BS EN 60432-3:2013

BSI Standards Publication

Incandescent lamps — Safety specifications

Part 3: Tungsten-halogen lamps (non-vehicle)

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National foreword

This British Standard is the UK implementation of EN 60432-3:2013. It is identical to IEC 60432-3:2012. It supersedes BS EN 60432-3:2003+A2:2008 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee CPL/34, Lamps and Related Equipment, to Subcommittee CPL/34/1, Electric lamps.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct applica-

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English version

Incandescent lamps - Safety specifications - Part 3: Tungsten-halogen lamps (non-vehicle)

(IEC 60432-3:2012)

Lampes à incandescence -
Prescriptions de sécurité -
Partie 3: Lampes tungstène-halogène
(véhicules exceptés)
(CEI 60432-3:2012)

Glühlampen -
Sicherheitsanforderungen -
Teil 3: Halogen-Glühlampen
(Fahrzeuglampen ausgenommen)
(IEC 60432-3:2012)

This European Standard was approved by CENELEC on 2012-08-08. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 34A/1567/FDIS, future edition 2 of IEC 60432-3, prepared by SC 34A "Lamps" of IEC/TC 34 "Lamps and related equipment", was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60432-3:2013.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-07-18
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-08-08

This document supersedes EN 60432-3:2003 + A1:2005 + A2:2008.

EN 60432-3:2013 includes the following significant technical changes with respect to EN 60432-3:2003 + A1:2005 + A2:2008:

- adapting the cold fill pressure requirements and tests for self-shielded lamps to the state of the technology;
- introduction of requirements to fully cover photobiological safety according to EN 62471.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 60432-3:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60127-2	NOTE	Harmonised as EN 60127-2.
IEC 60269-3	NOTE	Harmonised as HD 60269-3.
IEC 60335-2-56:2002	NOTE	Harmonised as EN 60335-2-56:2003 (not modified).
IEC 60432-2:1999	NOTE	Harmonised as EN 60432-2:2000 (modified).
IEC 60432-2:1999/A1:2005	NOTE	Harmonised as EN 60432-2:2000/A1:2005 (modified).
IEC 60598-1	NOTE	Harmonised as EN 60598-1.
IEC 60598-2 Series	NOTE	Harmonised as EN 60598-2 Series (partially modified).
IEC 60682	NOTE	Harmonised as EN 60682.
IEC 60838-1	NOTE	Harmonised as EN 60838-1.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-845	-	International Electrotechnical Vocabulary (IEV) - Chapter 845: Lighting	-	-
IEC 60061-1	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps	EN 60061-1	-
IEC 60061-3	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges	EN 60061-3	-
IEC 60061-4	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 4: Guidelines and general information	EN 60061-4	-
IEC 60357	-	Tungsten halogen lamps (non-vehicle) - Performance specifications	EN 60357	-
IEC 60432-1 (mod)	1999	Incandescent lamps - Safety specifications - Part 1: Tungsten filament lamps for domestic and similar general lighting purposes	EN 60432-1	2000
IEC 62471	-	Photobiological safety of lamps and lamp systems	EN 62471	-
IEC/TR 62471-2	-	Photobiological safety of lamps and lamp systems - Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety	-	-

CONTENTS

INCANDESCENT LAMPS – SAFETY SPECIFICATIONS –

Part 3: Tungsten halogen lamps (non-vehicle)

1 General

1.1 Scope

This part of IEC 60432 specifies the safety requirements for single-capped and double-capped tungsten halogen lamps, having rated voltages of up to 250 V, used for the following applications:

- projection (including cinematograph and still projection),
- photographic (including studio),
- floodlighting,
- special purpose,
- general purpose,
- stage lighting,

This International Standard does not apply to general purpose single-capped tungsten halogen lamps, covered by IEC 60432-2, that are used as replacement for conventional tungsten filament lamps.

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 if they are

a) floodlight lamps,

b) general purpose capsule lamps, or

c) general purpose reflector lamps.

1.2 Normative references

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

IEC 60050-845, *International Electrotechnical Vocabulary – Part 845: Lighting* Available from: http://www.electropedia.org/

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 60061-4, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 4: Guidelines and general information*

IEC 60357, *Tungsten halogen lamps (non-vehicle) – Performance specifications*

IEC 60432-1:1999, *Incandescent lamps – Safety specifications – Part 1: Tungsten filament lamps for domestic and similar general lighting purposes*

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*

1.3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845 as well as the following apply.

