamp illustrated)

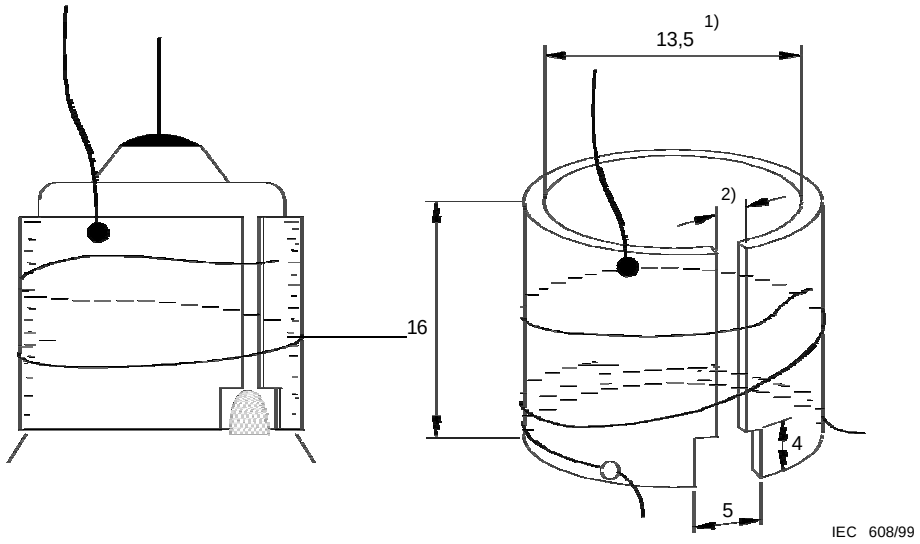


1) See note 1 to 7.3.

2) See note 2 to 7.3.

3) Attached as specified in 7.3.

Figure 2 – Position of a typical test lampholder and thermocouple (spring not shown)

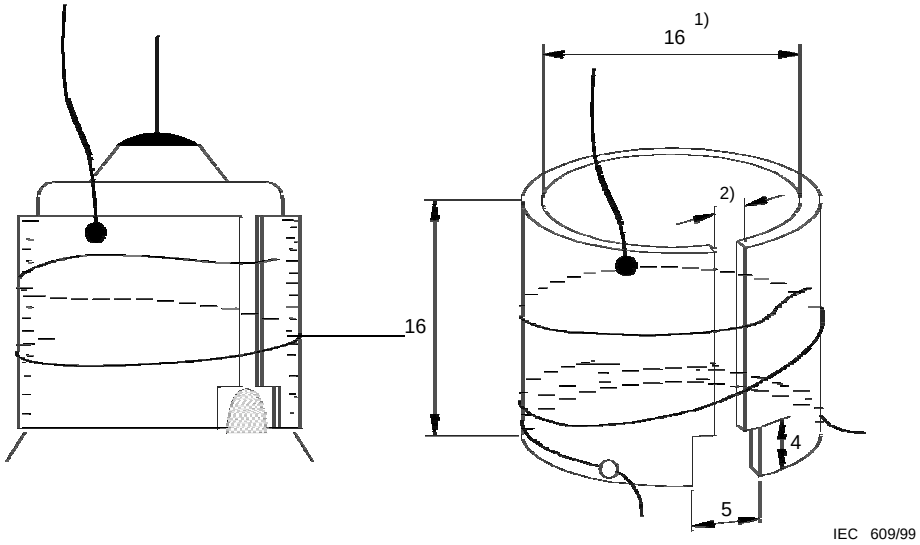


All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 3 – Approximate dimensions of test lampholder for E14/20 cap

