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REDLINE VERSION

INTERNATIONAL STANDARD

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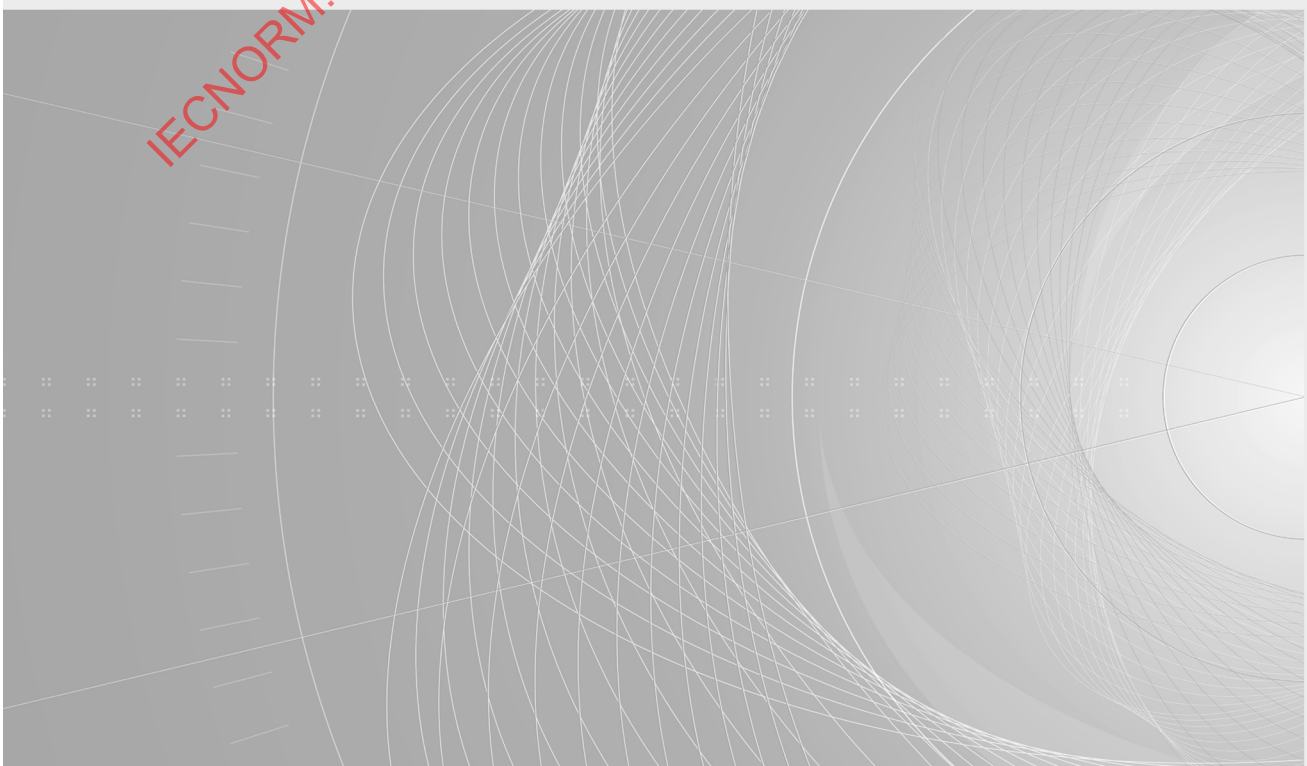
Self-ballasted compact fluorescent lamps for general lighting services – Performance requirements



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Self-ballasted compact fluorescent lamps for general lighting services – Performance requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SELF-BALLASTED COMPACT FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICES – PERFORMANCE REQUIREMENTS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60969 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamp and related equipment.

This second edition cancels and replaces the first edition published in 1988, Amendment 1:1991 and Amendment 2:2000. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) title change;
b) scope is now limited to compact fluorescent lamps, but expanded to cover all lamps of voltages greater than 50 V and all power ratings;
c) introduction of requirements for lamp equivalency claims, switching withstand, starting time, low temperature, run up time, treatment of claims for different operating conditions;
d) enhanced assessment and compliance criteria especially for lifetime;
e) introduction in-rush test conditions and displacement factor.

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

FDIS	Report on voting
34A/1923/FDIS	34A/1945/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 2.

The committee has decided that the contents of this publication 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.

The contents of the corrigendum of January 2017 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

SELF-BALLASTED COMPACT FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICES – PERFORMANCE REQUIREMENTS

1 Scope

This document specifies performance requirements together with test methods and conditions required to show compliance of ~~tubular~~ self-ballasted compact fluorescent ~~and other gas-discharge~~ lamps ~~with integrated means for controlling starting and stable operation (self-ballasted lamps)~~ intended for ~~domestic and similar~~ general lighting ~~purposes~~ services ~~having~~.

~~– a rated wattage up to 60 W;~~

~~– a rated voltage of 100 V to 250 V;~~

~~– Edison screw or bayonet caps.~~

This document applies to self-ballasted compact fluorescent lamps of voltages > 50 V and all power ratings with lamp caps complying with IEC 60061-1.

NOTE Some features of this document could be applicable to self-ballasted compact fluorescent lamps of voltages ≤ 50 V and to other types of self-ballasted gas discharge lamps.

The requirements of this document relate only to type testing.

~~Recommendations for whole product testing or batch testing are under consideration.~~

The performance requirements specified in this document are additional to the safety requirements specified in IEC 60968.

It can be expected that self-ballasted compact fluorescent lamps, which comply with this document, will start and operate satisfactorily at normal conditions (voltages between 92 % and 106 % of rated supply voltage, ambient air temperature of between -10 °C and 40 °C and in a luminaire complying with IEC 60598-1).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60630, *Maximum lamp outlines for incandescent lamps*

IEC 60968, *Self-ballasted fluorescent lamps for general lighting services – Safety requirements*

IEC 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current <= 16 A per phase)*

IEC 61000-4-7, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

IEC TR 61341, *Method of measurement of centre beam intensity and beam angle(s) of reflector lamps*

CIE 015-2004, *Colorimetry*

CIE 13.3, *Method of Measuring and Specifying Colour Rendering Properties of Light Source*

~~**3 Dimensions**~~

~~The lamp dimensions shall comply with the requirements as indicated by the manufacturer or responsible vendor.~~

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
self-ballasted lamp
integrated lamp
~~a tubular fluorescent or other discharge lamp unit that incorporates, permanently enclosed, all elements that are necessary for starting and for stable operation, and which does not include any replaceable or interchangeable parts.~~

unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source

Note 1 to entry: A self-ballasted lamp is referred to as a lamp in this document.

[SOURCE: IEC 60968:2015, 3.1, modified – The admitted term and note have been added]

3.2
new lamp
lamp which has not been energized since manufacture

~~**2.3**~~
~~**rated voltage**~~
~~the voltage or voltage range marked on the lamp~~

3.3
rated value
quantity value, assigned by the supplier, for a lamp characteristic under specified operating conditions

EXAMPLE Rated luminous flux.

3.4
test voltage
input voltage at which tests are carried out

[SOURCE: IEC 62612:2013, 3.2, modified – The word "input" has been added.]