1.3.1
tungsten halogen lamp
gas-filled lamp containing halogens or halogen compounds, the filament being of tungsten

1.3.2
single-capped tungsten halogen lamp
tungsten halogen lamp having a single cap or base

1.3.3
double-capped tungsten halogen lamp
tungsten halogen lamp having a cap or base on each end of the lamp

1.3.4
extra low voltage tungsten halogen lamp
tungsten halogen lamp with a rated voltage lower than 50 V

Note 1 to entry: Abbreviated: ELV tungsten halogen lamp.

1.3.5
extra low voltage low-pressure tungsten halogen lamp
tungsten halogen lamp with a gas pressure below a certain value and a rated voltage less than or equal to 12 V

1.3.6
self-shielded tungsten halogen lamp
tungsten halogen lamp for which the luminaire needs no protective shield

Note 1 to entry: Abbreviated: self-shielded lamp.

Examples of self-shielded tungsten halogen lamps are:

- ELV tungsten halogen lamps with integral outer envelope;
- ELV low-pressure tungsten halogen lamps;
- mains voltage tungsten halogen lamps which conform to IEC 60432-2;
- mains voltage tungsten halogen lamps which conform to the relevant clauses of this standard.

1.3.7
outer envelope
transparent or translucent enclosure containing a tungsten halogen light source

Note 1 to entry: The enclosure can also consist of a reflector with integral front cover.

1.3.8
rated voltage
voltage or voltage range specified in this standard or assigned by the manufacturer or responsible vendor

Note 1 to entry: If lamps are marked with a voltage range, they are appropriate for use on any supply voltage within that range.

1.3.9
test voltage
rated voltage unless otherwise specified

Note 1 to entry: If lamps are marked with a voltage range, the test voltage is the mean of the voltage range, unless otherwise specified.

1.3.10
rated wattage
wattage specified in this standard or assigned by the manufacturer or responsible vendor

1.3.11
rated current
current specified in this standard or assigned by the manufacturer or responsible vendor

1.3.12
test current
rated current unless otherwise specified

1.3.13
specific effective radiant UV power
effective power of the UV radiation of a lamp related to its luminous flux

Note 1 to entry: The specific effective radiant UV power is expressed in: mW/klm.

For a reflector lamp, this is the effective irradiance of the UV radiation related to the illuminance.

Note 2 to entry: The effective irradiance of the UV radiation related to the illuminance is expressed in $mW/(m^2 \cdot klx)$.

Note 3 to entry: The effective power (or irradiance) of the UV radiation is obtained by weighting the spectral power distribution of the lamp with the action spectrum published by the American Conference of Governmental Industrial Hygienists (ACGIH), which is endorsed by the World Health Organization (WHO) and recommended by the International Radiation Protection Association (IRPA). For references, see Bibliography.

1.3.14
maximum pinch temperature
maximum temperature which the components in the pinch/seal of a lamp are designed to withstand over the expected life of the lamp

1.3.15
maximum lamp cap-contact, base-pin or base-post temperature
maximum temperature of the lamp cap-contact, base-pin or base-post, which should be observed to safeguard electrical contact over the expected life of the lamp

1.3.16
maximum cap temperature
maximum temperature for which the components in the cap area of a lamp are designed to withstand over the expected life of the lamp

1.3.17
maximum reflector-rim temperature
maximum temperature for which the connection between front cover and reflector is designed to withstand over the expected life of the lamp

1.3.18
group
lamps for the same application as defined by the scope of this standard

1.3.19
type
lamps of the same group having the same nominal wattage, bulb shape and cap

1.3.20
family
grouping of lamps characterized by common features such as materials, components and/or method of processing

1.3.21
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

1.3.22
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

1.3.23
running test
test repeated at frequent intervals to provide data for assessment

1.3.24
batch
all lamps in one family and/or group and identified as such and put forward at one time for checking compliance

1.3.25
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

1.3.26
breakdown
plasma discharge between two points inside the bulb of the lamp with maximum difference of electrical potential

Note 1 to entry: For the purposes of this standard, it is assumed that breakdown has occurred if the current exceeds the rated current by a factor of 5 (under consideration).

2 Requirements

2.1 General

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

In general, compliance is checked by carrying out all the relevant tests specified in this standard. For the purposes of this standard, the voltage designations shown in IEC 60357 apply.

2.2 Marking

2.2.1 Lamp marking

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

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

– rated wattage (marked “W” or “watts”);

– rated voltage or rated voltage range (marked “V” or “volts”), or for airfield lamps the rated current (marked “A”).

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.

Compliance is checked on unused lamps as follows:

– presence and legibility by visual inspection;

– durability by applying the following test.

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

After this test, the marking shall still be legible.