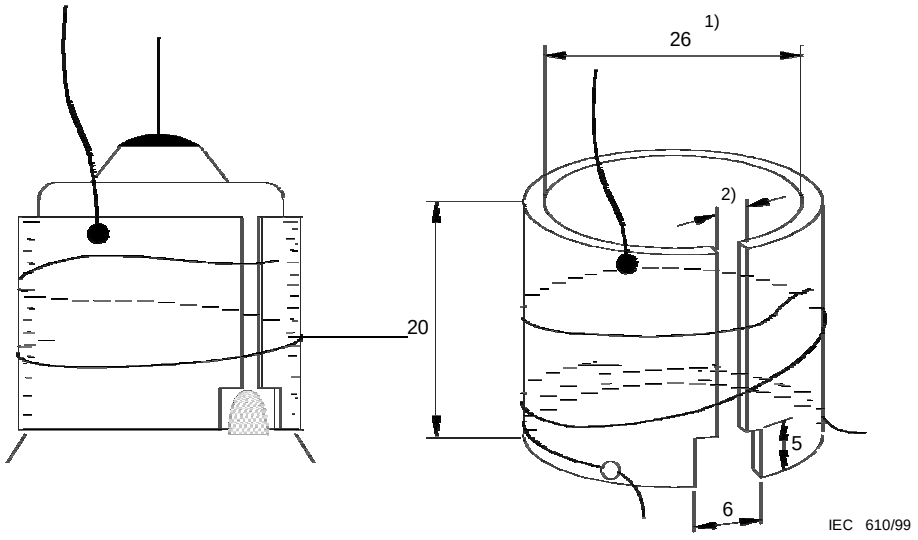


All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 4 – Approximate dimensions of test lampholder for E17/20 cap

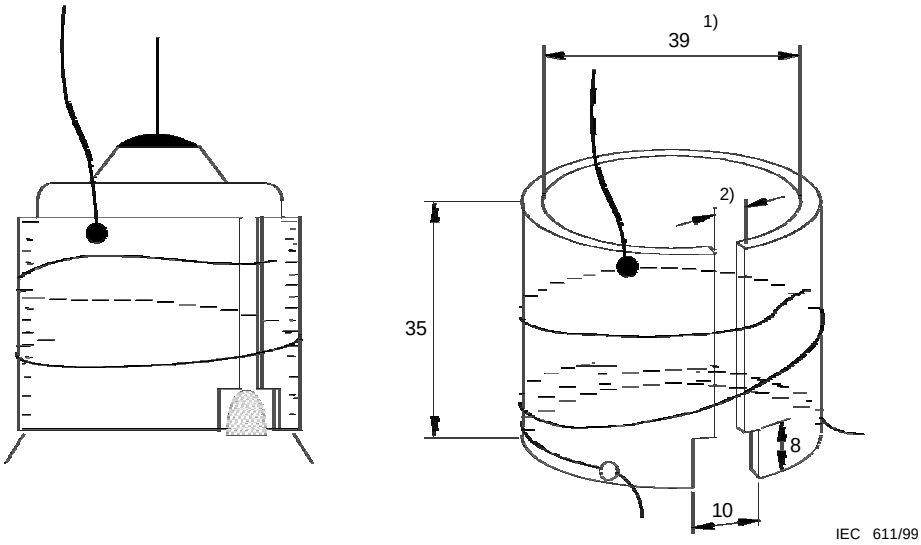


All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 5 – Approximate dimensions of test lampholder for E26/50 × 39, E27/51 × 39, E26, E26d and E27

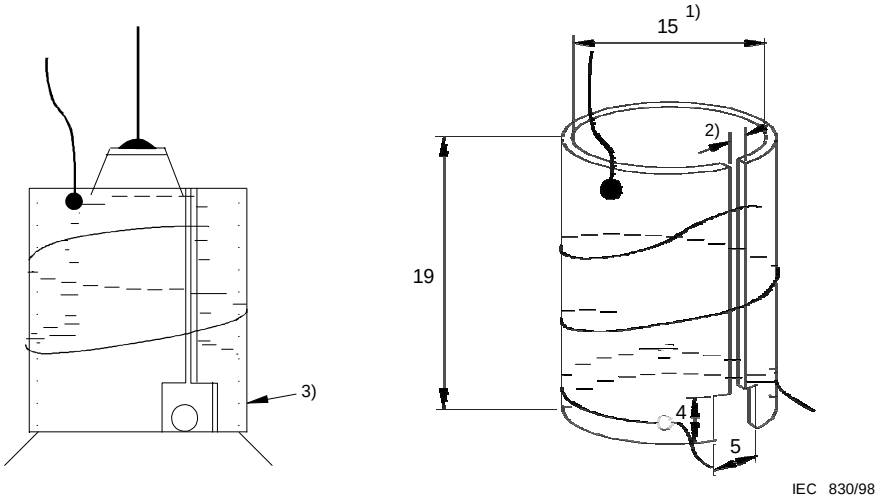


All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 6 – Approximate dimensions of test lampholder for E39 and E40 caps