~~**2.5**~~
~~**rated wattage**~~
~~the wattage marked on the lamp~~

3.5
initial value~~s~~
photometric and electrical characteristics measured at the end of the 100 h ageing period

~~**2.6**~~
~~**rated frequency**~~
~~the frequency marked on the lamp or declared as such by the manufacturer or responsible vendor~~

3.6
lamp failure
moment at which the lamp fails to light up, fails to remain alight or delivers low light output (in case of doubt, low light output refers to less than approximately 50 % of rated light output)

~~**2.7**~~
~~**rated luminous flux**~~
~~the flux marked on the lamp or declared as such by the manufacturer or responsible vendor~~

3.7
lamp life
<of an individual lamp> number of operating hours to lamp failure

3.8
median of lamp life
number of operating hours elapsed at which point 50 % of a representative group of lamps have failed, when operated under specified test conditions

3.9
starting time
time required for a lamp to develop an electrically stable arc discharge, the time being measured from the moment the lamp circuit is energized

~~**2.10**~~
~~**life (of an individual lamp)**~~
~~the length of time during which a complete lamp operates to burn-out or to any other criterion of life performance laid down in this standard~~

3.10
run-up time
~~the time needed, after the supply voltage is switched on, for the lamp to reach 80 % of its final luminous flux~~

time required for a lamp to reach a specified percentage of its (stable) luminous flux, the time being measured from the moment the lamp circuit is energized

~~**2.11**~~
~~**average life (life to 50 % failures)**~~
~~the length of time during which 50 % of the lamps reach the end of their individual lives~~

3.11
displacement factor
cosine of the phase-angle between the fundamental harmonic current and the mains voltage

Note 1 to entry: Displacement factor is explained in Annex J.

~~**2.12**~~
~~**rated average life (rated life to 50 % failures)**~~
~~the life declared by the manufacturer or responsible vendor as being the expected time at which 50 % of any large number of lamps reach the end of their individual lives~~

3.12
distortion factor
factor indicating the level of harmonic current distortion

Note 1 to entry: Distortion factor is explained in Annex J.

~~**2.13**~~
~~**colour**~~
~~the colour characteristics of a lamp are defined by the colour appearance and the colour rendition~~

~~a) The actual colour of the lamp is called colour appearance and is defined in terms of the spectral tristimulus values (colour co-ordinates) according to the recommendations of the CIE.~~

~~b) The spectral characteristics of the light emitted by the lamp have an effect on the appearance of the objects it illuminates; this effect is called colour rendition.~~

~~**2.14**~~
~~**rated colour**~~
~~the colour appearance as declared by the manufacturer or responsible vendor, or the colour corresponding to the colour designation marked on the lamp~~

3.13
power factor
under periodic conditions, ratio of the absolute value of the active power to the apparent power

Note 1 to entry: Alternatively, the power factor is the product of the displacement and distortion factor.

3.14
lumen maintenance
luminous flux at a given time in the life of a lamp, divided by the initial ~~value of the~~ luminous flux of the lamp

Note 1 to entry: Lumen maintenance is expressed as a percentage of the initial luminous flux.

3.15
lamp type
lamps that, independent of the type of cap ~~or base, are identical in photometric and electrical rating~~, have identical rated values in relation to the relevant compliance test

3.16
lamp stabilization time
~~the burning time of the lamp required to obtain stable operating electrical and photometric characteristics~~

time required for a lamp to reach stable conditions for measurement

3.17
type test
test or series of tests made on a type test sample, for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard

[SOURCE: IEC 60598-1:2014, 1.2.44]

3.18
type test sample
sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of a type test

[SOURCE: IEC 60598-1:2014, 1.2.45]

3.19
luminous efficacy
quotient of the lamp luminous flux by the lamp power consumption

3.20
beam angle
angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 % of the centre beam intensity

[SOURCE: IEC TR 61341:2010, 2.4]

3.21
ageing
preconditioning of lamps by operating them at controlled conditions for a specified period

3.22
supplier
manufacturer, responsible vendor or importer

3.23
dimmable lamp
lamp that is capable of producing varying levels of light when paired with a control or dimmer

3.24
inrush current
<of lamp> transient current associated with energizing a lamp

3.25
chromaticity coordinates
ratio of each of a set of three tristimulus values to their sum

[SOURCE: IEC 60050-845:1987, 845-03-33, modified – The notes have been deleted]

3.26
correlated colour temperature
CCT
temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions

Note 1 to entry: The correlated colour temperature is expressed in K.

Note 2 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-845:1987, 845-03-50, modified – The abbreviated term has been added and the notes have been replaced]

3.27
colour rendering index
CRI
measure of the degree to which the psychophysical colour of an object illuminated by the test illuminant conforms to that of the same object illuminated by the reference illuminant, suitable allowance having been made for the state of chromatic adaptation

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-845:1987, 845-02-61]

3.28
colour code
3-digit code expressing the rated colour rendering index and the rated correlated colour temperature as described in IEC TR 62732

Note 1 to entry: The light colour designation is detailed in IEC TR 62732.

4 Marking

For this performance standard the following data shall be provided (in addition to the mandatory data required by IEC 60968) by the supplier and located as specified in Table 1. The rated values refer to performance claims under the general conditions for measurement as specified in Clause A.1.

Table 1 – Locations where marking of rated values is required

Parameter (rated)	Product	Product packaging	Product datasheets or leaflets
a) Initial luminous flux of the lamp (lm) (luminous flux for reflector lamps is under consideration)	-	x	x
b) Beam angle (degrees) and centre beam intensity (cd) measured in accordance with IEC TR 61341 for reflector lamps	-	x	x
c) Initial luminous efficacy (lm/W)	-	-	x
d) Correlated colour temperature (K) For the product a colour code is permissible.	x	x	x
e) Colour rendering index For the packaging a colour code is permissible.	-	x	x
f) Chromaticity coordinates	-	-	x
g) Median lamp life (h)	-	x	x
h) Lumen maintenance (%) Including operating hours at which lumen maintenance value(s) are claimed	-	-	x
i) Switching withstand (no. of cycles)	-	-	x
j) Special operating requirements e.g. dimming, orientation (base up/down), restricted operating temperature range	-	x	x
k) Starting time (s)	-	-	x
l) Low temperature starting time (s) (and temperature if different from -10 °C)	-	-	x
m) Run-up time (s)	-	x	x
n) Displacement factor	-	-	x
o) Dimensions (mm)	-	-	x

Parameter (rated)	Product	Product packaging	Product datasheets or leaflets
p) Performance claims for different conditions	-	-	x
q) Location of additional information (how to find product datasheets or leaflets)	-	x	-
(x = required, – = not required but optional) NOTE In Japan, the power factor is used instead of displacement factor and the requirement on colour classification and indication is specified in JIS Z9112.			

If equivalence with an incandescent lamp is claimed, the claimed equivalent incandescent lamp power (rounded to 1 W) for lamps with CCT values less than 4 500 K shall be that corresponding in Table 2 below unless superseded by regional requirements. The intermediate values of both the luminous flux and the claimed incandescent lamp power (rounded to 1 W) shall be calculated by linear interpolation between two adjacent values.

