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METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

SRI LANKA STANDARDS INSTITUTION

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Gr. 8

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Sri Lanka.

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This standard does not purport to include all the necessary provisions of a contract.

Sri Lanka Standard
METHOD OF MEASUREMENT OF LAMP CAP TEMPERATURE RISE

FOREWORD

This standard was approved by the Sectoral Committee on Electrical Appliances and Accessories and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 1995.12.14.

This standard prescribes a method of measurement of lamp cap temperature rise of tungsten filament lamps including general conditions for measurements, test requirements, test lamp holder requirements and assembly of lamp with the test lamp holder etc.

All values given in this specification are in SI units.

In reporting the result of a test or an analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with CS 102.

In the preparation of this standard, guidance obtained from the publication IEC 360 of International Electrotechnical Commission is gratefully acknowledged.

1 SCOPE

This standard describes the standard method of measurement of lamp cap temperature rise which is to be used when testing tungsten filament lamps for compliance with the limits.

2 REFERENCES

CS 102 Presentation of numerical values.

3 DEFINITIONS

For the purpose of this standard the following definitions shall apply;

3.1 **temperature rise of cap** : The surface temperature rise of a standard test lampholder fitted to the lamp cap, when measured under conditions specified in this standard.

3.2 **equilibrium temperature(t_e)**: The steady-state temperature of a standard test lampholder reached after a sufficient lamp burning time.

NOTE

The measuring accuracy should be ± 1 °C.

3.3 rated voltage : Voltage assigned to the appliance by the manufacturer.

NOTE

For three phase supply it is the voltage between phases.

4 GENERAL CONDITIONS FOR MEASUREMENTS

4.1 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.

4.2 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 per cent.

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 per cent. Measurements shall be made using a reference ballast or a production ballast which at the calibration current has an impedance within ±1 per cent of the reference ballast.

If the lamp is marked with a voltage range the requirements given in SIS 984 : Part 1 : 1992 shall apply.

4.3 Ambient and reference temperatures

The reference temperature for defining cap temperature rise shall be 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 5.1, 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 t_m measured shall be converted to a temperature rise relevant to an ambient of 25 °C in accordance with the following formula:

$$t_{25} = t_m + 1/5\,(t_{amb} - 25)\,\frac{t_m}{100}^{1/2}$$

where:

t_{25} is temperature rise corrected to 25 °C reference

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

t_{amb} is ambient temperature

NOTE

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

5. TEST REQUIREMENTS

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

5.1 Test enclosure

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

The internal surfaces shall be 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 principle 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 x 500 mm x 500 mm may be used, provided 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.

5.2 Suspension methods

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

5.2.1 *Cap-up*

The test-lamp, assembled in the test lampholder as described in 9, shall be suspended from the top of the enclosure directly by the supply leads.

5.2.2 *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 9, 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.

6 TEST LAMPHOLDERS

6.1 General construction

Test lampholders consisting of a metallic sleeve fitted with a thermocouple shall be standardized for lamps provided with various types of caps. The various test lampholders shall be as specified in Figure 1 to Figure 11 as appropriated.

Each test lampholder shall have a permanently attached stranded flexible wire which in the case of screw caps and single contact bayonet caps serves as one of the supply leads. A thermocouple shall be permanently attached to the lampholder sleeve. (See 8.3) 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 screw cap. Figure 2 shows supplementary information.

6.2 Test lampholder sleeve material specification

6.2.1 *Composition*

Nickel + Cobalt:	99.5% min.
Cobalt:	0.5% max.
Sulphur:	0.005% max.
Zinc:	0.005% max.

6.2.2 *Structure and properties*

The material shall be finely grained and of regular structure.
Grain size: ASTM 8 minimum (approximately 0.019 mm maximum).
Vickers hardness: 135±15.

6.2.3 *Thickness*

0.5 ± 0.02 mm.

6.2.4 *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.

6.3 Spring material specification

Spring steel wire: (under consideration).
Diameter: approximately 0.8 mm
Length: approximately 1 to 1.5 turns around sleeve.

7. SUPPLY CONDUCTORS

7.1 **Material:** Copper.