2.2.2 Additional information and marking

If applicable, the following information shall be given.

a) Lamps shall be supplied with an appropriate cautionary notice indicating the need of a protective shield to be fitted to the luminaire. Alternatively the immediate lamp wrapping or container may be marked with the corresponding symbol as shown in Clause A.1.

NOTE In North America, a suitable cautionary notice is required. Use of the symbol is optional.

b) For self-shielded lamps (not needing luminaire shielding), the immediate lamp wrapping or container shall be marked with the symbol as shown in Clause A.2.

NOTE 1 This does not apply to lamps covered by IEC 60432-2.

NOTE 2 In North America, a written notice may be used in place of this symbol.

c) For dichroic-coated reflector lamps, the immediate lamp wrapping or container shall be marked with the symbol as shown in Clause A.3.

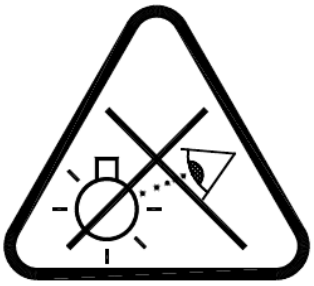
NOTE This symbol is not required in North America.

d) Double-capped lamps, with rated voltages 50 V – 250 V, shall be supplied with a cautionary notice or symbol as shown in Clause A.4 indicating that the luminaire shall be disconnected from the power supply before insertion or withdrawal of the lamp.

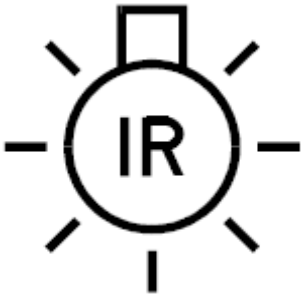
NOTE 1 In the USA, special package marking is required regarding the use of 500 W double-capped halogen lamps in residential indoor luminaires.

NOTE 2 In North America, a suitable cautionary notice is required. Use of the symbol is optional.

e) Projection lamps, photographic lamps, special purpose and stage lighting lamps shall be marked with the following symbol on the packaging or accompanying information.



f) Projection lamps, photographic lamps, special purpose and stage lighting lamps shall be marked with the following symbol on the packaging or accompanying information.



Information shall be given on the manufacturer's homepage, catalogue or similar means of information on how to address IR hazards properly.

Compliance is checked by visual inspection.

2.3 Caps or bases

2.3.1 General

Caps or bases originally developed for single-capped ELV lamps shall not be used for general purpose tungsten halogen lamps with rated voltages higher than 50 V.

NOTE Examples of such ELV fits are: G4, GU4, GY4, GX5.3, GU5.3, G6.35, GY6.35, GU7 and G53.

The GU10 base shall be used for aluminised reflector lamps only. The G9, GU10 or GZ10 base shall be used for self-shielded lamps only.

Compliance is checked by inspection.

2.3.2 Creepage distances

The minimum creepage distance between contacts or between contacts and the metal shell of the cap, if any, shall be in accordance with the recommendations in IEC 60061-4.

Compliance is checked by measurement.

2.3.3 Dimensions

If tungsten halogen lamps use standardized caps/bases they shall be in accordance with the requirements of IEC 60061-1.

Compliance is checked on finished lamps by using the gauges of IEC 60061-3.

Non standardized caps/bases shall be in accordance with the manufacturer's specification.

Compliance is checked by inspection.

2.4 Photobiological safety

The specific effective radiant UV power of self-shielded tungsten halogen lamps shall not exceed:

– 2 mW/klm or,
– for reflector lamps 2 mW/(m^2·klx).

Compliance is checked by measurement of the spectral power distribution.

NOTE Blue light and infrared hazards are covered by marking requirements.

2.5 Gas pressure of low-pressure self-shielded extra low voltage lamps

During operation, the gas pressure of single-capped low-pressure self-shielded ELV tungsten halogen lamps shall be limited. This shall be achieved by restricting:

a) the cold fill pressure to less than 1×10^5 Pa (1 bar) for rated wattages above 50 W and up to 100 W, and
b) the cold fill pressure to less than 4×10^5 Pa (4 bar) for rated wattages up to 50 W, and
c) the lamp volume to 1 cm^3 maximum.

Compliance is checked by inspection and by means of the test specified in Annex B.

2.6 Safety at end of life of self-shielded lamps with rated voltages from range B or C

When tested under the specified conditions, lamp failure shall not be accompanied by breakage of the bulb 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 F, or
– an operation-to-failure test.

The operation-to-failure test shall be carried out under the conditions specified for the life test procedure in Annex A of IEC 60357:2002. The test rack circuit characteristics shall be in line with Table E.1 of IEC 60432-1:1999. The test is continued until end of life.

