IEC 60432-1

Edition 2.2 2012-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Incandescent lamps – Safety specifications –
Part 1: Tungsten filament lamps for domestic and similar general lighting purposes

Lampes à incandescence – Prescriptions de sécurité –
Partie 1: Lampes à filament de tungstène pour usage domestique et éclairage général similaire

IEC 60432-1:1999+A1:2005+A2:2011

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INCANDESCENT LAMPS – SAFETY SPECIFICATIONS –

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FOREWORD

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International Standard IEC 60432-1 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This consolidated version of IEC 60432-1 consists of the second edition (1999) [documents 34A/873/FDIS and 34A/887/RVD], its amendment 1 (2005) [documents 34A/1118/FDIS and 34A/1127/RVD] and its amendment 2 (2011) [documents 34A/1475/CDV and 34A/1519/RVC].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

Annexes A through J form an integral part of this standard.

Annex K is for information only.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

INCANDESCENT LAMPS – SAFETY SPECIFICATIONS –

Part 1: Tungsten filament lamps for domestic and similar general lighting purposes

1 General

1.1 Scope

International Standard IEC 60432-1 specifies the safety and interchangeability requirements of tungsten filament incandescent lamps for general lighting service having:

– rated wattage up to and including 200 W;

– rated voltage of 50 V to 250 V inclusive;

– bulbs of the A, B, C, G, M, P, PS, PAR or R shapes* , or other bulb shapes where the lamps are intended to serve the same purpose as lamps with the foregoing bulb shapes;

– bulbs with all kinds of finishes;

– caps B15d, B22d, E12, E14, E17, E26**, E26d, E26/50×39, E27 or E27/51×39.

As far as is reasonably practicable, this standard is also applicable to lamps with bulbs and caps other than those mentioned above, but which serve the same purpose.

This standard specifies the method a manufacturer should use to show that his product conforms to 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.

This part of IEC 60432 covers photobiological safety according to IEC 62471 and IEC/TR 62471-2. Lamps covered by this part of IEC 60432 do not reach risk levels that require risk group marking.

This standard is concerned with safety criteria only and does not take into account the performance of tungsten filament lamps with respect to luminous flux, life or power consumption characteristics. Readers should refer to IEC 60064 for such characteristics with respect to types normally used for general lighting service.

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* See IEC 60887 for description of the letter symbols. Associated traditional names are:

– Pear shape	= A, PS
– Mushroom	= M
– Candle	= B, C (in North America)
– Round bulb	= P
– Globular	= G
– Reflector	= R
– Parabolic reflector	= PAR

** There are two variations of E26 caps which are not fully compatible. In this standard separate references are made to E26/24 caps used in North America and E26/25 caps used in Japan.

1.2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

IEC 60064: *Tungsten filament lamps for domestic and similar general lighting purposes. Performance requirements*

IEC 60360: *Standard method of measurement of lamp cap temperature rise*

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

IEC 60432-2: *Incandescent lamps – Safety specification – Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes*

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

IEC 60887: *Glass bulb designation system for lamps*

IEC 62471, *Photobiological safety of lamps and lamp systems*

IEC/TR 62471-2, *Photobiological safety of lamps and lamp systems – Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety*

ISO 3951: *Sampling procedures and charts for inspection by variables for percent non-conforming*

1.3 Definitions

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

1.3.1
category
all lamps of one manufacturer having the same general construction (bulb shape, external dimensions, cap type, filament type), rated voltage, rated wattage and finish

For the purposes of this standard:

a) clear, frosted and coatings equivalent to a frosted finish are considered to be the same;

b) various coloured and white finishes are not considered to be the same.

NOTE Lamps differing only by their caps (e.g. E27 and B22d) are of different “categories”, but of the same “type” as defined in IEC 60064.

1.3.2
type
lamps which, independent of the type of cap, are identical in photometric and electrical characteristics

1.3.3
class
all lamps of one manufacturer having the same general construction (bulb shape, external dimensions, cap type, filament type), rated wattage and finish and differing only by their rated voltages, when these voltages fall within the same voltage range (e.g. 100 V to 150 V, 200 V to 250 V)

1.3.4
rated voltage
voltage or voltage range specified in the relevant lamp standard or assigned by the manufacturer or responsible vendor

(If lamps are marked with a voltage range, it shall be interpreted that they are appropriate for use on any supply voltage within that range.)

1.3.5
test voltage
rated voltage unless otherwise specified

(If lamps are marked with a voltage range, the test voltage shall be taken as the mean of the voltage range unless otherwise specified.)

