

**NORME
INTERNATIONALE
INTERNATIONAL
STANDARD**

**CEI
IEC
61199**

Deuxième édition
Second edition
1999-10

**Lampes à fluorescence à culot unique –
Prescriptions de sécurité**

**Single-capped fluorescent lamps –
Safety specifications**



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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SINGLE-CAPPED FLUORESCENT LAMPS –
SAFETY SPECIFICATIONS**

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.
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International Standard IEC 61199 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition published in 1993, amendment 1 (1997), amendment 2 (1998) as well as consolidated edition 1.2 (1998). This second edition constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
34A/883/FDIS	34A/897/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.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A, B, D, E, F and G form an integral part of this standard.

Annexes C and H are for information only.

The committee has decided that this publication remains valid until 2003-09

At this date, in accordance with the committee's decision, the publication will be

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- withdrawn;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

SINGLE-CAPPED FLUORESCENT LAMPS – SAFETY SPECIFICATIONS

1 General

1.1 Scope

This International Standard specifies the safety requirements for single-capped fluorescent lamps for general lighting purposes of all groups having 2G7, 2GX7, GR8, 2G10, G10q, GR10q, GX10q, GY10q, 2G11, G23, GX23, G24, GX24 and GX32 caps.

It also specifies the method a manufacturer should use to show compliance with the requirements of this standard on the basis of whole production appraisal in association with his test records on finished products. This method can also be applied for certification purposes. Details of a batch test procedure which can be used to make limited assessment of batches are also given in this standard.

NOTE – Compliance with this standard concerns only safety criteria and does not take into account the performance of single-capped fluorescent lamps for general lighting purposes with respect to luminous flux, colour, starting and operational characteristics. For this information, readers are referred to IEC 60901.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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

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

IEC 60410, *Sampling plans and procedures for inspection by attributes*

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

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

IEC 60695-2-1/0, *Fire hazard testing – Part 2: Test methods – Section 1/sheet 0: Glow-wire test methods – General*

IEC 60901, *Single-capped fluorescent lamps – Performance specifications*

1.3 Definitions

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

1.3.1

single-capped fluorescent lamp

low-pressure mercury discharge lamp having a single cap in which most of the light from the lamp is emitted by a layer of fluorescent material excited by the ultraviolet radiation from the discharge

1.3.2

group

lamps having the same electrical and cathode characteristics, the same physical dimensions and the same starting method

1.3.3

type

lamps of the same group having the same photometric and colour characteristics

1.3.4

family

lamp groups which are distinguished by common features of materials, components, tube diameter and/or method of processing

1.3.5

nominal wattage

wattage used to designate the lamp

1.3.6

design test

test made on a sample for the purpose of checking compliance of the design of a family, group or a number of groups with the requirements of the relevant clause

1.3.7

periodic test

test, or series of tests, repeated at intervals in order to check that a product does not deviate in certain respects from the given design

1.3.8

running test

test repeated at frequent intervals to provide data for assessment

1.3.9

batch

all lamps of one family and/or group and identified as such and put forward at one time for test or checking compliance

1.3.10

whole production

production during a period of twelve months of all types of lamps within the scope of this standard and nominated in a list of the manufacturer for inclusion in the certificate

2 Safety requirements

2.1 General

Lamps shall be so designed and constructed that in normal use they present no danger to the user or the surroundings.

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

2.2 Marking

2.2.1 The following information shall be legibly and durably marked on the lamps:

- a) mark of origin (this may take the form of a trade mark, the manufacturer's name or the name of the responsible vendor);
- b) the nominal wattage (marked "W" or "watts") or any other indication which identifies the lamp.

2.2.2 Compliance is checked by the following:

- a) presence and legibility of the marking by visual inspection;
- b) durability of marking by applying the following test on unused lamps.

The area of the marking on the lamp shall be rubbed by hand with a smooth cloth damped with water for a period of 15 s.

After this test, the marking shall still be legible.

2.3 Mechanical requirements for caps

2.3.1 Construction and assembly

Caps shall be so constructed and assembled to the tube(s) that the whole assembly remains intact and attached during and after operation.

Compliance is checked by carrying out the tests given in annex A.

At the end of the tests, the caps shall show no damage that impairs safety.

2.3.2 Dimensional requirements for caps

2.3.2.1 Lamps shall use standardized caps in accordance with the dimensional requirements of IEC 60061-1.

2.3.2.2 Compliance is checked by using the gauges shown in table 1.

2.3.3 Pin connections and keying configurations

2.3.3.1 Pin connections

The connection of lamp cathodes to the pins of caps having four pins shall conform to the requirements shown in annex E for the relevant cap.

Compliance is checked by electrical continuity tests between relevant pins and/or by visual inspection.

2.3.3.2 Key configuration

For those cap types incorporating keys which ensure non-interchangeability with similar lamp types, the caps shall conform to the cap/key version given in the relevant lamp data sheet of IEC 60901. Annex F gives guidance to which cap/key shall be used when designing lamps to operate on a certain ballast.