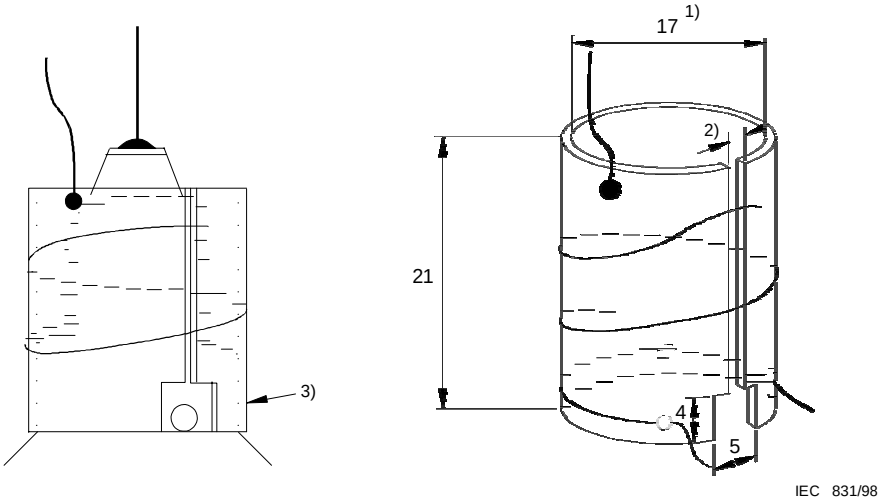
All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

3) The test lampholder shall be installed over the skirt of the cap as shown in the figure.

Figure 7 – Approximate dimensions of test lampholder for E14/23 × 15 cap



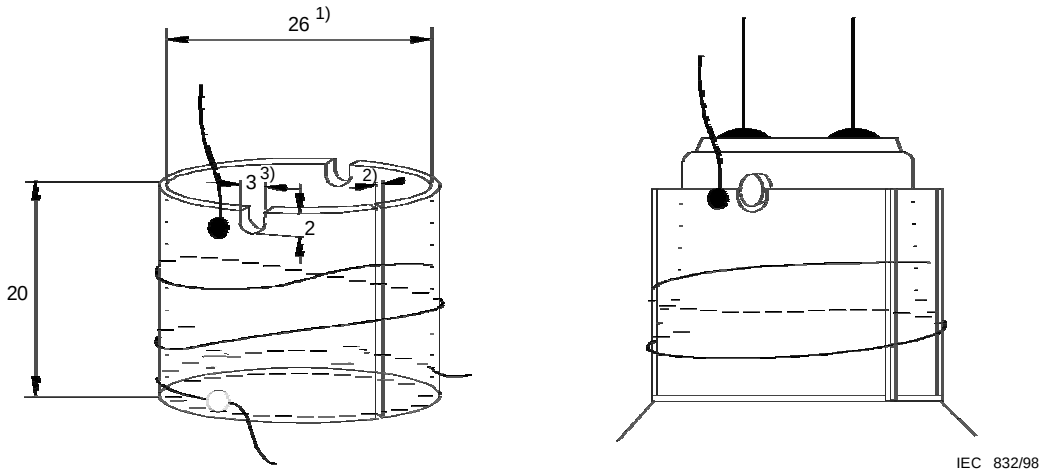
All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

3) The test lampholder shall be installed over the skirt of the cap as shown in the figure.