NOTE 1 In the event of dispute the reference test method is the induced failure test.

NOTE 2 Some lamp designs are not suitable for testing with the induced failure test because a breakdown cannot reliably be achieved. Such lamps, provided they are of voltage range B or C, will be submitted to an operation-to-failure test as described above.

2.7 Information for luminaire design

Refer to Annex C.

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. Subclause 3.2 gives 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 3.3. 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 manufacturer's records

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

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

The assessment shall be based in general on individual factories, each meeting the acceptance criteria of 3.2.1. 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 local relevant records and quality control procedures.

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.

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 1.

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 assurance 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.

The manufacturer shall provide sufficient test records with respect to each clause and subclause as indicated in column 5 of Table 1.

Table 1 – Grouping of test records – Sampling and acceptable quality levels (AQL)

1	2	3	4	5		6
Sub-clause	Test	Type of test	Permitted accumulation of test records	Minimum annual sample per accumulation		AQL[a] %
				For lamps made most of the year	For lamps made infrequently	
2.2.1	Marking – legibility	Running	All families with the same method of marking	200	32	2,5
2.2.1	Marking – durability	Periodic	All families with the same method of marking	50	20	2,5
2.2.2	Additional information and marking	Running	By group and type	200	32	2,5
2.3.2	Caps or bases – creepage distances	Design	All families with same cap or base	Use Clause D.1		–
2.3.3	Caps or bases – dimensions	Periodic	All families with same cap or base	32		2,5
2.4	UV radiation	Design		Use Clause D.2		–
2.5	Gas pressure	Periodic	By group and type	125	80	0,65
2.6	Safety at end of life					
	– Induced failure or – Operation to failure [b]	Design	All lamps of all families	Use Clause D.3		–
				Use Clause D.4		–
	– Induced failure or – Operation to failure [b]	Periodic		315		0,25

[a] For the use of this term, see IEC 60410.

[b] The operation to failure test is allowed in those cases where no reliable breakdown can be achieved. See also Note 2 to Subclause 2.6.

The number of non-conformities in the manufacturer's records shall not exceed the limits shown in Tables 2, 3 or 4 relevant to the acceptable quality level (AQL) values shown in column 6 of Table 1.

Table 2 – Acceptance numbers AQL = 0,25 %

Number of lamps in manufacturer's records	Acceptance number
315	2
316 to 500	3
501 to 635	4
636 to 800	5
801 to 1 040	6
1 041 to 1 250	7
1 251 to 1 500	8
1 501 to 1 750	9
1 751 to 2 000	10

Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records %
2 001	0,485
2 200	0,48
2 600	0,46
3 300	0,44
4 200	0,42
5 400	0,40
7 200	0,38
10 000	0,36

Table 3 – Acceptance numbers AQL = 0,65 %

Number of lamps in manufacturer's records	Acceptance number
80	1
81 to 125	2
126 to 200	3
201 to 260	4
261 to 315	5
316 to 400	6
401 to 500	7
501 to 600	8
601 to 700	9
701 to 800	10
801 to 920	11
921 to 1 040	12
1 041 to 1 140	13
1 141 to 1 250	14
1 251 to 1 360	15
1 361 to 1 460	16
1 461 to 1 570	17
1 571 to 1 680	18
1 681 to 1 780	19
1 781 to 1 890	20
1 891 to 2 000	21

Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records %
2 001	1,03
2 100	1,02
2 400	1,00
2 750	0,98
3 150	0,96
3 550	0,94
4 100	0,92
4 800	0,90
5 700	0,88
6 800	0,86
8 200	0,84
10 000	0,82
13 000	0,80
17 500	0,78
24 500	0,76
39 000	0,74
69 000	0,72
145 000	0,70
305 000	0,68
1 000 000	0,67

Table 4 – Acceptance numbers AQL = 2,5 %

Number of lamps in manufacturer's records	Acceptance number
20	1
21 to 32	2
33 to 50	3
51 to 65	4
66 to 80	5
81 to 100	6
101 to 125	7
126 to 145	8
146 to 170	9
171 to 200	10
201 to 225	11
226 to 255	12
256 to 285	13
286 to 315	14
316 to 335	15
336 to 360	16
361 to 390	17
391 to 420	18
421 to 445	19
446 to 475	20
476 to 500	21
501 to 535	22
536 to 560	23
561 to 590	24
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

Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records %
1 001	3,65
1 075	3,60
1 150	3,55
1 250	3,50
1 350	3,45
1 525	3,40
1 700	3,35
1 925	3,30
2 200	3,25
2 515	3,20
2 950	3,15
3 600	3,10
4 250	3,05
5 250	3,00
6 400	2,95
8 200	2,90
11 000	2,85
15 500	2,80
22 000	2,75
34 000	2,70
60 000	2,65
110 000	2,60
500 000	2,55
1 000 000	2,54

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.