Compliance is checked by a suitable measuring system and/or visual inspection.

2.4 Insulation resistance

2.4.1 The insulation resistance between the metal parts, if any, of the cap and all pins connected together shall not be less than 2 M Ω .

2.4.2 Compliance is checked by measurement with suitable test equipment using a d.c. voltage of 500 V.

In the case of caps made entirely from insulating material, the test is made between all pins connected together and metal foil wrapped over those surfaces that are accessible when the cap has been connected to a lampholder with minimum shrouding dimensions, as given in IEC 60061-2.

2.5 Electric strength

2.5.1 The insulation between the same parts as those referred to in 2.4 shall withstand the test voltage of 2.5.2. No flash-over or breakdown shall occur during the test.

2.5.2 Compliance is checked with a 1 500 V a.c. voltage of substantially sine-wave form, with a frequency of 50 Hz or 60 Hz and applied for 1 min. Initially, not more than half the prescribed voltage shall be applied; it shall then be raised rapidly to the full value.

Glow discharges without a drop in voltage are neglected.

2.6 Parts which can become accidentally live

2.6.1 Metal parts, if any, intended to be insulated from live parts shall not be or become live.

2.6.2 With the exception of cap pins, no live part shall project from any part of the cap.

2.6.3 Compliance is checked by a suitable measuring system which may include visual inspection where appropriate. In addition, there shall be regular daily checks of the equipment or a verification of the effectiveness of the inspection. See 3.5.4.

2.7 Resistance to heat and fire

2.7.1 Insulating material of caps shall be sufficiently resistant to heat.

2.7.2 Compliance is checked by the following tests.

2.7.2.1 Samples are tested for a period of 168 h in a heating cabinet at a temperature as given in annex G.

At the end of the test, the samples shall not have undergone any change impairing their future safety, especially in the following respects:

- reduction in the protection against electric shock as required in 2.4 and 2.5;
- loosening of cap pins, cracks, swelling and shrinking as determined by visual inspection.

At the end of the test, the dimensions shall comply with the requirements of 2.3.2.

2.7.2.2 Samples are subjected to a ball-pressure test by means of the apparatus shown in figure G.1.

The surface of the part under test is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against this surface by a force of 20 N. If the surface under test bends, the part where the ball presses shall be supported.

The test shall be made in a heating cabinet at a temperature of $125\text{ °C} \pm 5\text{ °C}$.

After 1 h the ball shall be removed and the diameter of the impression measured. This diameter shall not exceed 2 mm.

The test shall not be made on parts of ceramic material.

2.7.3 Insulating material of caps shall be resistant to abnormal heat and to fire.

2.7.4 Compliance is checked by the following test.

Parts are subjected to a test using a nickel-chromium glow-wire heated to 650 °C. The test apparatus shall be that described in IEC 60695-2-1/0.

The sample to be tested is mounted vertically 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 of the sample. The penetration of the glow-wire into the sample is mechanically limited to 7 mm. After 30 s the sample is withdrawn from contact with the glow-wire tip.

Any flame or glowing of the sample shall extinguish within 30 s of withdrawing the glow-wire and any burning or molten drops shall not ignite a piece of tissue paper consisting of five layers, spread out horizontally $200\text{ mm} \pm 5\text{ mm}$ below the sample.

The glow-wire temperature and heating current shall be constant for 1 min prior to commencing the test. Care shall be taken to ensure that heat radiation does not influence the sample 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 60695-2-1/0.

NOTE – Precautions should be taken to safeguard the health of personnel conducting tests against risks of

- explosion or fire;
- inhalation of smoke and/or toxic products;
- toxic residues.

2.8 Creepage distance for caps

2.8.1 The minimum creepage distance between contact pins and the metal parts (if any) of the cap shall be in accordance with the requirements in IEC 60061-1. Relevant cap standard sheet numbers are given in table 1.

2.8.2 Compliance is checked by measurement in the most onerous position.

2.9 Lamp cap temperature rise

2.9.1 For lamps operated with internal means of starting and for lamps for operation with the use of an external starter, the lamp cap temperature rise above ambient temperature shall not exceed the relevant value given in table B.2.

2.9.2 The test procedure is specified in annex B. Conditions of compliance are given in D.4.

2.9.3 Where it can be shown that one lamp group produces the highest cap temperature rise for a given lamp family, only tests on this one lamp group are necessary to show compliance of all identically capped lamps.

2.10 Radio interference suppression capacitors

Lamps which contain integral means of starting and/or contain capacitors to suppress radio interference shall have capacitors which comply with the following requirements.

2.10.1 Moisture resistance

The capacitor shall be resistant to moisture. Compliance is checked by the following test.

Before humidity treatment, the capacitors shall be kept at an ambient temperature which does not differ from the temperature within the humidity test enclosure by more than $+4$ °C for at least 4 h.