Figure 8 – Approximate dimensions of test lampholder for E14/25 × 17 cap



All dimensions in millimetres

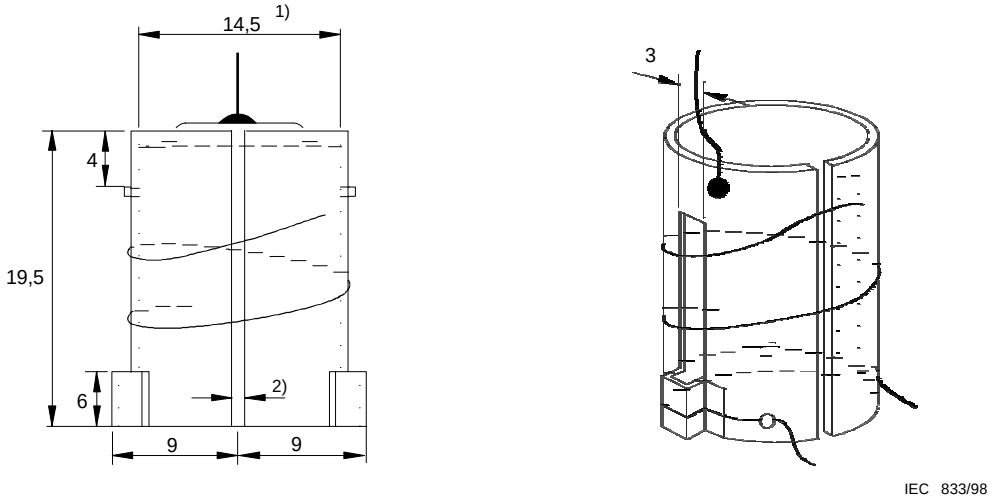
1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

3) The slots for the bayonet pins fall on one of the orthogonal centrelines shown in figure 2. Therefore it will be necessary to locate the connection of the supply line off centre, slightly toward the thermocouple hot junction.

4) The test lampholder shall be installed over the skirt of the cap as shown in the figure.

Figure 9 – Approximate dimensions of test lampholder for culot B22d/25 × 26 and B22d-3 (90°/135°)/25 × 26 caps

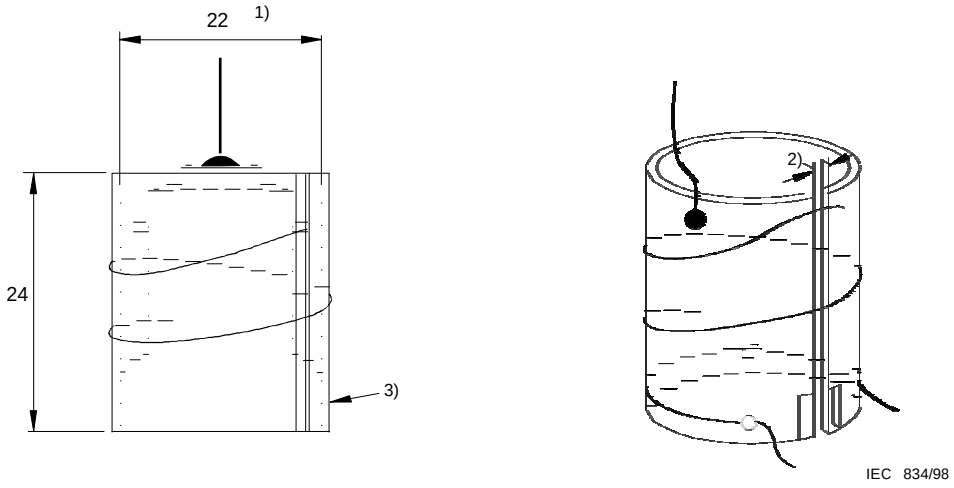


All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 10 – Approximate dimensions of test lampholder for B15d (unskirted) cap



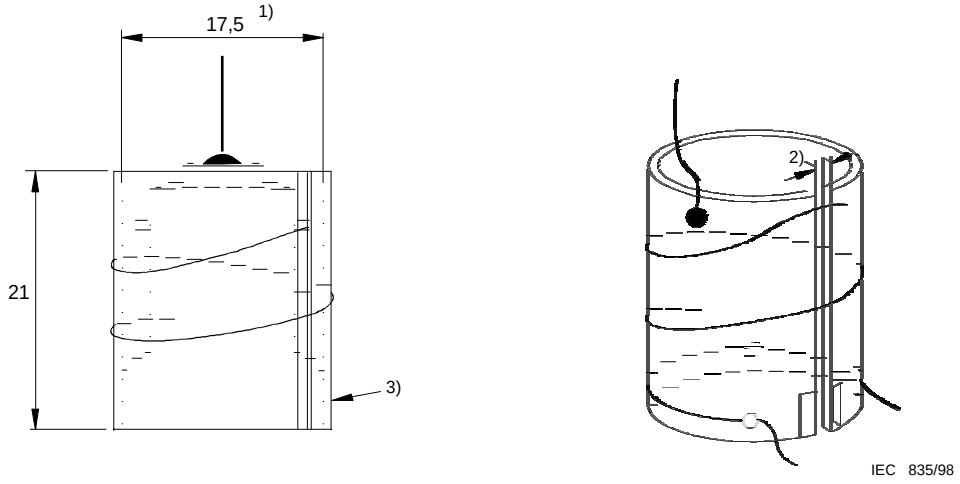
All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

3) The test lampholder shall be installed over the skirt of the cap as shown in the figure.