Table 2 – Equivalency with non-directional incandescent lamps

Claimed equivalent incandescent lamp power W	(for 220-240 V regions) **Minimum rated luminous flux** lm	(for 110-120 V regions) **Minimum rated luminous flux** lm
15	125	
25	229	250
40	432	450
60	741	800
75	970	1 100
100	1 398	1 600
150	2 253	2 550
200	3 172	

~~**5 Starting and run-up**~~

~~The starting and run-up time shall comply with the values as indicated by the manufacturer or responsible vendor.~~

5 Test conditions

~~Test~~ Conditions for testing ~~electrical and photometric characteristics, lumen maintenance and life~~ are given in annex A.

For lamps with special features for example dimming and daylight sensing, the supplier shall provide advice on how to disable these features in order to test the lamp.

Where applicable, sample sizes and compliance conditions for various requirements are given in Table 3.

Where a supplier claims suitability for operation at different conditions (for instance, at higher voltage, temperature or humidity) then:

a) lamps shall be tested under claimed different conditions; and

b) lamps shall start and operate satisfactorily under claimed different conditions; and

c) lamps shall meet the performance claims under the claimed different conditions, which may differ from the general conditions for measurement specified in Clause A.1.

~~**6 Lamp wattage**~~

~~The power dissipated by the lamp shall not differ from the rated wattage by more than 15%.~~

6 Performance criteria: assessment and compliance

6.1 General

A lamp, on which compliance with this document is claimed, shall comply with the requirements of IEC 60968.

A lamp shall be designed so that its performance is reliable in normal and accepted use. In general this can be achieved by satisfying the requirements of 6.2.

The requirements and information given apply to 95 % of production.

NOTE It can be expected that the type test samples submitted by the supplier for type test to the requirements and tolerances of this document will, in principle, consist of units having characteristics typical of the manufacturer's production and being as close to the production centre point values as reasonably possible.

It can be expected with the tolerances given in this document that products manufactured in accordance with the type test sample will comply with this document for the majority of production. Due to the production spread however, it is inevitable that there will sometimes be products outside the specified tolerances. For guidance on sampling plans and procedures for inspection by attributes, refer to ISO 2859 and for inspection by variables refer to ISO 3951.

6.2 Performance requirements

Lamps shall be assessed against all the parameters listed in Table 3. Minimum sample sizes for each test are specified in column C, compliance conditions for all parameters and test conditions are listed in column D and column E.

Table 3 – Sample sizes, compliance criteria and test conditions

A	B	C	D	E
Row	**Parameter for test**	**Minimum type test sample size**	**Compliance**	**Test condition for compliance**
1	Initial power	10	Mean measured value shall not exceed 108 % of rated value, and all samples shall measure below 115 % of rated value.	Annex A
2	Displacement factor [a]	10	All samples shall measure equal to or greater than the rated displacement factor value minus 0,05. NOTE In Japan, the power factor instead of displacement factor is used.	Annex I
3	Distortion factor (harmonics) [a]	10	All samples shall be within limits for harmonics according to IEC 61000-3-2.	IEC 61000-3-2
4	Initial luminous flux	10	Mean measured value shall be greater than or equal to 90 % of rated value, and all samples shall measure greater than or equal to 85 % of rated value.	Annex D
5	Beam angle (reflector lamps)	1	Measured beam angle shall be within ±25 % of rated value.	IEC TR 61341
6	Centre beam intensity (reflector lamps)	1	Mean measured centre beam intensity shall be equal to or greater than 75 % of the rated value.	IEC TR 61341

A	B	C	D	E
Row	**Parameter for test**	**Minimum type test sample size**	**Compliance**	**Test condition for compliance**
7	Chromaticity coordinates[b]	10	Chromaticity coordinates of at least 90 % of the samples shall measure less than or equal to 5 SDCM (standard deviation of colour matching) from the rated value.	CIE 015
8	Colour rendering index (CRI)	10	All samples shall measure equal to or greater than the rated CRI value minus 3.	CIE 13.3
9	Starting time	6	Mean measured value shall be less than or equal to 1,5 s, and all samples shall start within 2,0 s. Mean measured value shall be ≤110% of rated value.	Annex B
10	Low temperature and low supply voltage starting	6	All lamps shall start within the time if specified by the supplier or within 10 s maximum.	Annex E
11	Run-up time	6	The mean measured time, to reach 60% of initial luminous flux, shall be less than or equal to 110 % of the rated time. All samples shall reach 60% of initial luminous flux within 150 % of the rated time.	Annex C
12	Lumen maintenance	10	Mean measured value(s) shall be equal to or greater than 90 % of the rated value(s). All samples shall measure equal or greater than 85 % of the rated value(s).	Annex D
13	Premature lamp failure rate (if claimed)	10	After the operating hours specified by the supplier have elapsed, the proportion of lamp failures shall be less than or equal to the rated value.	Annex G
14	Lifetime	10 or 20	Assess lifetime based on either of the following tests (Based on Weibull shape factor 3[c]): Test 10 samples to 100 % of rated life Pass if less than or equal to 6 failures Fail if equal or greater than 7 failures. Test 20 samples to 90 % of rated life Pass if less than or equal to 10 failures Fail if equal or greater than 11 failures.	Annex G
15	Switching withstand	10	Assess switching withstand based on the following test (Based on Weibull shape factor 3 [c]): Test 10 samples to the rated number of switching cycles Pass if less than or equal to 6 failures Fail if equal or greater than 7 failures.	Annex F
16	Dimensions	6	All samples shall comply with rated minimum and maximum specifications. Mean measured dimension shall be within 90 % and 110 % of rated value. [d] If dimensional equivalence with incandescent lamps is claimed then lamps shall comply with IEC 60630.	Physical measurements
17	Inrush current	1	Inrush current shall not exceed given limits.	Annex H
18	Performance under different conditions	In accordance with the relevant type test in this table	Claims for performance at different conditions (voltages or temperatures outside of normal conditions, including high humidity) shall be tested under	In accordance with the relevant type test in this table

A	B	C	D	E
Row	Parameter for test	Minimum type test sample size	Compliance	Test condition for compliance
			those conditions using the relevant annexes to this document (altering test conditions to suit different conditions). Under these conditions: a) lamps shall start and operate satisfactorily, and b) lamps shall meet all performance claims, which may differ from the performance claims under the general conditions for measurement specified in Clause A.1.	
NOTE There are local and regional regulations for many of these and other parameters.				
[a] The relationship between power factor, displacement and distortion factors are explained in Annex J. [b] Preferred rated chromaticity coordinates are the standardised chromaticity coordinates for 2 700 K, 3 000 K, 3 500 K, 4 000 K, 5 000 K and 6 500 K as defined in IEC 60081, Annex D. [c] Statistical tools, such as Weibull analysis and parametric fits may be used to estimate median lamp life of the sample. [d] Supplier should advise sizes to allow assessment, and these should be clear if maximum or rated dimensions.				