Immediately after the humidity treatment of 48 h in an atmosphere of 91 % to 95 % relative humidity and an ambient temperature between 20 °C and 30 °C maintained within limits of ± 1 °C, the capacitor shall be subjected to and satisfactorily withstand a d.c. voltage of 2 000 V without breakdown for 1 min.

The test voltage shall be applied across the terminations of the capacitor and initially shall not be more than half the prescribed voltage. It shall then be raised gradually to the full value.

2.10.2 Resistance to flame and ignition

The capacitor shall be resistant to flame and ignition.

Compliance is checked by the following test. The capacitors are each subjected to a gradually increasing a.c. voltage until breakdown occurs. The voltage source used to this effect shall have a short-circuit power of approximately 1 kVA.

Thereafter, each capacitor shall be connected in series with an inductive ballast, of a rated wattage suitable for operating the relevant lamps and operated for 5 min at the rated voltage of the ballast.

During this test, the capacitor shall not induce flame or cause ignition.

2.11 Information for luminaire design

Refer to annex C.

2.12 Information for ballast design

Refer to annex H.

3 Assessment

3.1 General

This clause specifies the method a manufacturer should use to show that his product conforms to this standard on the basis of whole production assessment, in association with his test records on finished products. This method can also be applied for certification purposes. Subclauses 3.2, 3.3 and 3.5 give details of assessment by means of the manufacturer's records.

Details of a batch test procedure which can be used to make limited assessment of batches are given in 3.4 and 3.6. Requirements for batch testing are included in order to enable the assessment of batches presumed to contain unsafe lamps. As some safety requirements cannot be checked by batch testing, and as there may be no previous knowledge of the manufacturer's quality, batch testing cannot be used for certification purposes nor in any way for an approval of the batch. Where a batch is found to be acceptable, a testing agency may only conclude that there is no reason to reject the batch on safety grounds.

3.2 Whole production assessment by means of the manufacturer's records

3.2.1 The manufacturer shall show evidence that his products comply with the particular requirements of 3.3. To this end, the manufacturer shall make available all the results of his product testing pertinent to the requirements of this standard.

3.2.2 The test results may be drawn from working records and, as such, may not be immediately available in collated form.

3.2.3 The assessment shall be based in general on individual factories each meeting the acceptance criteria of 3.3. However, a number of factories may be grouped together, providing they are under the same quality management. For certification purposes, one certificate may be issued to cover a nominated group of factories, but the certification authority shall have the right to visit each plant to examine the relevant local records and quality control procedures.

3.2.4 For certification purposes, the manufacturer shall declare a list of marks of origin and corresponding lamp families, groups and/or types which are within the scope of this standard and manufactured in a nominated group of factories. The certificate shall be taken to include all lamps so listed made by the manufacturer. Notification of additions or deletions may be made at any time.

3.2.5 In presenting the test results, the manufacturer may combine the results of different lamp families, groups and/or types according to column 4 of table 2.

The whole production assessment requires that the quality control procedures of a manufacturer shall satisfy recognized quality system requirements for final inspection. Within the framework of a quality system based also on in-process inspection and testing, the manufacturer may show compliance with some of the requirements of this standard by means of in-process inspection instead of finished product testing.

3.2.6 The manufacturer shall provide sufficient test records with respect to each clause and subclause as indicated in column 5 of table 2.

3.2.7 The number of non-conformities in the manufacturer's records shall not exceed the limits shown in table 3 or 4 relevant to the Acceptable Quality Level (AQL) values shown in column 6 of table 2.

3.2.8 The period of review for assessment purposes need not be limited to a predetermined year, but may consist of 12 consecutive calendar months immediately preceding the date of review.

3.2.9 A manufacturer who has met, but no longer meets, the specified criteria, shall not be disqualified from claiming compliance with this standard providing he can show that

- a) action has been taken to remedy the situation as soon as the trend was reasonably confirmed from his test records;
- b) the specified acceptance level was re-established within a period of
 - 1) six months for 2.3.1 and 2.9;
 - 2) one month for the other clauses and subclauses.

When compliance is assessed after corrective action has been taken in accordance with items a) and b), the test records of these lamp families, groups and/or types which do not comply shall be excluded from the 12-month summation for their period of non-compliance. The test results relating to the period of corrective action shall be retained in the records.

3.2.10 A manufacturer who has failed to meet the requirements of a clause or subclause where grouping of the test results is permitted under 3.2.5 shall not be disqualified for the whole of the lamp families, groups and/or types so grouped if he can show by additional testing that the problem is present only in certain families, groups and/or types so grouped. In this case, either these families, groups and/or types are dealt with in accordance with 3.2.9 or they are deleted from the list of families, groups and/or types which the manufacturer may claim are in conformity with the standard.