Figure 11 – Approximate dimensions of test lampholder for B15d/27 × 22 cap



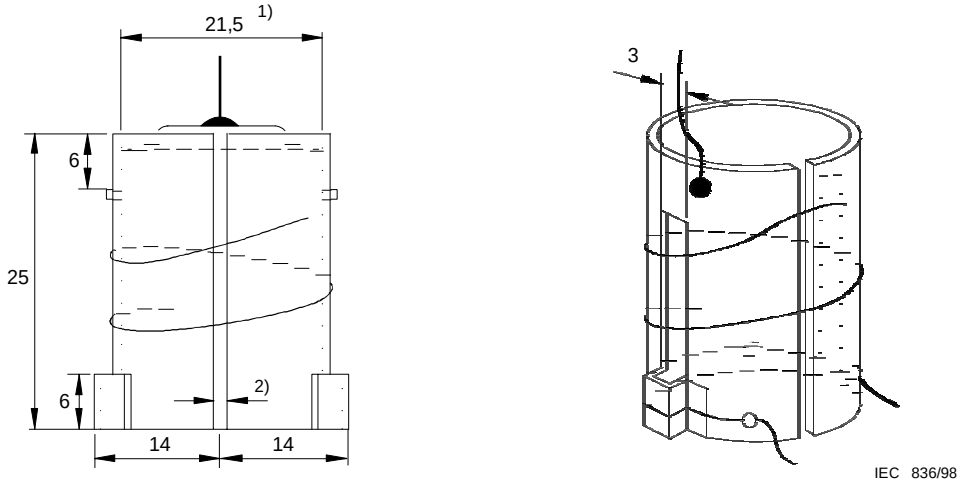
All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

3) The test lampholder shall be installed over the skirt of the cap as shown in the figure.

Figure 12 – Approximate dimensions of test lampholder for B15d/24 × 17 cap

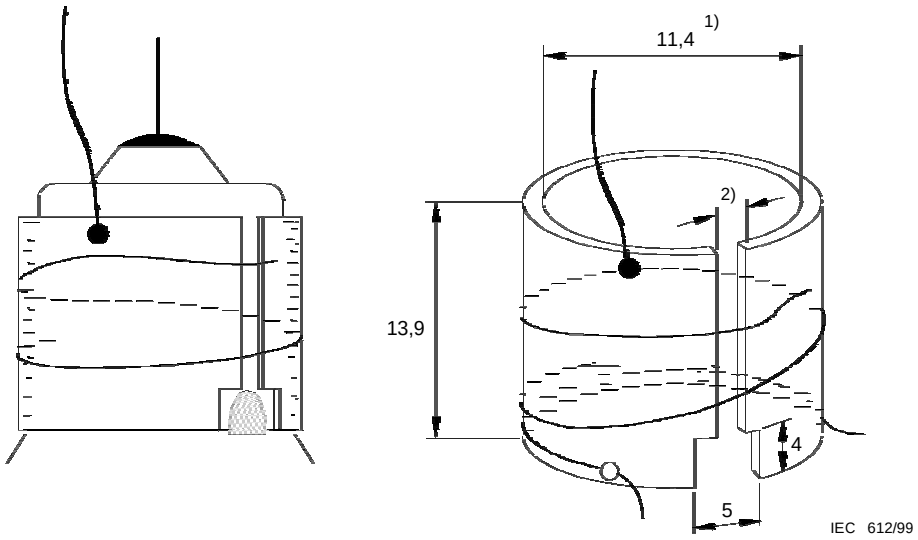


All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 13 – Approximate dimensions of test lampholder for B22d/22 cap



All dimensions in millimetres

1) Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

2) The width of the slit shall be 2 mm ± 1,5 mm when the test lampholder is mounted on the lamp.

Figure 14 – Approximate dimensions of test lampholder for E12/15 cap

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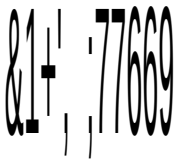

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