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 Subclause 2.6;
    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.

A manufacturer who has failed to meet the requirements of a clause or subclause where grouping of the test results is permitted 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 a) and b) as above or they are deleted from the list of families, groups and/or types which the manufacturer may claim are in conformity with the standard.

In the case of a family, group and/or type which has been deleted from the list, 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 1, required by the clause or subclause where non-compliance occurred. This sample may be collected over a short period of time.

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.

3.2.1 Assessment of manufacturer’s records for particular tests

Table 1 specifies the type of test and other information which applies to the method of assessing compliance to the requirements of various clauses and 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.

3.2.2 Sampling procedures for the whole production testing

The conditions of Table 1 apply.

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 1 are met.

Whole production tests shall be made on samples randomly selected at a rate not less than that indicated in column 5 of Table 1. Lamps selected for one test need not be used for other tests.

In relation to the safety at end of life (see 2.6), the manufacturer shall have a sampling plan which does not deliberately exclude any of the types in his nominated list.

3.3 Assessment of batches

3.3.1 Sampling for batch testing

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 ten containers.

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.

3.3.2 Number of lamps in the batch sample

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

3.3.3 Sequence of the tests

The testing shall be carried out in the order of the subclause numbers listed in Table 5, up to and including Subclause 2.4. Subsequent tests may involve damage to the lamp and each test sample shall be taken separately from the original sample.

3.3.4 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

Table 5 – Batch sample size and rejection number

Sub-clause	Test	Number of lamps tested	Rejection number
2.2.1	Marking – legibility	200	11
2.2.1	Marking – durability	50	4
2.2.2	Additional information and marking	200	11
2.3.2	Caps and bases – creepage distances	Use Clause D.1	
2.3.3	Caps and bases – dimensions	32	3
2.4	UV radiation	Use Clause D.2	
2.5	Gas pressure	125	3
2.6	Safety at end of life – Induced failure	Use Clause D.3	

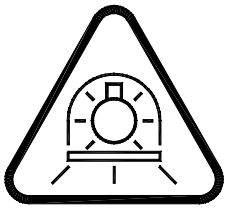
Annex A
(normative)

Symbols

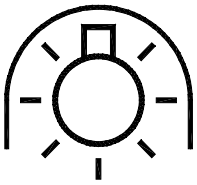
This concerns symbols as referred to in 2.2.2.

The height of graphical symbols shall not be less than 5 mm, and for letters, not less than 2 mm.

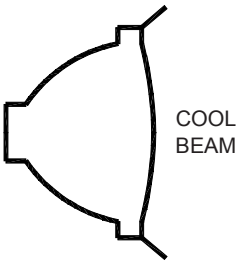
A.1 Symbol indicating that the lamp shall be operated only in a luminaire with a protective shield



A.2 Self-shielded lamp symbol indicating that the lamp can be operated in a luminaire without a protective shield

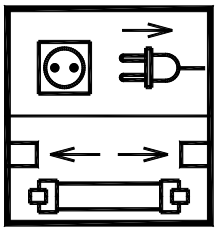


A.3 Symbol for dichroic-coated reflector lamp



The bulb shape may be varied to show the shape of the lamp.

A.4 Symbol indicating that the luminaire shall be disconnected from the power supply before insertion or withdrawal of the lamp



Annex B
(normative)

Method of testing the gas-pressure

In case of doubt, this is the reference method.

With the aid of an ultrasonic drill, a hole with a maximum diameter of 1 mm is drilled in the lamp until a bulb wall thickness of approximately 0,5 mm is left.

Subsequently:

1) the sample is submerged in water of 15 °C to a maximum of 30 cm depth, wiped off and weighed (G1);
2) the sample is submerged again and opened through the pre-drilled hole. Escaping filling gas is collected by a suitable vessel and measured (V_e) When the pressure inside the lamp is equalized, the sample is lifted out of the water, taking care that no filling gas or water escapes, and afterwards wiped off and weighed (G2);
3) the sample is submerged for the third time and fully filled up with water with the aid of an injection needle, wiped off and weighed (G3);
4) the lamp volume and cold fill pressure are calculated.

Care should be taken that during opening of the bulb, all glass parts are collected.

At 15 °C and $1{,}103 \times 10^5$ Pa (760 mm Hg), 1 l of water weighs 1 kg;

G3 – G1 (in grams) = L = Lamp volume (in cubic centimetres);

G3 – G2 (in grams) = V_b = Volume of filling gas (in cubic centimetres) at the prevailing atmospheric pressure if no filling gas escaped from the lamp; otherwise, total volume of filling gas is $V = V_b + V_e$.