3.2.11 In the case of a family, group and/or type which has been deleted under 3.2.10 from the list (see 3.2.4), it may be reinstated if satisfactory results are obtained from tests on a number of lamps equivalent to the minimum annual sample specified in table 2, required by the clause or subclause where non-compliance occurred. This sample may be collected over a short period of time.

3.2.12 In the case of new products, there may be features which are common to existing lamp families, groups and/or types, and these can be taken as being in compliance if the new product is taken into the sampling scheme as soon as manufacture is started. Any feature not so covered shall be tested before production starts.

3.3 Assessment of the manufacturer's records of particular tests

Table 2 specifies the type of test and other information which applies to the method of assessing compliance to the requirements of various clauses or subclauses.

A design test need be repeated only when a substantial change is made in the physical or mechanical construction, materials, or manufacturing process used to manufacture the relevant product. Tests are required for only those properties affected by the change.

3.4 Rejection conditions of batches

Rejection is established if any rejection number in table 5, with due regard to annex D, is reached irrespective of the quantity tested. A batch shall be rejected as soon as the rejection number for a particular test is reached.

3.5 Sampling procedures for whole production testing

3.5.1 The conditions of table 2 apply.

3.5.2 The whole production running tests shall be applied at least once per production day. They may also be based on in-process inspection and testing.

The frequency of application of the various tests may be different, providing the conditions of table 2 are met.

3.5.3 Whole production tests shall be made on samples randomly selected at a rate not less than that indicated in column 5 of table 2. Lamps selected for one test need not be used for other tests.

3.5.4 For whole production testing of the requirements for accidentally live parts (see 2.6), the manufacturer shall demonstrate that there is a continuous 100 % inspection.

3.6 Sampling procedures for batch testing

3.6.1 The lamps for testing shall be selected in accordance with a mutually agreed method so as to ensure proper representation. Selection shall be randomly made as nearly as possible from one-third of the total number of containers in the batch, with a minimum of 10 containers.

3.6.2 In order to cover the risk of accidental breakage, a certain number of lamps in addition to the test quantity shall be selected. These lamps shall only be substituted for lamps of the test quantities if necessary to make up the required quantities of lamps for the tests.

It is not necessary to replace an accidentally broken lamp if the results of the test are not affected by its replacement, provided the required quantity of lamps for the following test is available. If replaced, such a broken lamp shall be neglected in calculating results.

Lamps having broken bulbs when removed from the packaging after transit shall not be included in the test.

3.6.3 Number of lamps in the batch sample

There shall be at least 500 lamps (see table 5).

3.6.4 Sequence of the tests

The testing shall be carried out in the order of the clause or subclause numbers listed in table 5, up to and including 2.6. Subsequent tests may involve damage to the lamp and each test sample shall be taken separately from the original sample.

Table 1 – Sheet references of IEC 60061

Cap type	Sheet numbers	
	IEC 60061-1 Lamp caps	IEC 60061-3 Gauges
2GX7	7004-103	7006-102
2G7	7004-102	7006-102
2G11	7004-82	7006-82
G10q	7004-54	7006-79
2G10	7004-118	7006-118
GR8	7004-68	7006-68A, 68B, 68E
GR10q	7004-77	7006-77A, 68B, 68E
GX10q	7004-84	7006-79, 84, 84A and 84B
GY10q	7004-85	7006-79, 85 and 85A
G23	7004-69	7006-69
GX23	7004-86	7006-86
G24, GX24	7004-78	7006-78
GX32	7004-87	7006-87

**Table 2 – Grouping of test records –
Sampling and acceptable quality levels (AQL)**

1 Clause or subclause	2 Test	3 Type of test	4 Permitted accumulation of test records between lamp groups	5 Minimum annual sample per accumulation		6 AQL* %
				For lamps made most of the year	For lamps made infrequently	
2.2.2 a)	Marking – legibility	Running	All families with the same method of marking	200	32	2,5
2.2.2 b)	Marking – durability	Periodic	All families with the same method of marking	50	20	2,5
2.3.1 (annex A as appropriate)	Construction and assembly of cap to bulb (unused lamps)	Periodic or design	All families using the same method of attachment and same tube diameter	125 or use D.1	80 or use D.1	0,65 –
	Construction and assembly of cap to bulb (after heating test)	Design	All families using the same method of attachment and same tube diameter	Use D.1	Use D.1	–
2.3.2.2	Dimensional requirements for caps	Periodic	All families using the same method of attachment and same tube diameter	32	32	2,5
2.3.3.1	Cap pin connection	Periodic	By group and type	125	80	0,65
2.3.3.2 (where applicable)	Cap key configuration	Periodic	By group and type	125	80	0,65
2.4	Insulation resistance	Design	All families using the same cap	Use D.2	Use D.2	–
2.5	Electric strength	Design	All families using the same cap	Use D.2	Use D.2	–
2.6	Accidentally live part	100 % Inspection	By group and type	–	–	–
2.7.2	Resistance to heat	Design	All families	Use D.3	Use D.3	–
2.7.4	Resistance to fire	Design	All families	Use D.3	Use D.3	–
2.8	Cap creepage distance	Design	All families	Use D.3	Use D.3	–
2.9	Cap temperature rise	Design	Lamps selected according to 2.9.3	Use D.4	Use D.4	–
2.10	Capacitor test	Design	All families using the same capacitor	Use D.3	Use D.3	–

* For the use of this term, see IEC 60410.