~~7 Luminous flux~~

~~The initial luminous flux measured after the ageing time shall be not less than 90 % of the rated luminous flux.~~

~~An increase is under consideration.~~

~~8 Colour~~

~~The colour co-ordinates of a lamp shall be within the tolerance area on the chromaticity chart as declared by the manufacturer or responsible vendor, but shall in any case be within 5 SDCM from the target values.~~

~~For further information see annex D of IEC 60081.~~

~~9 Lumen maintenance~~

~~After 2 000 h of operation, including the ageing period, the lumen maintenance shall be not less than the value declared by the manufacturer or responsible vendor.~~

~~10 Life~~

~~The life to 50 % failures (average life) measured on "n" lamps shall be not less that the rated life to 50 % failures.~~

~~("n" is declared by the manufacturer or responsible vendor, but shall be a minimum of 20 lamps.)~~

~~11 Harmonics~~

~~Under consideration.~~

Annex A
(normative)

General conditions for measurement of photometric and electrical characteristics and requirements for test equipment

A.1 Method of measuring lamp characteristics

Sample sizes and compliance conditions are given in Table 3.

The visual appearance of all samples shall be checked before testing, and if required all samples shall be cleaned before photometric testing.

Unless specified elsewhere all tests shall:

a) be made in a draught-free atmosphere at an ambient temperature of (25 ± 1) °C and a relative humidity of 65 % maximum. If lamp operation under different conditions is claimed by the supplier, operation at this atmosphere shall also be tested. Air movement shall be in accordance with CIE 121. For lamp ageing, the lamp life test and the switch withstand test, the ambient temperature of the room shall be in the range of 15 °C to 40 °C, and some draught is allowed but vibration and shock should be minimized.

b) be carried out at rated voltage and frequency if a single value is declared. If the rated voltage is a range, the lamp shall be aged and tested at the mean voltage of that range. For dual-voltage lamps, for example those intended for operation at 110 V to 130 V and 220 V to 240 V, ageing and testing shall be conducted at the mean voltage of each voltage range.

c) have a test voltage tolerance during ageing and luminous flux maintenance testing within 2 %. During lamp stabilization the voltage shall be within ±0,5 %. At the moment of measurement the tolerance shall be within ±0,2 % for voltage and ±0,2 % for frequency. ~~For life testing the tolerance is 2%.~~ The total harmonic content of the supply voltage shall not exceed 3 %[1]. The harmonic content is defined as the R.M.S. summation of the individual harmonic components using the fundamental as 100 %. IEC 61000-3-2, Annex A, provides guidance on the supply voltage source.

d) be conducted with lamps operated in free air in a vertical base-up position for all tests including ~~life~~ lumen maintenance tests. If a supplier has declared the lamp is suitable for use in a specific orientation only, then the lamp shall be mounted in the declared orientation during all tests.

~~Electrical and photometric instruments used shall be selected having a guaranteed accuracy commensurate with the requirements of the test.~~

~~A.2 Starting and run-up~~

~~The starting and run-up tests shall be made before ageing except in the case of lamps declared by the manufacturer to be VPC (Vapour Pressure Control) types, where the following procedure shall be carried out.~~

~~*VPC lamps are aged for a period of at least 100 h of normal operation and then switched off for at least 24 h before the run-up test is performed. The starting test for VPC lamps shall be performed both before ageing and at the commencement of the run-up test.*~~

~~[1] For some self-ballasted lamps a lower value is necessary for proper electrical and photometric measurements.~~

~~The test voltage for the starting test shall be equal to 92 % of the rated voltage or, in case of a voltage range, 92 % of the minimum value of that range.~~

~~*For run-up the test voltage is increased to the rated voltage or in the case of a lamp with a voltage range increased to the mean value of the voltage range.*~~

A.2 Lamp stabilization

Measurements shall be made after the lamp stabilization time.

NOTE During shipping and normal handling of the lamps, for example rotating of the lamp, any excess amount of mercury could be distributed in small droplets within the discharge tube. Proper conditioning is reached when all the excess mercury has been collected at the coldest spot in the tube. Experience has shown that initially this process of lamp conditioning can take up to 16 h. When a lamp has passed this conditioning period it is ready for measurement.

For conditioning and warming up the lamp may be operated in a location, distant to the test location. When moving to the test location, provided that the lamp has been kept in the same orientation, not subjected to vibration or shock and no warm glass parts are touched (i.e. creating a parasitic cold spot), a stabilization period of 15 min to 60 min is necessary in the test location. To avoid cooling down of warm glass parts during moving the lamp to test location thermally insulating gloves or similar technique shall be used. The interruption of the supply should be as short as possible. If deviating from the values in Table A.1, the relevant specification of the supplier should be observed.

Measurements shall not start before stabilization is reached. Stabilization is achieved if the difference of maximum and minimum light output readings, taken at least once per minute, is less than 1 % within a 15 min observation period. If stabilization is not reached in the minimum period, the period is extended until 15 successive readings at 1 min intervals fulfil the requirement. If this cannot be achieved within 60 min, the measurement can be started and the fluctuation shall be stated. Table A.1 summarizes the relevant time periods.

Table A.1 – Conditioning, off time and stabilization time

Minimum conditioning time (hours)[a]	16
Maximum off time (transport to test location) (minutes)	5
Stabilization time (minutes)	15 to 60
[a] This can be part of ageing.	

~~A.3 Electrical and photometric characteristics~~

~~A.3.1 Test voltage~~

~~The test voltage shall be the rated voltage. In the case of a voltage range, measurements shall be carried out at the mean value.~~

~~A.3.2 Ageing~~

~~Lamps shall have been aged for a period of 100 h of normal operation.~~

~~A.3.3 Stabilization time~~

~~Lamps shall be measured at the test voltage immediately after the stabilization period as stated by the manufacturer or responsible vendor.~~

A.3 Lamp ageing and life test

Unless specified elsewhere, lamp ageing shall take place in the ageing facility for the specified number of hours of operation.

For testing details, see Annex G.

Ageing hours and life hours shall only be deemed to have occurred during the periods when the lamp is ON.

~~A.4 Lamp life and lumen maintenance~~

~~A.4.1 Ambient~~

~~Ambient temperature shall be kept within the range of 15 °C to 40 °C. Excessive draught should be avoided and the lamps should not be subjected to extreme vibration and shocks.~~

~~These conditions are under consideration.~~

~~A.4.2 Test voltage~~

~~The test voltage shall be the rated voltage with a tolerance of ±2 %. In the case of a voltage range, measurements shall be carried out at the mean value.~~

~~A.4.3 Switching on and off~~

~~Lamps on lumen maintenance and life test shall be switched off eight times in every 24 h running. The "off" period shall be between 10 min and 15 min. The "on" period shall be at least 10 min.~~

~~A.4.4 Establishing of average life~~

~~The average life shall be derived from a test quantity of at least 20 lamps.~~

A.4 Electrical measurement

Electrical measurements (power, current and power quality) shall be conducted on lamps aged for 100 h.

Instruments shall be of the true r.m.s. type, essentially free from waveform errors and of a precision appropriate to the requirements.

A.5 Photometric measurements

Photometric characteristics shall be measured in accordance with the relevant recommendations of the CIE (Commission Internationale de l'Eclairage).

Measurement of initial luminous flux, beam angle (reflector lamps), centre beam intensity (reflector lamps), chromaticity coordinates, colour rendering index (CRI) shall be conducted on lamps aged for 100 h.