Since PV is constant at equal temperature, the cold filling-gas pressure (P) can be determined from the formula:

$$P = V/L \times H$$

where H is the prevailing atmospheric pressure, in Pascal.

Annex C
(informative)

Information for luminaire design

C.1 General

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

C.2 Protective shields

Luminaires intended for tungsten halogen lamps should be fitted with a glass protective shield, except when they are intended for self-shielded tungsten halogen lamps.

NOTE For examples of tungsten halogen self-shielded lamps, see 1.3.6.

C.3 Luminaires for self-shielded tungsten halogen lamps

Luminaires intended for self-shielded tungsten halogen lamps should be marked with the symbol as shown in Clause A.2.

NOTE This does not apply to luminaires intended for conventional tungsten filament lamps.

C.4 Luminaires for tungsten halogen reflector lamps

The design of luminaires should take into account the differences in thermal behaviour between dichroic reflector lamps (emitting most heat to the back) and aluminised reflector lamps (emitting most heat to the front). Luminaires for GZ10 based reflector lamps should be designed to be suitable for both types of lamps.

Dichroic reflector (cool beam) tungsten halogen lamps, marked in accordance with 2.2.2, are applied in special luminaires. Such tungsten halogen lamps are unsuitable for use in ordinary luminaires which accept similarly shaped lamps because overheating could occur. Associated luminaire marking requirements appear in IEC 60598-1.

C.5 Cap/holder fits

Holders originally developed for single-capped ELV tungsten halogen lamps should not be used in luminaires intended for general purpose lamps with rated voltages higher than 50 V.

NOTE Examples of such ELV fits are: G4, GU4, GY4, GX5.3, GU5.3, G6.35, GY6.35, GU7 and G53.

C.6 Series operation

Series operation of ELV tungsten halogen lamps is not permitted unless the lamps are especially designed for such operation and approved for such use by the lamp manufacturer. Special circuits which suitably limit the lamp voltage and/or current are also permitted.

C.7 External fuses

C.7.1 Single-capped general purpose ELV tungsten halogen lamps

Single-capped general purpose ELV tungsten halogen lamps with a rated voltage between 24 V and 50 V should always be operated in series with a fuse as specified in Table C.1.

This fuse should be in the secondary (lamp) circuit of the transformer/convertor.

Table C.1 – Fuse values for general purpose ELV tungsten halogen lamps

Lamp		Fuse [a]
Rated voltage V	**Rated wattage** W	**Rated current** A
24	20	2,0
	50	4,0
	75	6,3
	100	6,3
	150	10,0 [b]
Recommendations for fuses for lamps of other wattages and voltage ratings are under consideration.		
[a] Quick-acting miniature fuses 250 V with high breaking capacity (see IEC 60127-2). [b] Not included in IEC 60127-2, but in common use.		

C.7.2 Photographic tungsten halogen lamps

Photographic tungsten halogen lamps should always be operated in series with a fuse as specified in Table C.2.

Table C.2 – Fuse values for photographic lamps

Lamp		Fuse	
Rated voltage V	**Rated wattage** W	**Rated current** A	
		[a]	[b]
100 to 135	500	6,3	–
200 to 250		4,0	–
100 to 135	600	6,3	–
200 to 250		4,0	–
100 to 109	650	10,0 [c]	10,0
110 to 135		6,3	6,0
200 to 250		4,0	4,0
100 to 135	800	10,0 [c]	10,0
200 to 250		6,3	6,0
100 to 109	1 000	–	16,0
110 to 135		10,0 [c]	10,0
200 to 250		6,3	6,0
200 to 250	1 250	10,0 [c]	10,0
100 to 135	2 000	–	25,0
200 to 219		–	16,0
220 to 250		–	10,0
110 to 135	5 000	–	50,0
200 to 219		–	35,0
220 to 250		–	25,0
110 to 135	10 000	–	100,0
200 to 250		–	50,0

[a] Quick-acting miniature fuses 250 V with high breaking capacity (see IEC 60127-2).

[b] Quick-acting D-fuses, 500 V (see IEC 60269-3).

[c] Not included in IEC 60127-2, but in common use.

C.8 Maximum bulb wall temperatures of self-shielded lamps

The bulb wall temperature of self-shielded tungsten halogen lamps where access to the bulb is possible should not exceed the values given in Table C.3.

Compliance with these limits will avoid weakening of the bulb.