7.2 **Size:** 0.56 mm^2 effective cross-sectional area.
(This is equivalent to a diameter range of 0.85 mm to 0.95 mm for solid conductors.)

7.3 **Length:** approximately 110 mm.

When attached to the eyelets of a bayonet cap or to the centre contact of screw or single contact bayonet 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.

8. THERMOCOUPLE

8.1 Materials

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

8.2 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.

8.3 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 Figure 1 to Figure 11, page 8 to page 13. 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.

NOTES

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.

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

8.4 Equipment

The temperature or millivolt indicating equipment shall be calibrated to be accurate within ± 0.5 per cent.

8.5 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).

9 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 x 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 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 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 5.2.1).

For cap-down measurement a special fixture shall be used (see 5.2.2).

10. MEASUREMENT OF TEMPERATURE RISE

The minimum burning time for each lamp before measurement shall be 0.5 h. 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 1 °C. Then a calculation of cap temperature rise shall be made, using the corrective equation of 4.3 if necessary.

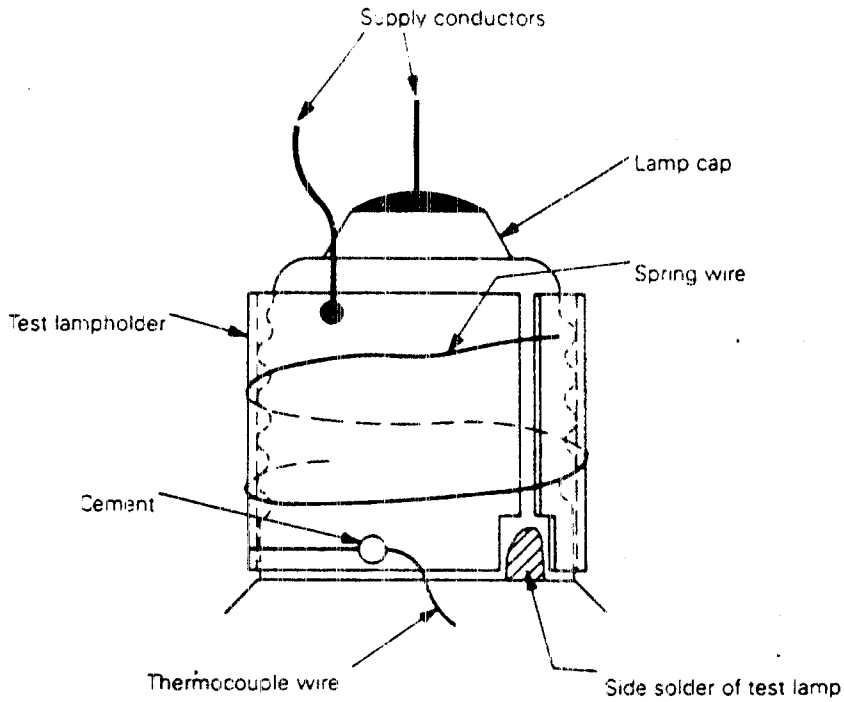
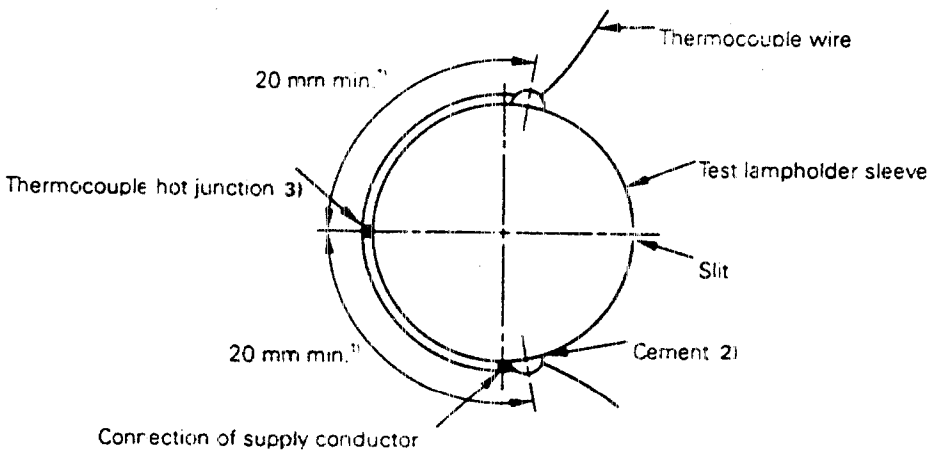
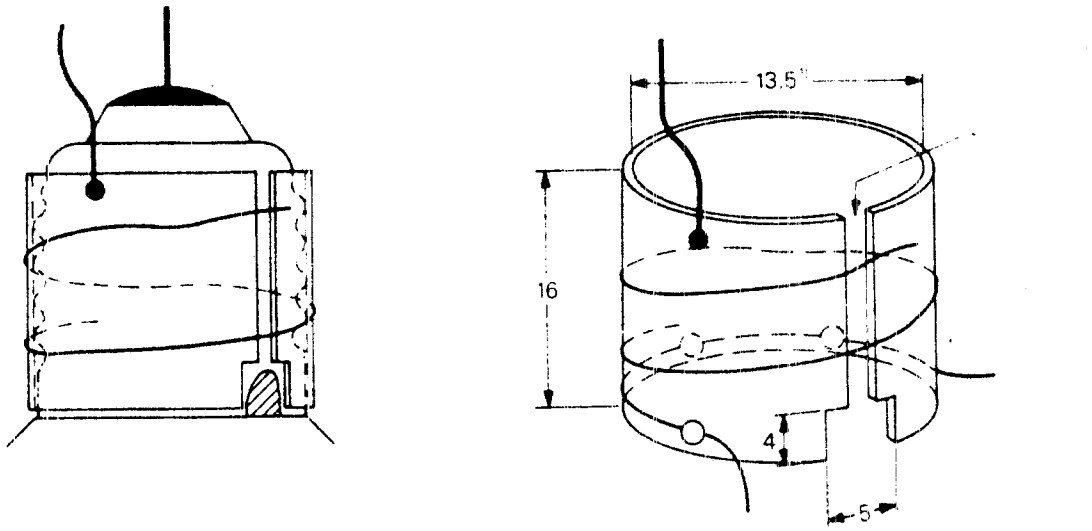