Table 3 – Acceptance numbers AQL = 0,65 %

Part 1		Part 2	
Number of lamps in manufacturer's records	Acceptance number	Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records
80	1	2 001	1,03
81 to 125	2	2 100	1,02
126 to 200	3	2 400	1,00
201 to 280	4	2 750	0,98
281 to 315	5	3 150	0,96
316 to 400	6	3 550	0,94
401 to 500	7	4 100	0,92
501 to 600	8	4 800	0,90
601 to 700	9	5 700	0,88
701 to 800	10	6 800	0,86
801 to 920	11	8 200	0,84
921 to 1 040	12	10 000	0,82
1 041 to 1 140	13	13 000	0,80
1 141 to 1 250	14	17 500	0,78
1 251 to 1 360	15	24 500	0,76
1 361 to 1 460	16	39 000	0,74
1 461 to 1 570	17	69 000	0,72
1 571 to 1 680	18	145 000	0,70
1 681 to 1 780	19	305 000	0,68
1 781 to 1 890	20	1 000 000	0,67
1 891 to 2 000	21		

Table 4 – Acceptance numbers AQL = 2,5 %

Part 1		Part 2	
Number of lamps in manufacturer's records	Acceptance number	Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records
20	1	1 001	3,65
21 to 32	2	1 075	3,60
33 to 50	3	1 150	3,55
51 to 65	4	1 250	3,50
66 to 80	5	1 350	3,45
81 to 100	6	1 525	3,40
101 to 125	7	1 700	3,35
126 to 145	8	1 925	3,30
146 to 170	9	2 200	3,25
171 to 200	10	2 525	3,20
201 to 225	11	2 950	3,15
226 to 255	12	3 600	3,10
256 to 285	13	4 250	3,05
286 to 315	14	5 250	3,00
316 to 335	15	6 400	2,95
336 to 360	16	8 200	2,90
361 to 390	17	11 000	2,85
391 to 420	18	15 500	2,80
421 to 445	19	22 000	2,75
446 to 475	20	34 000	2,70
476 to 500	21	60 000	2,65
501 to 535	22	110 000	2,60
536 to 560	23	500 000	2,55
561 to 590	24	1 000 000	2,54
591 to 620	25		
621 to 650	26		
651 to 680	27		
681 to 710	28		
711 to 745	29		
746 to 775	30		
776 to 805	31		
806 to 845	32		
846 to 880	33		
881 to 915	34		
916 to 955	35		
956 to 1 000	36		

Table 5 – Batch sample size and rejection number

Clause or subclause	Test	Number of lamps tested	Rejection number
2.2.2 a)	Marking – legibility	200	11
2.2.2 b)	Marking – durability	50	4
2.3.1	Construction and assembly for caps (unused lamps)	125 or apply D.1 as relevant	3 or apply D.1 as relevant
2.3.2.2	Dimensional requirements for caps	32	3
2.3.3.1	Pin connections	125	3
2.3.3.2	Key configuration	125	3
2.4	Insulation resistance		Apply D.2
2.5	Electric strength		Apply D.2
2.6	Accidentally live parts	500	1
2.3.1	Construction and assembly for caps (after heating)		Apply D.1
2.7.2	Resistance to heat		Apply D.3
2.7.4	Resistance to fire		Apply D.3
2.8	Cap creepage distance		Apply D.3
2.9	Cap temperature rise		Test not applicable
2.10	Radio interference suppression capacitors		Apply D.3

Annex A

(normative)

Tests for assessing caps for construction and assembly

A.1 GR8, G10q and GR10q caps

A.1.1 For unused lamps

Where lamps are so constructed that the action of inserting or withdrawing them from lampholders could conceivably cause parts of the cap to pull apart, the following design tests shall be applied. For conditions of compliance, see D.1.

A pull of 80 N shall be exerted between the parts of the cap identified as conceivable to pull apart. The pull shall be applied for 1 min without a jerk. At the end of the test, the cap shall be safe and shall not exhibit any opening of seams or the like such that a jointed test finger as described in IEC 60529 can be inserted to touch live parts.

The means of applying the pull to the cap parts shall not weaken the structure. If necessary, specially prepared samples shall be provided by mutual agreement between manufacturer and test authority.

For lamps with G10q caps, the following additional periodic test shall be applied. The cap shall be capable of being rotated, without difficulty, over at least an arc of $\pm 5^\circ$ about the nominal angle α to the plane through the lamp tube. The lead wires shall not short-circuit during maximum rotation of the cap. After moving the cap to the most onerous position, a jointed test finger shall not be able to be inserted to touch live parts.