Table C.3 – List of maximum bulb temperatures

Rated wattage	**Maximum bulb temperature** °C
≤ 20 W	600
> 20 W and ≤ 50 W	Under consideration
> 50 W	900

Conditions and methods of measurement are described in Annex E.

C.9 Maximum pinch temperature of self-shielded lamps

Unless otherwise indicated on the relevant lamp data sheet, the pinch temperature of self-shielded quartz-glass tungsten halogen lamps should not exceed 350 °C.

The methods of measuring the pinch temperature are described in IEC 60682.

C.10 Maximum cap-contact, base-pin, base-post or cap temperatures

Unless otherwise indicated on the relevant lamp data sheet, the cap-contact, base-pin, base-post or cap temperature of tungsten halogen lamps should not exceed the values specified below.

The temperature is measured in the area of electrical contact with the holder.

The conditions of measurement are those given in Clause E.1.

This measurement may be combined with the checking of the operating temperature of the lampholder during testing of the luminaire. The temperature difference between the holder contact and the lamp contact is usually negligible.

NOTE According to IEC 60838-1, the measuring point for the operating temperature of the lampholder is that area of the lampholder which makes electrical contact with the lamp cap/base.

a) **Bi-pin lamp bases**

This group covers bases like G4, GU4, GX5.3, GU5.3 and GY6.35.

For general purpose lamps the base-pin temperatures shown in Table C.4 should not be exceeded:

Table C.4 – Maximum base-pin temperatures

Rated wattage	Temperature °C
≤ 20 W	220
> 20 W and < 50 W	250
≥ 50 W	300

b) **Bi-post lamp bases**

This group covers bases like GU7, GU10 and GZ10.

For general purpose tungsten halogen lamps, the base-post temperature should not exceed 250 °C.

c) **Bayonet and screw lamp caps**

For ELV general purpose tungsten halogen lamps, the temperatures shown in Table C.5, measured in the area of electrical contact as described above, should not be exceeded:

Table C.5 – Maximum contact temperatures

Cap	Temperature °C
EZ10	Under consideration
B15d/BA15d	250

For mains voltage general purpose tungsten halogen lamps with caps like B15d, the temperatures are measured at the cap rim and should not exceed the corresponding values given in Annex C of IEC 60432-2:1999.

NOTE Requirements for E11 capped lamps are under consideration.

C.11 Maximum reflector-rim temperature

The reflector-rim temperature of tungsten halogen lamps with integral front cover should not exceed the values specified in Table C.6.

The conditions of measurement are those given in Clause E.1.

Table C.6 – Maximum reflector-rim temperatures

Reflector diameter mm	Cap/base	Rated voltage V	Rated wattage W	Temperature °C
35	GU4/GZ4	12	12, 20, 35	220
51	GU5.3/GX5.3	12	20, 35	180
51	GU5.3/GX5.3	12	50, 65, 75	220
51	GU7	12	20, 35	180
51	GU7	12	50,65	220
51	GU10/GZ10	50 to 250	50	240
64	GU10/GZ10	50 to 250	75	240

C.12 Protection from water contact

All lamps within the scope of this standard should be protected from direct water contact, e.g. drips, splashing, etc., by the luminaire if rated at IPX1 or higher.

NOTE The X in the IP number indicates a missing numeral but both of the appropriate numerals are marked on the luminaire.

C.13 Photobiological safety

It is expected that the luminaires using lamps covered by this part of the standard will not require further assessment for photobiological safety marking if they are

a) floodlight lamps,

b) general purpose capsule lamps, or

c) general purpose reflector lamps.

However, luminaires using beam focussing optics should be assessed for blue light hazards in the same way as a reflector lamp.

Annex D
(normative)

Conditions of compliance for design tests

D.1 Cap creepage distance

First sample: 5	Rejection number: 2 – Accept when no failure has been found. – If one failure found, take a
second sample: 5	Rejection number: 2 (in the combined sample)

D.2 UV Radiation

Sample size: 5	Rejection number: 1

D.3 Safety at end of life – induced failure test

D.3.1 Assessment for Subclause F.3.1

First sample: 125	Rejection number: 2 – Accept when no failures have been found – If 1 failure found, take a
second sample: 125	Rejection number: 2 (in the combined sample)

D.3.2 Assessment for Subclause F.3.2

First sample: 125	Rejection number: 7 – Accept when a maximum of 3 failures have been found – If 4, 5 or 6 failures found, take a
second sample: 125	Rejection number: 9 (in the combined sample)

D.4 Safety at end of life – operation-to-failure-test

First sample: 125	Rejection number: 2 – Accept when no failures have been found – If 1 failure found, take a
second sample: 125	Rejection number: 2 (in the combined sample)

Annex E
(informative)

Bulb wall temperature measurement

E.1 Conditions of measurement

The temperature limits specified in Clause C.8 are related to measurements according to the relevant equipment/luminaire specification, i.e. for:

– projection tungsten halogen lamps, Clause 11 of IEC 60335-2-56:2002;

– photographic, floodlight, general purpose and stage lighting tungsten halogen lamps, the subclause dealing with “Thermal test (normal operation)” of the IEC 60598-2 series (the number depends on the application);

– special purpose tungsten halogen lamps, under consideration.