FIG. 1. — Typical test lampholder parts (ES capped lamp illustrated).



1) See Note 1 to Sub-clause 8.3
2) See Note 2 to Sub-clause 8.3
3) Attached as specified in Sub-clause 8.3

FIG. 2. — Position of a typical test lampholder and thermocouple (spring not shown)

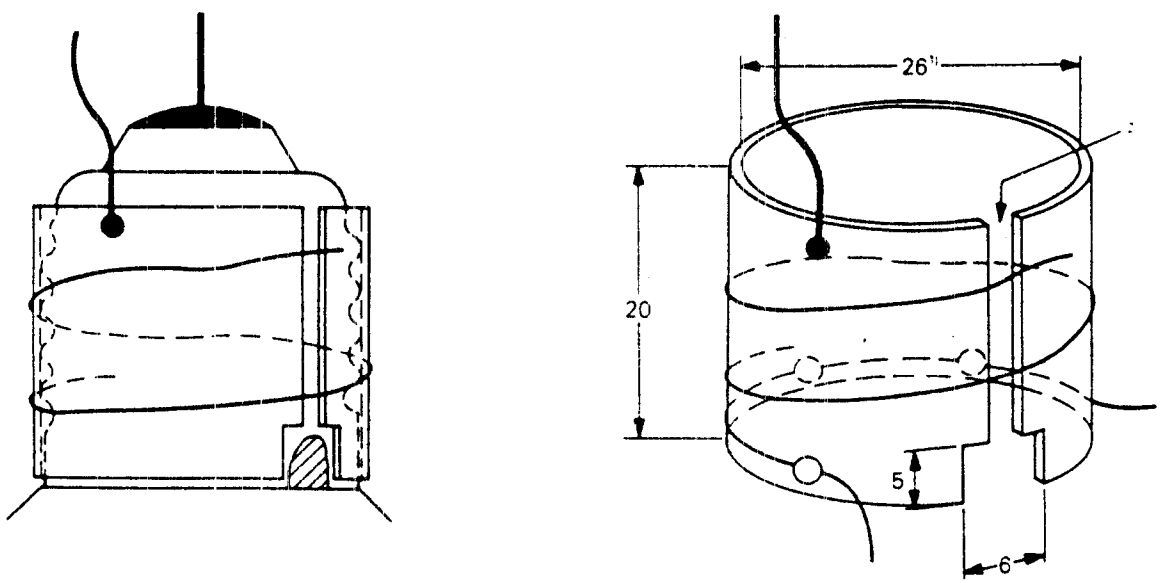


All dimensions in millimetres

[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 ± 1.5 mm when the test lampholder is mounted on the lamp.

FIG. 3. — Approximate dimensions of test lampholder for E14/20 cap.

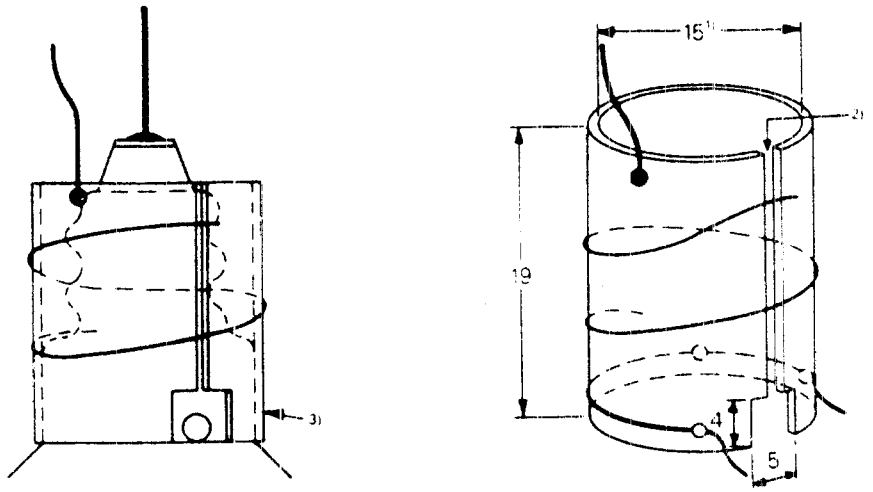


All dimensions in millimetres

[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 ± 1.5 mm when the test lampholder is mounted on the lamp.

FIG. 4 — Approximate dimensions of test lampholder for E26/50 × 39, E27/51 × 39, E26, E26d and E27 caps.



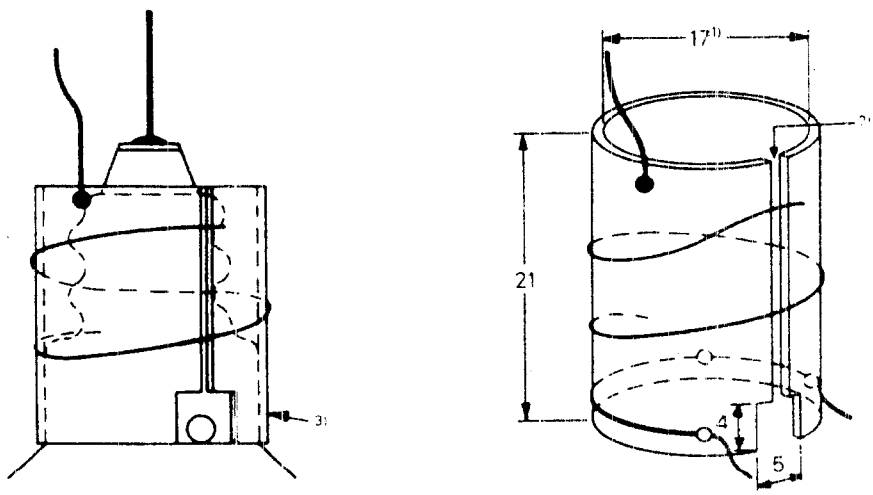
All dimensions in millimetres

[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 ± 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.