1.3.6
rated wattage
wattage specified in the relevant lamp standard or assigned by the manufacturer or responsible vendor

1.3.7
end of life
instant when the energized lamp ceases to emit light

1.3.8
cap temperature rise (Δt_s)
surface temperature rise, above ambient temperature, of a standard test lampholder fitted to the lamp's cap, when measured in accordance with the standard method described in IEC 60360

1.3.9
design test
test made on a sample, for the purposes of checking compliance of the design of a category, class or group of categories with the requirements of the relevant clause

1.3.10
periodic test
test repeated at intervals in order to check that the product does not deviate in certain respects from the given design

1.3.11
running test
test applied at frequent intervals in order to provide data for assessment

1.3.12
batch
all the lamps of one category, identified as such, and put forward at one time for checking compliance

1.3.13
whole production
production of all types of lamps within the scope of this standard manufactured during a period of 12 months and nominated by the manufacturer in a list for inclusion in the control, this list being incorporated in the certificate when certification is in operation

1.3.14
bowl mirror lamp
lamp with part of its bulb coated with reflecting material so as to reflect a substantial part of the light in the general direction of the lamp cap

1.3.15
maximum cap temperature
maximum temperature which the components in the cap area of a lamp are designed to withstand over the expected life of the lamp

1.3.16
lamp neck reference diameter
that diameter of a lamp which is of influence on the protection against accidental contact and which is measured at a defined distance from the solder contact plate

For E14 capped lamps, this distance is 30 mm.

2 Requirements

2.1 General

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

Lamps shall satisfy the requirements of this clause.

2.2 Marking

2.2.1 Mandatory markings

The following information shall be marked on the lamps and shall be legible and durable when subjected to the test procedure in A.1:

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

b) the rated voltage or the rated voltage range, marked as "V" or "volts";

c) the rated wattage, marked as "W" or "watts".

For lamps with 40 mm diameter bulbs or larger and with a realized wattage of 14 W or less, the wattage need not be marked.

The rated voltage marking for lamps intended for use on United Kingdom supply voltages may be 240 volts or 240 V.

NOTE The United Kingdom implementation of 230 V European harmonization process allows supply voltages to remain at 240 V.

2.2.2 Dichroic reflectorized (cool beam) lamps and bowl mirror lamps

The immediate lamp wrapping or container shall be marked with the relevant symbol as shown in annex B.

2.2.3 Lamps with operating position limitations

For lamps requiring operating position limitations, such as some 60 W candle and round bulb lamps capped with B22d or E27 caps which can comply with the requirement of the lamp cap temperature rise only by excluding the cap-up position, the immediate lamp wrapping or container shall be marked with the appropriate symbol. An example is shown in annex B.

NOTE The requirements in 2.2.2 and 2.2.3 are intended as information for the end-user of the lamp.

2.3 Protection against accidental contact in screw lampholders

Dimensions of screw capped lamps shall be such that safety against accidental contact is ensured according to IEC 60061.

The lamps shall satisfy the gauges, defined in IEC 60061-3 in accordance with table 1.

Table 1 – Gauges for checking lamps for protection against accidental contact

Lamp cap	Gauge sheet No.	Lamp cap	Gauge sheet No.
E12	–	E26d	7006-29A
E14	see 2.3.1	E27/25 and E27/27	7006-51A
E17	–	E27/51×39	7006-51
E26/24	–		
E26/25	–		
E26/50×39	–		
NOTE The dash marking in the Gauge sheet No. column means that at the moment no such test system has been developed.			

2.3.1 E14 capped lamps

E14 capped lamps shall satisfy the following requirements:

a) candle lamps shall be fitted with caps E14/25×17 and tested with gauge 7006-55;

b) round bulb, pigmy, tubular and reflector lamps having lamp neck reference diameters of 21 mm and greater shall be fitted with caps E14/25×17 and tested with gauge 7006-55;

c) round bulb, pigmy, tubular and reflector lamps having lamp neck reference diameters between 16 mm and 21 mm shall be fitted with caps E14/23×15 or E14/20;

d) round bulb, pigmy, tubular and reflector lamps having lamp neck reference diameters between 14 mm and 16 mm shall be fitted with caps E14/20.

In cases c) and d) a gauge is not required, because the choice of caps guarantees the same degree of safety as in cases a) and b).

2.4 Lamp cap temperature rise (Δt_s)

2.4.1 Average cap temperature rise

The average cap temperature rise per class of lamp manufactured in a period of 12 months shall not exceed the following:

a) the appropriate value as specified in table 2; or

b) 45 K lower than the relevant values in table 2 where advantage is taken of the lower maximum cap temperature of 2.5.4 b).