E.2 Methods of measurement

The bulb wall temperature is most conveniently determined by means of an infrared temperature measuring instrument.

Only if this is not possible should the bulb wall temperature be measured by means of thermocouples.

Thermal contact between the thermocouple junction and the bulb wall is essential and this may be assured by the use of springs or adhesives. For details of the thermocouples and adhesives, see IEC 60682.

As the thermocouple itself (and the adhesive if used) will absorb a certain amount of heat by radiation, it should be connected to an automatic chart recorder. After temperature stabilization has been obtained, the lamp is switched off. The temperature will then at first fall quickly but after about 0,5 s the rate of fall of temperature will become steady. This steady portion of the temperature/time curve is used to determine by extrapolation the true bulb temperature at the time of switching-off.

Annex F
(normative)

Induced failure test

F.1 Test circuit and equipment

The test circuit shall consist of the following:

– a 50 Hz or 60 Hz supply line whose voltage shall be the test voltage of the lamps within a ± 2 % tolerance;

– a fuse with a rating not less than 25 A, for 220 V – 250 V lamps, and a rating of 15 A (under consideration) for lamps below 220 V.

A safety cover shall be provided to cover the lamp in the test position (during the warm-up of the lamp and during breakdown).

A laser of adequate power shall be used to induce breakdown of the filament.

NOTE An example of a suitable laser is a neodymium-glass laser.

The inductance and resistance of the whole circuit, including the items of the above-mentioned components and including any fuse and all wiring, shall meet the following requirements:

a) for lamp voltage ratings between 200 V and 250 V
   – resistance (Ω): 0,4 to 0,45;
   – inductance (mH): 0,6 to 0,65;
b) for lamp voltage ratings between 100 V and 150 V
   – resistance (Ω): 0,3 to 0,35;
   – inductance (mH): 0,6 to 0,65.

For current measurements, an appropriate device shall be installed with a minimum time resolution of 0,1 ms, minimum recording time of 1 s, minimum current resolution of 0,1 A (a maximum current range up to 500 A is recommended).

F.2 Test procedure

The lamp to be tested shall be inserted in the lampholder and the safety cover put in place. Through a small hole in the cover, the laser beam shall be aligned and focused on the lamp filament. The lamp shall be switched on. After a complete warm-up of the lamp, a laser pulse shall be applied.

If the lamp remains alight, the output power of the laser shall be increased and the laser pulse shall be applied again. This procedure shall be repeated until breakdown or disruption of the filament is achieved.

If the focusing of the laser beam is disturbed by the finish of the lamp or the structure of the outer envelope, specially prepared samples (e.g. laser polishing of the frosted bulb wall) should be used.

A lamp where no breakdown can be achieved shall be disregarded and a new lamp tested.

NOTE In the case of filament disruption without breakdown, it might help to create a breakdown more easily by adjusting the lamp in such a way that a point with optimum potential difference is situated right above the laser aiming point. In this position, the evaporating tungsten might help to create a breakdown.

F.3 Inspection and assessment

F.3.1 After the test, each test lamp is examined. If:

a) the bulb is no longer intact;

b) or the bulb is detached from the cap;

c) or, for bayonet caps only, there is a short circuit between either contact and the shell,

then the lamp is deemed to have failed the test and is counted as a non-conformity.

F.3.2 Additionally, for G9-based lamps of voltage range C, the current curve of the breakdown is analysed. For this purpose, all current values shall be converted to positive values.

The resulting curve shall not exceed an envelope which is defined by a first box with a height of 200 A and a duration of 2 ms and a subsequent box with a height of 10 A and a duration of 5 ms.

If the current curve cannot be covered by the envelope described above, the lamp is also deemed to have failed the test and is counted as a non-conformity.

The above curve is based on experience where the light-producing component has a single pinch. For those with double pinch, the time values are under consideration.

NOTE Testing of lamps with other base types and of voltage range B is under consideration.

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Amendment 1:2005

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NOTE

ACGIH American Conference of Governmental Industrial Hygienists.

INIRC International Non-Ionizing Radiation Committee.

IRPA International Radiation Protection Association.

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