FIG. 5. — Approximate dimensions of test lampholder for E14/23 × 15 cap.



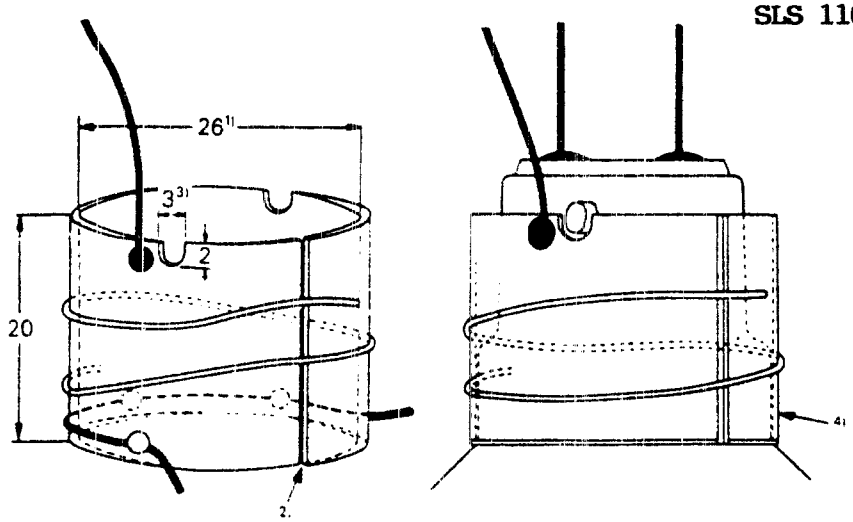
All dimensions in millimetres

[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 ± 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.

FIG. 6. — Approximate dimensions of test lampholder for E14/25 × 17 cap.



All dimensions in millimetres

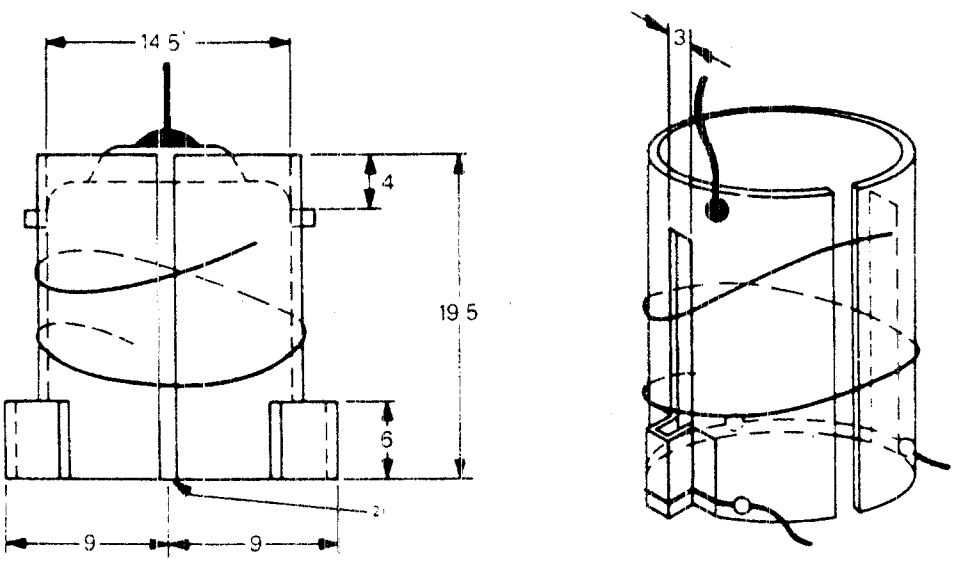
[1] Inside diameter. Shall allow the holder to be clamped on the cap by spring action.

[2] The width of the slit shall be 2 ± 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.

FIG. 7. — Approximate dimensions of test lampholder for B22/25 × 26 and B22d-3 (90°/135°)/25 × 26 caps.