However, lamps fitted with E12, E17 and E26 caps with higher Δt_s values intended for special applications are permitted, provided suitable cautionary notices accompany each lamp.

NOTE In North America, lampholder and luminaire designs may be primarily aligned with the cap temperature rise characteristics of common frosted, clear and white lamps. Therefore, lamps with other bulb finishes or other characteristics yielding a higher cap temperature rise may require special cautionary notices.

2.4.2 Compliance

Compliance shall be checked by measurements of lamp cap temperature rise on lamps in the same class in accordance with the test procedure specified in IEC 60360.

If the lamp is marked with a voltage range, the cap temperature rise shall be measured at the mean voltage provided the limits of the voltage range do not differ by more than 2,5 % from the mean voltage. For lamps with a wider voltage range, the measurement shall be at the highest marked voltage.

NOTE Table 2 shows upper limits for average cap temperature rise which apply to all lamps listed by wattage, bulb and cap. In practice, several design features such as light centre length, mount shape and bulb finish affect cap temperature rise, but such factors are encompassed in each limit.

2.4.3 Batch testing

For the testing of batches when the 20 lamp sample size is needed, the average shall not exceed the appropriate value in accordance with 2.4.1, with an allowance of +9 K.

2.5 Resistance to torque

2.5.1 Caps

Caps shall be so constructed and assembled to the bulbs that they remain attached during normal operation.

2.5.2 Unused lamps

For unused lamps, the lamp cap shall not move relative to the bulb when subjected to the relevant torque value from table 3 as tested in accordance with C.1. Where the means of attachment is other than by capping cement or adhesive, relative movement between bulb and cap is permitted, provided it does not exceed 10°.

2.5.3 Resistance to heat

The lamp cap and capping cement or other means of attachment shall endure exposure to heat at a level equal to the maximum cap temperature for which that class of lamp is designed.

The lamp cap shall not move relative to the bulb when subjected to the relevant torque values of table 4 after the heating test specified in C.2 at the appropriate temperature of 2.5.4. In the case where the means of attachment is other than by capping cement or adhesive, relative movement between bulb and cap is permitted, provided it does not exceed 10°.

Table 2 – Maximum allowable cap temperature rise (Δt_s) for various lamp wattages and classes over a 12 month period average

Group number	Wattage[1] W	Bulb shape	Δt_s max. K							
			B15d	B22d	E12	E14	E17	E26/24	E26/25	E27
1	25 & 30	A, PS, M and other shapes intended for use in the same luminaire	-	-	-	-	-	95	65	-
	40		-	-	-	-	-	95	85	-
	60		-	125	-	-	-	120	95	120
	100		-	135	-	-	-	120	110	130
	150 & 200		-	135	-	-	-	120	100	130
2	40	B, G (diameter ≤ 45 mm), P and other shapes intended for use in the same luminaire	135	140	140^{4,6}	130	-	140^{4,6}	-	140
	60		145	125^{2}	165^{4,6}	140	-	165^{4,6}	-	120^{2}
3	15	C, F and other shapes intended for use in the same luminaire	-	-	-	-	90^{9}	-	90	-
	25		-	-	120	-	110^{9}	120	110	-
	40		-	-	140^{4,6}	-	130^{9}	140^{4,6}	130	-
	60		-	-	165^{4,6}	-	130^{9}	165^{4,6}	130	-
4	25 & 40	G (diameter > 45 mm)	-	-	-	-	110	-	110	-
	60 & 100		-	-	-	-	-	-	110	-
5	25	P & G (diameter ≤ 45 mm) with bowl mirror	-	-	-	-	110	-	110	-
	40		135	135	-	135	-	-	110	135
	60		135	-	-	135	-	-	110	-
6	60	A & PS with bowl mirror	-	130	-	-	-	-	110	130
	100		-	135	-	-	-	-	110	135
	150 & 200		-	135	-	-	-	-	-	135
7	25	R and other shapes intended for use in the same luminaire	-	-	-	-	85	-	-	-
	40		120	120	-	120	95	145^{6}	95	120
	60		-	130	-	-	105	145^{6}	105	130
	100, 150 & 200		-	135	-	-	-	145^{6,7,8}	110	135
8	75	PAR shapes[3]	-	-	-	-	-	145^{6,8}	85	150
	100		-	-	-	-	-	145^{6,8}	100	150
	150		-	-	-	-	-	145^{6,8}	125	150
9	150	PAR shapes with dichroic reflector[3]	-	-	-	-	-	175	150	175

1 For lamps with intermediate wattage values, the requirement of the next higher value shown applies.

2 This may require a limitation on operating position.

3 Lamps with skirted caps: E26/50x39, E27/51x39, etc..

4 Some lamp classes may be limited to operation in the cap-down or cap-down-through-horizontal positions by the manufacturer.