A.1.2 For lamps after heating test

After heating lamps for a period of $2\,000\text{ h} \pm 50\text{ h}$ in an oven held at a temperature as specified in annex G, all tests and requirements given in A.1.1 shall be applied as design tests. For conditions of compliance see D.1.

A.2 2G7, 2GX7, GX10q, GY10q, 2G10, 2G11, G23, GX23, G24, GX24 and GX32 caps

A.2.1 For unused lamps

Compliance is checked by the following periodic tests.

Neither lamp bulb nor lamp cap shall be loosened by an axial pull of 40 N or a bending moment of 3 Nm. The bending shall be applied by holding in a uniform manner that part of the glass tube closest to the cap. The pivot point lies at the cap reference plane (mating plane with the lamp holder). The pulling force and bending moment shall not be applied suddenly but shall be increased gradually from zero to the specified value.

A.2.2 For lamps after heating test

After heating lamps for a period of $2\,000\text{ h} \pm 50\text{ h}$ in an oven held at a temperature as specified in annex G, caps shall withstand pulling forces and bending moments which are under consideration. For conditions of compliance, see D.1.

Annex B (normative)

Maximum lamp cap temperature rise values and method of measurement

B.1 General test conditions

B.1.1 The lamp shall be operated in a draught-free atmosphere at an ambient temperature of $25\text{ °C} \pm 5\text{ °C}$, suspended in low mass nylon slings with the cap pins facing vertically upwards.

B.1.2 The lamp shall be a normal production lamp but specially produced such that its cathodes are deactivated, i.e. without cathode emitter.

B.1.3 Electrical connections to the lamp shall be made with copper conductors having a cross-sectional area of $1\text{ mm}^2 \pm 5\%$, attached to the relevant cap pins.

B.1.4 The lamp shall be operated with its relevant reference ballast which shall be supplied with 1,10 times its rated voltage.

B.1.5 The starter shall be short-circuited, i.e. the cathodes shall be operated in series.

B.1.6 The test shall continue until a stable temperature is achieved.

B.1.7 Where necessary, the surface of caps shall be suitably prepared to give good contact with the temperature measuring device (e.g. thermocouples).

B.2 Particular test conditions

B.2.1 2G7, 2GX7, GX10q, GY10q, 2G10, 2G11, G23, GX23, G24, GX24, and GX32 caps

The temperature rise shall be measured at the hottest point on the cap surface at a distance x from the reference plane of the cap, as indicated in table B.1, in the direction of the glass limbs.

Table B.1 – Measuring point

Cap designation	Distance x mm
2G7, 2GX7	8*
GX10q, GY10q	8
G23, GX23	8
2G10, 2G11, G24, GX24	12*
GX32	16*
* Under consideration.	

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B.2.2 GR8, GR10q and G10q caps**B.2.2.1 GR8 and GR10q caps (all wattages, excluding 10 W)**

The temperature rise shall be measured at a point on the cap surface which is equidistant between the two glass limbs which emerge from the cap, and which lies on the straight line which joins the axes of the glass limbs.

B.2.2.2 GR10q caps (10 W)

The temperature rise shall be measured at the centre of the cap face which is opposite to that containing the cap pins.

B.2.2.3 G10q caps

Under consideration.

Table B.2 – Maximum cap temperature rise

Cap designation	Lamp nominal wattage	Maximum cap temperature rise
	W	K
G23, G24, GX23, GX24, GX32	All	75
2G7, 2GX7, 2G10, 2G11	All	75
GX10q, GY10q	All	75
G10q	All	–*
GR8	16	45
GR8	28	35
GR10q	10, 28 and 38	35
GR10q	16 and 21	45
* Under consideration.		

Annex C (informative)

Information for luminaire design

C.1 Guidelines for safe lamp operation

To ensure safe lamp operation, it is essential to observe the following recommendations.

C.2 Maximum lamp cap temperature under abnormal operating conditions

The luminaire designer should ensure that the cap temperature of the lamp, under abnormal operating conditions, does not exceed the maximum cap temperature value shown in table C.1.

Luminaires should be tested using the intended lamp with the starter short-circuited, i.e. the cathodes operated in series.

The measuring point is given in B.2.

Compliance is checked in accordance with the relevant test specified in 12.5.1 of IEC 60598-1.

Table C.1 – Maximum cap temperature

Cap designation	Lamp nominal wattage W	Maximum cap temperature °C
G23, G24, GX23, GX24, GX32	All	140*
2G7, 2GX7, 2G10, 2G11	All	140*
GX10q, GY10q	All	120*
G10q	All	120*
GR8	All	110*
GR10q	All	110*
* Under consideration.		

C.3 Cap/holder – Key configuration

The luminaire designer should ensure that, if applicable, a holder with the correct key version for the intended lamp/ballast combination is installed in the luminaire.