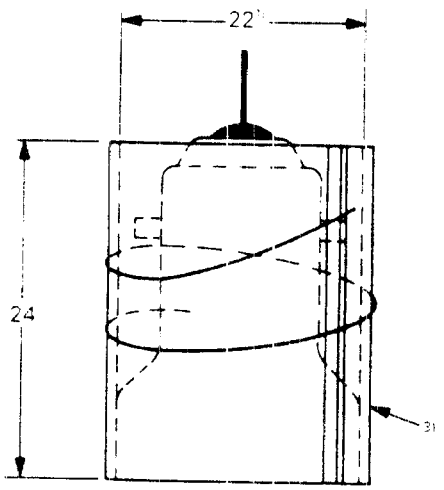


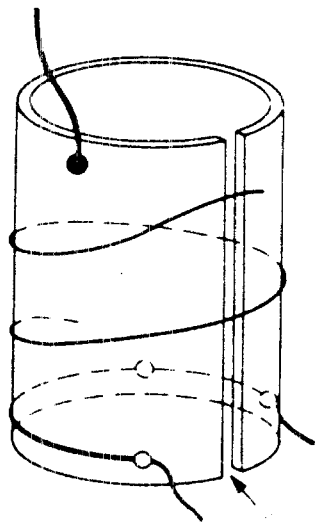
All dimensions in millimetres

[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 ± 1.5 mm when the test lampholder is mounted on the lamp.

FIG. 8. — Approximate dimensions of test lampholder for B15d (unskirted) cap.





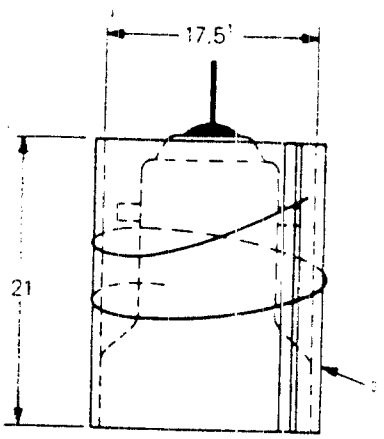
All dimensions in millimetres

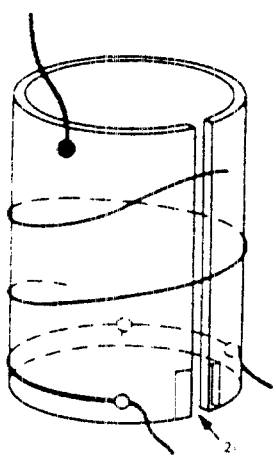
[1] Inside diameter. Shall allow the holder to be clamped on the cap by spring-action.

[2] The width of the slit shall be 2 ± 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.

FIG. 9. — Approximate dimensions of test lampholder for B15d/27 × 22 cap.





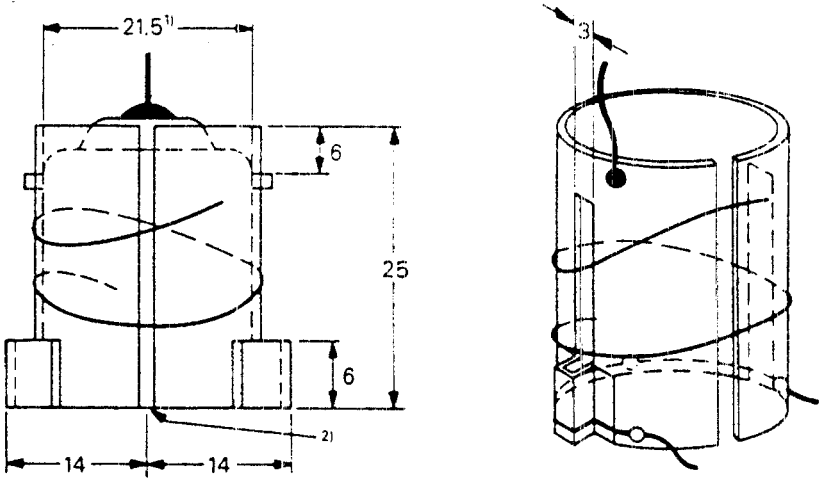
All dimensions in millimetres

[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 ± 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.

FIG. 10. — 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 ± 1.5 mm when the test lampholder is mounted on the lamp.

FIG. 11. — Approximate dimensions of test lampholder for B22d/22 cap.

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