A.6 Time and cycles measurement

Appropriate accuracy for time and cycle measurements are:

Starting time:	±0,1 s
Run-up time:	±3 s
Lamp life:	±100 h
Lumen maintenance:	±100 h
Ageing:	±5 h
Switching cycle time:	±3 s
Switching withstand cycles:	±200 cycles

Annex B
(normative)

Test for starting time

B.1 General

The starting time test shall be conducted on lamps aged for 100 h.

Prior to the test the lamps shall be stored in the planned test position for at least 22 h at 20 °C to 27 °C ambient temperature, and additional storing shall be at least 2 h at 25 °C ± 1 °C ambient temperature.

Sample sizes and compliance conditions are given in Table 3.

B.2 Test conditions

The test voltage for the starting test shall be the rated voltage using a supply as defined in A.1 c).

Additional tests for dimmable lamps are under consideration.

B.3 Test procedure

A typical test procedure is:

a) The test equipment and the measurement device(s) shall be in a state such that the lamp test can immediately be started.

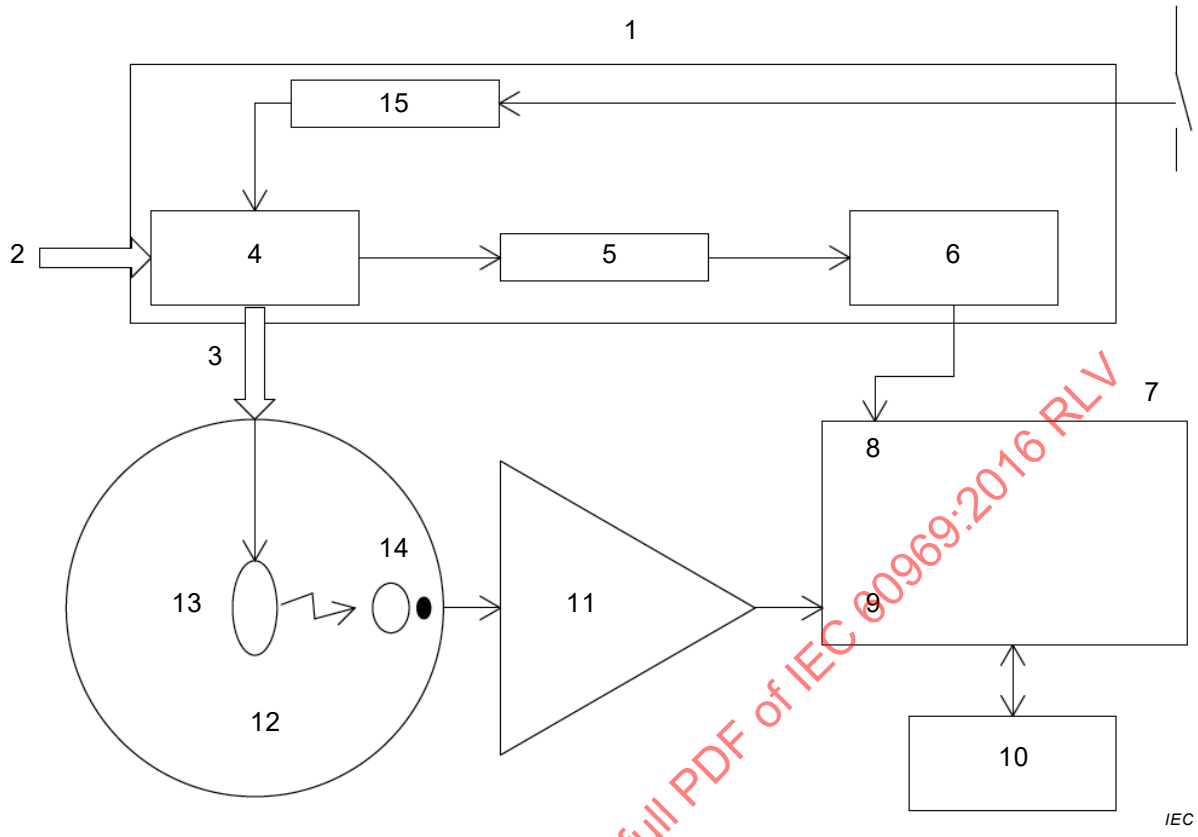
b) Switch on power to the lamp and triggering equipment as required.

c) Record ambient temperature and relative humidity.

d) Record luminous flux over time.

e) The test shall run until the lamp starts fully and remains alight. If, after a reasonable period the lamp does not start, cease the test.

A typical test setup and equipment is shown in Figure B.1. Alternatively a picoammeter may be used to store sensor values.



Key

1 Control circuit
2 Power in
3 Power to lamp
4 Zero voltage switch
5 Trigger sense
6 Trigger conditioning
7 Data capture
8 Trigger
9 Signal
10 Display and PC
11 Amplifier – Sensor. Rise time less than 1 ms
12 Environment without stray light
13 Lamp
14 Photo sensor
15 De-bounce circuit

NOTE Data capture sampling rate equal or greater than 900/s and integration time less than 1 ms.

Figure B.1 – Typical setup for starting time test

B.4 Calculations

The starting time is determined as the period from the start of the test to when the lamp has fully completed the starting sequence (lamp is fully started and remains alight) as observed by the front edge of the first plateau in the envelope of the light output signal.

Annex C
(normative)

Test for run-up time

C.1 General

The run-up time test shall be conducted on lamps aged for 100 h.

Prior to the test the lamps shall be stored in the planned test position for at least 22 h at 20 °C to 27 °C ambient temperature, and additional storing shall be at least 2 h at 25 °C ± 1 °C ambient temperature.