5 Some lamp classes may be limited to operation in the cap-down position by the manufacturer.

6 Some lamp classes may be limited by the manufacturer to applications in high-temperature lampholders, because low-temperature lampholders could deteriorate.

7 Some lamp classes may be limited by the manufacturer to applications at 260 °C maximum cap temperature in high-temperature lampholders.

8 Some lamps in this category may no longer be sold in the United States and Canada due to updated energy regulations. Consult local regulations.

9 Under consideration.

2.5.4 Heating treatment temperatures

The heating treatment shall be conducted at one of the following levels:

a) the maximum cap temperature, in relation to cap type as specified in table K.1; or

b) for certain classes of lamps where 210 °C is specified in table K.1, the manufacturer may elect to design lamps that can withstand a maximum cap temperature of 165 °C, in which case the heating test is carried out at 165 °C, provided their rated wattage is 15 W or lower, and the lamp is not a reflector or bowl mirror type.

NOTE For special applications in North America, maximum cap temperatures lower than those shown in table K.1 may be assigned by the lamp manufacturer. When such a lower temperature lamp class is established, the manufacturer is encouraged to:
– propose special limits for this standard;
– alert luminaire manufacturers.

Table 3 – Torque test values for unused lamps

Cap type	Torque value Nm
B15d	1,15
B22d	3,0
E12	0,8
E14	1,15
E17	1,5
E26, E26d, E27, E26/50×39 and E27/51×39	3,0

Table 4 – Torque test values after heating

Cap type	Torque value Nm
B15d	0,3
B22d	0,75
E12	0,5
E14	1,0
E17	1,0
E26, E26d, E27, E26/50×39 and E27/51×39	2,5

2.6 Insulation resistance of B15d, B22d, E26/50×39 and E27/51×39 capped lamps and other lamps having insulated skirts

Insulation resistance between the shell of the cap and the contacts of bayonet capped lamps, or between the shell and the insulated skirt of skirted Edison screw capped lamps, shall be not less than 2 MΩ when measured in accordance with the procedure of A.3.

2.7 Accidentally live parts

2.7.1 Metal parts intended to be insulated from live parts

Metal parts intended to be insulated from live parts shall not be or become live. Any moveable conductive material shall be placed without the use of a tool, in the most onerous position before inspection in accordance with A.4.

2.7.2 Bayonet caps

On bayonet caps, any projection from the contact plate shall not come within 1 mm of metal parts intended to be insulated.

2.7.3 Edison screw caps

On Edison screw caps any projection from the cap shell shall not project more than 3 mm from the surface of the cap. See figure 1.

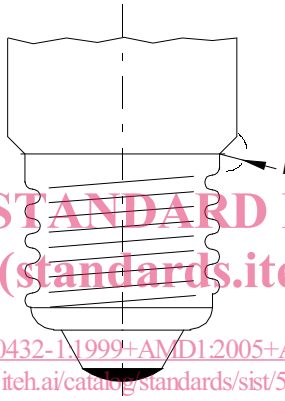

Figure 1 – Edison screw cap

2.8 Creepage distances for B15d and B22d capped lamps

The minimum creepage distance between the metal shell of the cap and the contacts shall be in accordance with the distance given in IEC 60061-4, sheet 7007-6.

2.9 Safety at end of life

When tested under the specified conditions, lamp failure shall not be accompanied by breakage of the outer glass envelope nor its ejection from the cap. For bayonet capped lamps, it is also required that there shall not be an internal short-circuit to the cap shell after the test.

The test conditions are:

– an induced-failure test in accordance with annex D or in accordance with the alternative induced-failure test of annex A of IEC 60432-2, and

– an operation-to-failure test in accordance with annex E.

NOTE 1 In case of disagreement, tests of annexes D and E are the reference methods.

NOTE 2 The induced-failure test is not suitable for lamps with rated voltages below 100 V; however, the alternative induced-failure test is suitable for lamps with rated voltages below 100 V.

NOTE 3 If lamps fail the induced-failure test, it is not necessary for them to be submitted to the operation-to-failure test.

NOTE 4 Under circumstances defined in H.3, the operation-to-failure test may be used in place of the induced-failure test.