Compliance is checked by visual inspection.

Annex D (normative)

Conditions of compliance for design tests

D.1 Cap construction and assembly (2.3.1)

Sample size: 32

Rejection number: 2

D.2 Insulation resistance and electric strength (2.4 and 2.5)

Each test shall be assessed separately

First sample: 125

Rejection number: 2

If one failure is found, take
a second sample of 125

Rejection number: 2 in the combined sample

D.3 Resistance to heat, (2.7.2), resistance to fire (2.7.4), cap creepage distances (2.8), capacitor test (2.10)

Each test shall be assessed separately.

First sample: 5

Accept when no failure has been found
Rejection number: 2

If one failure is found, take a second
sample of 5

Rejection number: 2 in the combined sample

D.4 Cap temperature rise (2.9)

First sample: 5

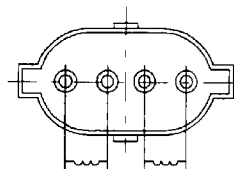
Accept if all samples have a temperature
rise of at least 5 K below limit

In other cases, take a second sample of 5

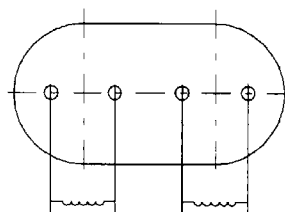
Rejection number: 2 in the combined sample
with a cap temperature rise that exceeds the
limit in table B.2 in the combined sample

Annex E
(normative)

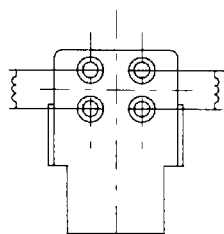
Cathode connection configurations



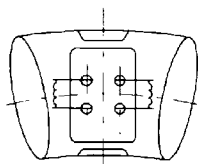
Caps 2G7, 2GX7



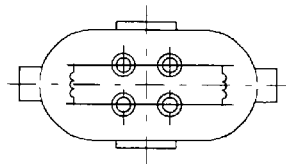
Caps 2G10, 2G11



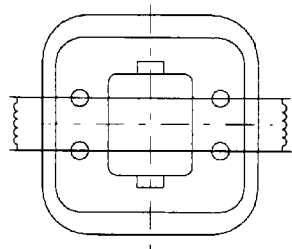
Cap GR10q



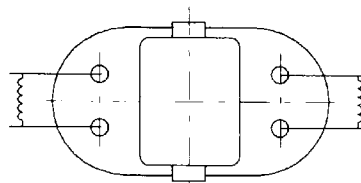
Cap G10q



Caps GX10q, GY10q



Caps G24q, GX24q



Cap GX32q

IEC 1473/99

Figure E.1

Annex F (normative)

Lamp non-interchangeability requirements

For lamps using either an internal or external starter, the most onerous situation with regard to cap temperature occurs when the pre-heat current flows continuously through the lamp electrodes. This can happen at the end of lamp life when the lamp does not start.

Therefore, a lamp shall not be connected to a ballast having a maximum pre-heat current which results in a higher temperature than the cap of the lamp can withstand. For some types of lamp caps, it is necessary to introduce a non-interchangeability feature which prevents the incorrect installation of different lamps using similar cap types into the luminaire circuit.

For certain lamps, such a feature has been introduced by means of different cap/holder keys, and table F.1 gives the relationship between a specific cap/holder designation and the allowable maximum pre-heat current.

Also shown in table F.1 are cap types which do not have a keying feature because no existing lamp/circuit combination exceeds the maximum allowable pre-heat current.

To ensure that an unsafe condition cannot occur in the future due to the introduction of lamps and/or circuits with higher pre-heat currents, the limiting maximum pre-heat currents are also specified in table F.1.

This relationship shall be observed for all new lamp designs utilizing these cap/holder designations.

Table F.1 – Maximum allowable pre-heat currents

Cap/holder (designation key)	Maximum pre-heat current A
2G7, G23 2GX7, GX23	0,240* 0,530*
2G10, 2G11, GR8, GR10q	0,780*
G24-1, GX24-1 G24-2, GX24-2 G24-3, GX24-3	0,280* 0,380* 0,550*
GX32-1 GX32-2 GX32-3	0,650* 0,850* 1,080*
* Under consideration	
NOTE – It is essential that any new key configuration be standardized.	