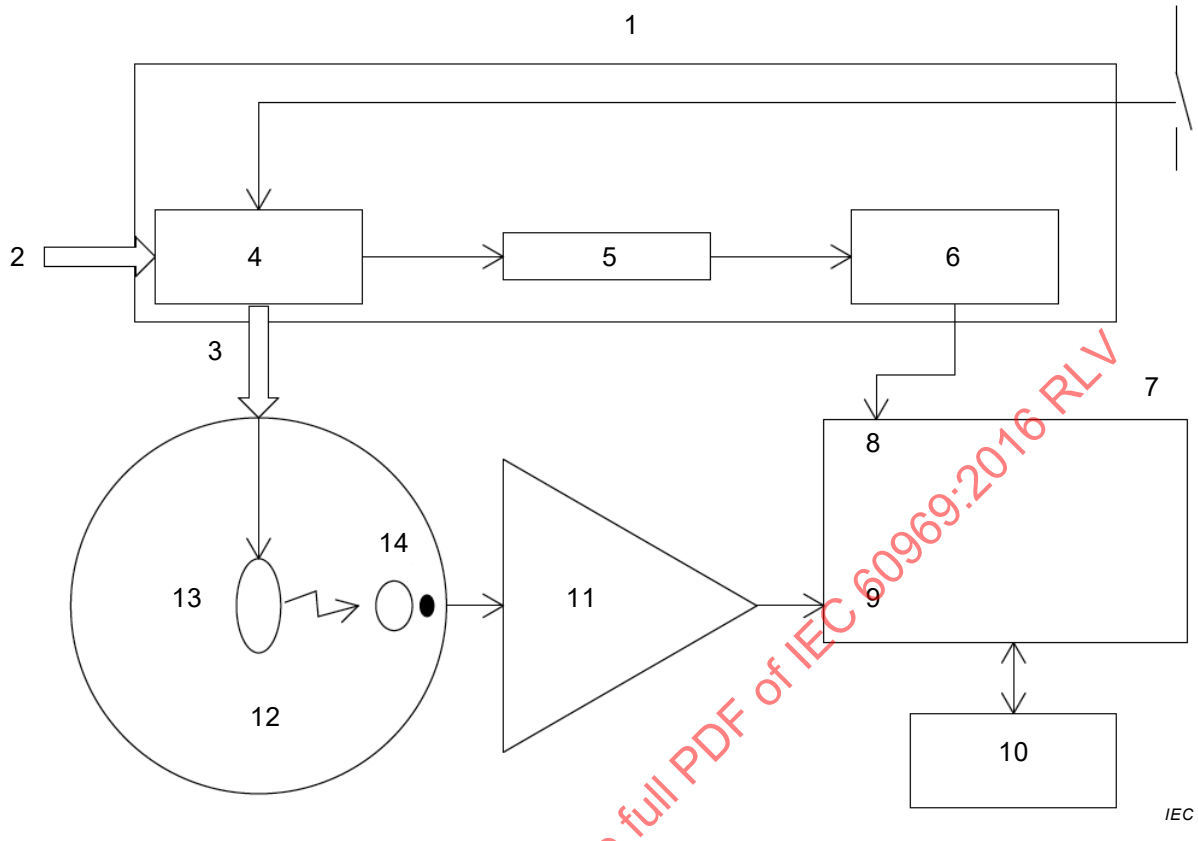
Sample sizes and compliance conditions are given in Table 3.

For the run-up time test an integrating sphere as per CIE 84 is the preferred method.

C.2 Test conditions

The test conditions and equipment shall be as specified in Annex A.

A typical test setup and equipment is shown in Figure C.1.



Key

1 Control circuit
2 Power in
3 Power to lamp
4 Zero voltage switch
5 Trigger sense
6 Trigger conditioning
7 Data capture
8 Trigger
9 Signal
10 Display and PC
11 Amplifier – Sensor. Rise time less than 1 ms
12 Environment without stray light
13 Lamp
14 Photo sensor

NOTE Data capture sampling rate equal or greater than 1/s and integration time less than n, multiplied by the mains period (ms), where n equals any integer from 1 to 40.

Figure C.1 – Typical setup for run-up time test

C.3 Test procedure

An example of test equipment setup is given in Figure C.1.

a) The test equipment and the measurement device(s) shall be in a state that the lamp test can immediately be started.

b) Switch on power to the lamp and triggering equipment as required.

c) Record ambient temperature and relative humidity.

d) Record luminous flux over time.

e) The test shall run until the lamp light output is stable as defined in Clause A.2.

C.4 Calculations

From the test data, determine the time taken from the start of the test, to when the lamp achieves the required percentage of its initial luminous flux.

Annex D
(normative)

Measurement of initial luminous efficacy and lumen maintenance

D.1 General

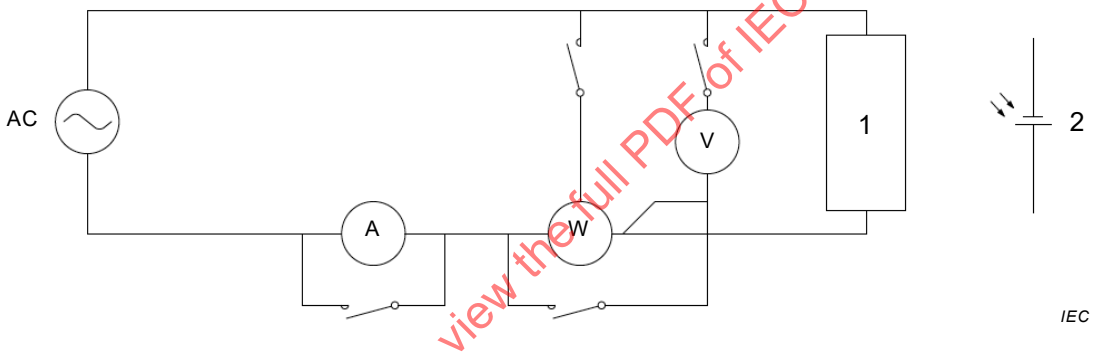
The measurement of initial luminous flux shall be conducted on lamps aged for 100 h.

Sample sizes and compliance conditions are given in Table 3.

D.2 Test conditions

The test conditions and equipment shall be as specified in Annex A.

The circuit in Figure D.1 should be used:



Key

1 Lamp

2 Photocell

Figure D.1 – Measurement of luminous flux

D.3 Test procedure

The lamp shall be left to reach a stable condition as defined in Clause A.2.

D.4 Initial luminous efficacy test

D.4.1 Test procedure

The test shall be conducted on lamps aged for 100 h.

Sample sizes and compliance conditions are given in Table 3.

During the procedure for measurement of luminous flux, simultaneously measure lamp power and record the data.

The luminous flux and the lamp power shall be measured from the same test lamp.

D.4.2 Calculations

Calculate the luminous efficacy as follows:

Luminous flux/lamp power. Units: lm/W.

D.5 Lumen maintenance test

The sample of lamps that underwent initial luminous efficacy tests, or new lamps shall be aged under the same conditions as described in Clause A.3 for the specified number of hours.

The luminous flux shall be measured after 100 h ageing and after other elapsed periods as required to demonstrate compliance with rated values.

The mean value at each specified elapsed period shall be calculated for the remaining, still-working lamps and the number of any non-working lamps shall be reported.

Annex E
(normative)

Test for low temperature and low supply voltage starting

E.1 General

The low temperature and low supply voltage starting test shall be conducted on lamps that have been aged for 100 h.

Sample sizes and compliance conditions are given in Table 3.

E.2 Test conditions

The test voltage shall be equal to 92 % of the lowest given rated voltage using a supply as defined in A.1 c)

Prior to the test, the lamps shall be stored in the planned test position for at least 20 h at or near the test temperature and additional storing shall be at least 4 h at the test temperature ±1 °C. If the lamp is to be moved to a test location, thermally insulating gloves or similar technique shall be used to avoid warming of cool parts.

The test temperature is the supplier's rated minimum starting temperature or, if a rated minimum starting temperature is not supplied, then the test temperature shall be –10 °C.

E.3 Test procedure

The test procedure is:

a) The lamp shall be switched on and a timing device used to record the time when the lamp starts fully and remains alight.

b) The ability of the lamp to start at the specified temperature shall be confirmed by visual inspection or other methods.

c) Cease the test if the lamp fails to start within 10 s.

Annex F
(normative)

Test for switching withstand

Sample sizes and number of cycles compliance conditions are given in Table 3.

The test conditions and equipment shall be as specified in Annex A for lamp ageing and life test. The switching cycle used for the switching withstand test shall be 1 min ON and 3 min OFF.

Annex G
(normative)

Test for lamp life

Sample sizes and compliance conditions are given in Table 3.

The sample of lamps shall be new or aged for a maximum of 100 h.

For lamp ageing and life testing, lamps shall be repeatedly cycled for 2 h 45 min ON followed by 15 min OFF.

The hours of operation until lamp failure occurs shall be recorded for each lamp. The lamp is deemed to have failed if it fails to light up, fails to remain alight or delivers less than approximately 50 % of its rated luminous flux as confirmed by visual inspection.

The hours of operation recorded shall only include the periods of the cycle when the lamp was switched ON. The hours of operation shall include any initial ageing period.

Annex H
(normative)

Tests for compatibility with dimmers and switches

H.1 Inrush current

The inrush current shall be limited to avoid damage to dimmers or switches.

For maximum allowed values and test conditions, see Table H.1 and Figures H.1, H.2 and H.3.

The waveform generator circuit for determining the inrush current is shown in Figure H.3.

The lamp shall be tested at rated voltage, as specified in A.1 b).

Table H.1 – Inrush current limitations and test conditions

Device under test		Test condition; source impedance		Compliance	
Lamp power W	Lamp rated voltage V rms	Maximum resistance Ω	Maximum inductance µH	Maximum peak current I_{peak} A	Maximum inrush energy I^2t A^2 s
P≤15	100-130	0,450	100	60	0,50
P≤15	200-250	0,2	400	20	0,08
15<P≤25	100-130	0,450	100	60	0,50
15<P≤25	200-250	0,2	400	35	0,15

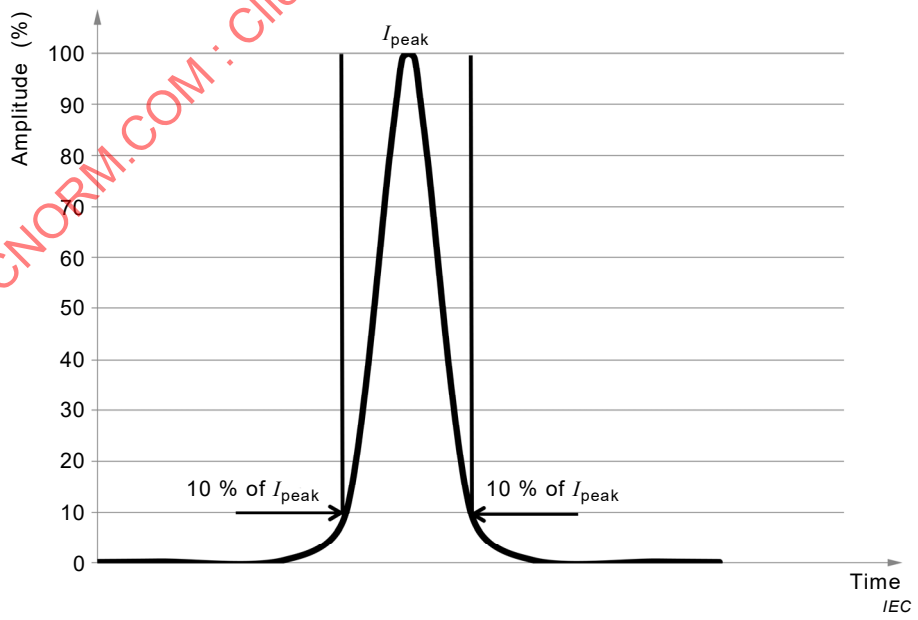


Figure H.1 – Typical inrush current profile

Only currents greater than 10 % of I_{peak} shall be included in the inrush energy integral. See Figure H.1.

When measuring the inrush current of self-ballasted lamps, prior to the occurrence of I_{peak}, one or more current spikes may be observed which exceed the subsequent I_{peak}. These spikes typically have durations of a few microseconds, where the actual inrush current has a duration of approximately 100 µs. Such spike(s) do not significantly contribute to the inrush current and can be neglected by use of a digital filter with 5 µs window or low pass filter with 5 µs time constant or equivalent means. See Figure H.2.

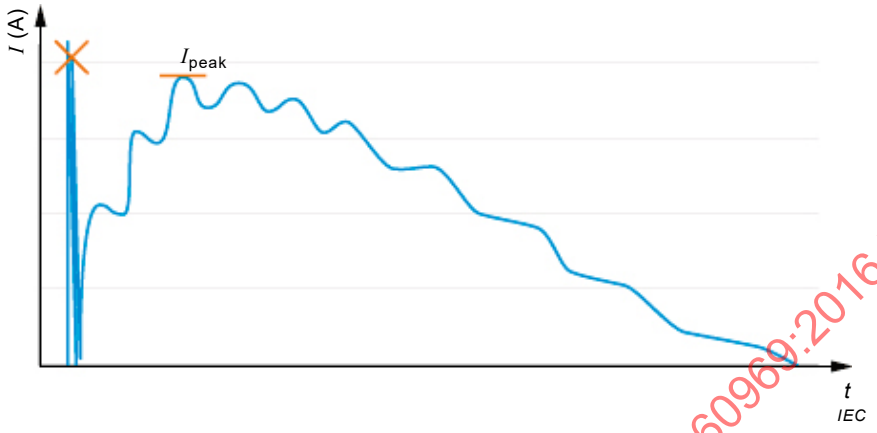
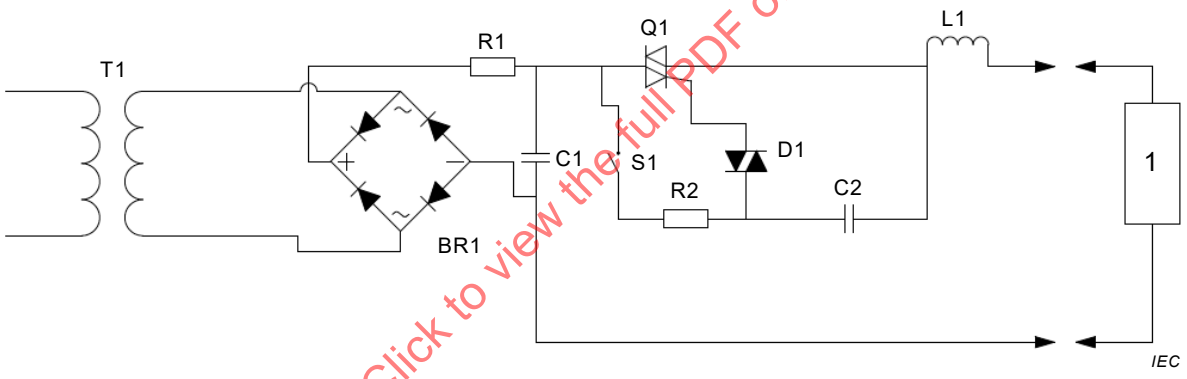


Figure H.2 – Current spikes before I_{peak} are ignored



Key

1	Lamp
BR1	Rectifier – suitable for voltage and current
C1	Capacitor > 750 µF and > 4 × lamp capacitance
C2	Capacitor 47 nF
D1	Diac DB3 or equivalent
L1	Inductor to match typical mains line characteristics. See Table H.1
Q1	Triac Q8025R5 or equivalent
R1	Resistor < 1 s / C1
	NOTE Full charging time between tests > 10 s
R2	Resistor 1 kΩ
S1	Switch – suitable for voltage and current
T1	Transformer Isolation – suitable for voltage and current

SOURCE: Adapted from NEMA SSL 7A -2013 Clause 4.5

Figure H.3 – Waveform generator circuit for inrush current

H.2 Specific requirements for dimmable lamps

Under consideration.