Annex G
(normative)

Information for thermal tests

Table G.1 – Tests temperatures

Cap designation	Lamp nominal wattage	Temperature
	W	°C
G23, G24, GX23, GX24, GX32	All	160*
2G7, 2GX7, 2G10, 2G11	All	160*
GX10q, GY10q	All	140*
G10q	All	140*
GR8	All	130*
GR10q	10	140*
GR10q	16, 21, 28, 38	130*

* Under consideration

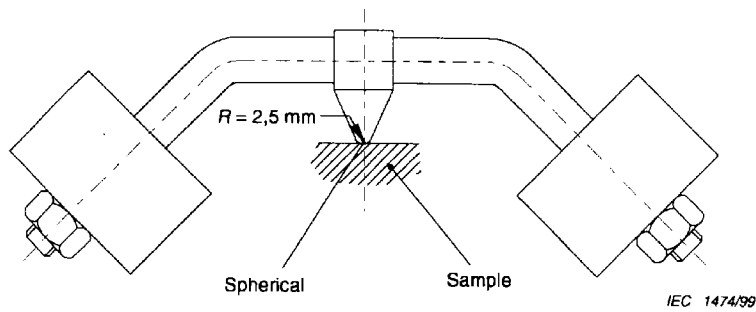


Figure G.1 – Ball-pressure apparatus

Annex H (informative)

Information for ballast design

H.1 Guidelines for safe lamp operation

To ensure safe lamp operation, it is essential to observe the following recommendations.

H.2 Lamp end temperature under abnormal operating conditions

In the case where a lamp does not start, any continuation of cathode preheating should not lead to overheating of the lamp ends.

In the case where one of the cathodes is depleted or broken, while the lamp continues to operate (partial rectification), overheating of the lamp ends should be prevented by suitable measures in the circuit.

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Bibliography

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

Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: (e.g. 60601-1-1)

.....

Q2 Please tell us in what capacity(ies) you bought the standard (tick all that apply). I am the/a:

- purchasing agent
- librarian
- researcher
- design engineer
- safety engineer
- testing engineer
- marketing specialist
- other.....

Q3 I work for/in/as a: (tick all that apply)

- manufacturing
- consultant
- government
- test/certification facility
- public utility
- education
- military
- other.....

Q4 This standard will be used for: (tick all that apply)

- general reference
- product research
- product design/development
- specifications
- tenders
- quality assessment
- certification
- technical documentation
- thesis
- manufacturing
- other.....

Q5 This standard meets my needs: (tick one)

- not at all
- nearly
- fairly well
- exactly

Q6 If you ticked NOT AT ALL in Question 5 the reason is: (tick all that apply)

- standard is out of date
- standard is incomplete
- standard is too academic
- standard is too superficial
- title is misleading
- I made the wrong choice
- other

Q7 Please assess the standard in the following categories, using the numbers:

- (1) unacceptable,
- (2) below average,
- (3) average,
- (4) above average,
- (5) exceptional,
- (6) not applicable

- timeliness.....
- quality of writing.....
- technical contents.....
- logic of arrangement of contents
- tables, charts, graphs, figures.....
- other

Q8 I read/use the: (tick one)

- French text only
- English text only
- both English and French texts

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

.....



Q1 Veuillez ne mentionner qu'**UNE SEULE NORME** et indiquer son numéro exact: (ex. 60601-1-1)

.....

Q2 En tant qu'acheteur de cette norme, quelle est votre fonction? (cochez tout ce qui convient)
Je suis le/un:

- agent d'un service d'achat
- bibliothécaire
- chercheur
- ingénieur concepteur
- ingénieur sécurité
- ingénieur d'essais
- spécialiste en marketing
- autre(s).....

Q3 Je travaille: (cochez tout ce qui convient)

- dans l'industrie
- comme consultant
- pour un gouvernement
- pour un organisme d'essais/ certification
- dans un service public
- dans l'enseignement
- comme militaire
- autre(s).....

Q4 Cette norme sera utilisée pour/comme (cochez tout ce qui convient)

- ouvrage de référence
- une recherche de produit
- une étude/développement de produit
- des spécifications
- des soumissions
- une évaluation de la qualité
- une certification
- une documentation technique
- une thèse
- la fabrication
- autre(s).....

Q5 Cette norme répond-elle à vos besoins: (une seule réponse)

- pas du tout
- à peu près
- assez bien
- parfaitement

Q6 Si vous avez répondu PAS DU TOUT à Q5, c'est pour la/les raison(s) suivantes: (cochez tout ce qui convient)

- la norme a besoin d'être révisée
- la norme est incomplète
- la norme est trop théorique
- la norme est trop superficielle
- le titre est équivoque
- je n'ai pas fait le bon choix
- autre(s)

Q7 Veuillez évaluer chacun des critères ci-dessous en utilisant les chiffres

- (1) inacceptable,
- (2) au-dessous de la moyenne,
- (3) moyen,
- (4) au-dessus de la moyenne,
- (5) exceptionnel,
- (6) sans objet
- publication en temps opportun
- qualité de la rédaction.....
- contenu technique
- disposition logique du contenu.....
- tableaux, diagrammes, graphiques, figures
- autre(s)

Q8 Je lis/utilise: (une seule réponse)

- uniquement le texte français
- uniquement le texte anglais
- les textes anglais et français

Q9 Veuillez nous faire part de vos observations éventuelles sur la CEI:

.....