Annex I
(normative)

Measurement of displacement factor

I.1 General

The phase-angle (φ_1) of the displacement factor (cos φ_1) of 3.11 shall be measured according to the definition of Clause I.2 and with the measurement requirements of Clause I.3.

I.2 Phase-angle definition

The phase-angle (φ_1) between the fundamental harmonic current (I_1) and the mains-voltage (U_{mains}) is determined as described in Figures I.1 and I.2.

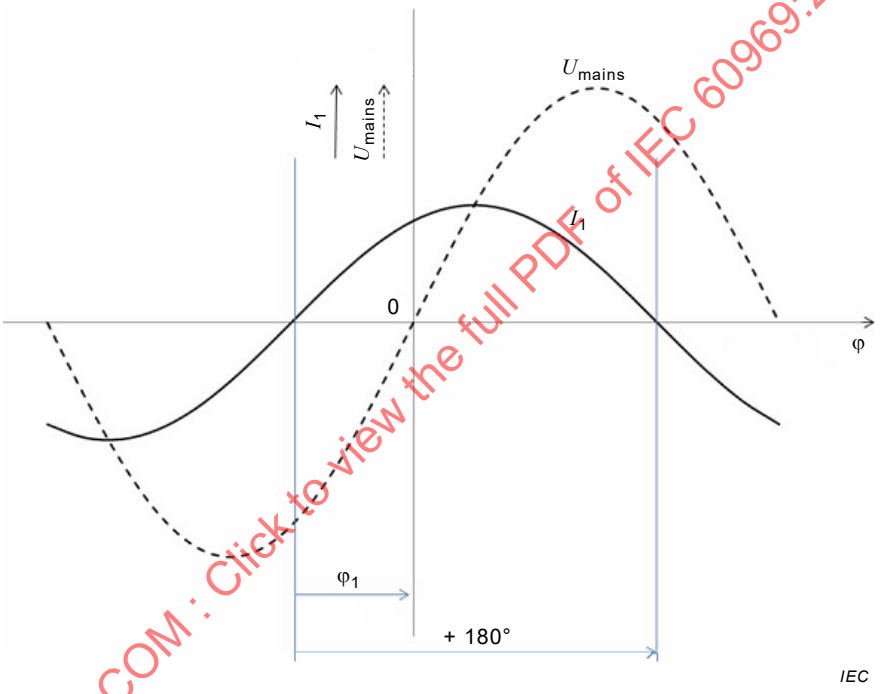


Figure I.1 – Definition of the first harmonic current phase-angle (φ_1) (I_1 leads U_{mains}), $\varphi_1 > 0$)

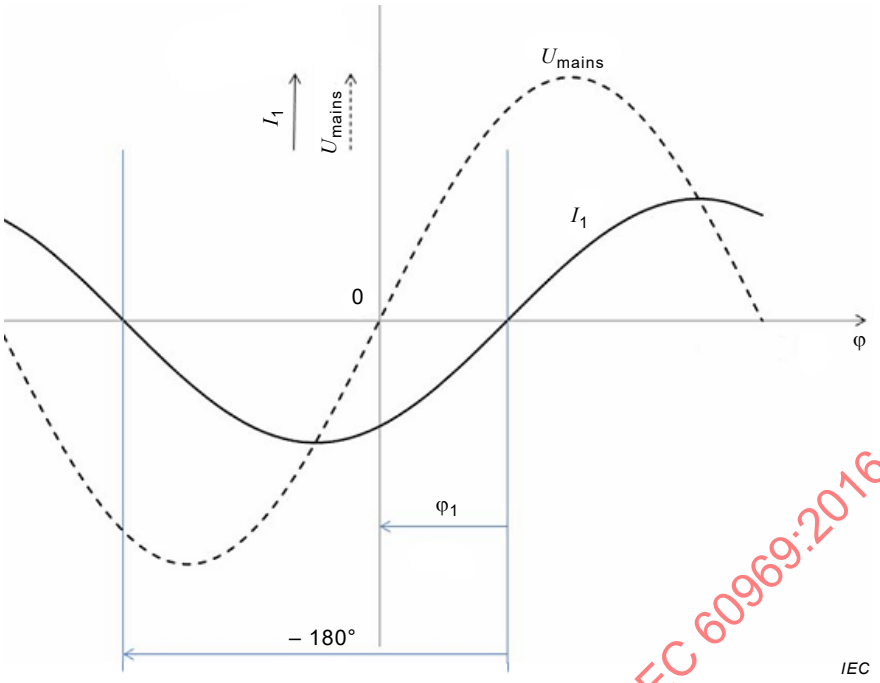


Figure I.2 – Definition of the first harmonic current phase-angle (φ_1) (I_1 lags U_{mains}), $\varphi_1 < 0$)

I.3 Measurements requirements

I.3.1 Measurement circuit and supply source

The measurement circuit and the supply source are defined in Annex A of IEC 61000-3-2:2014.

I.3.2 Requirements for measurement equipment

The requirements for measurement equipment are defined in IEC 61000-4-7.

I.3.3 Test conditions

The test conditions for the measurements of the displacement/phase-angle associated with some types of equipment are given in Clause C.5 of IEC 61000-3-2:2014.

Annex J
(informative)

Explanation of displacement and distortion factors

J.1 General

The metric power factor (λ) is a composite metric and consists of the primary metrics displacement factor ($\kappa_{\text{displacement}}$) and distortion factor ($\kappa_{\text{distortion}}$).

The relation between the composite metric λ and its primary metrics $\kappa_{\text{displacement}}$ and $\kappa_{\text{distortion}}$ is:

$$\lambda = K_{\text{displacement}} \cdot K_{\text{distortion}}$$

with

$$K_{\text{displacement}} = \cos\varphi_1$$

and

$$K_{\text{distortion}} = \frac{1}{\sqrt{1+THD^2}}$$

resulting in

$$\lambda = \frac{\cos\varphi_1}{\sqrt{1+THD^2}}$$

Angle φ_1 is the phase angle between the fundamental of the supply voltage and the fundamental of the mains current. The total harmonic distortion (THD) is quantified by the harmonics of the mains current, according to IEC 61000-3-2. The relation between the individual harmonics of the mains current and the THD is in the below equation:

$$THD = \sqrt{\sum_{n=2}^{40}\left(\frac{I_n}{I_1}\right)^2}$$

Where I_n is the amplitude of the n^{th} harmonic of the mains current.

J.2 Recommended values for displacement factor

No negative effects on the power grid are to be expected from self-ballasted compact fluorescent lamps when complying with the recommendations in Table J.1.

Table J.1 – Recommended values for displacement factor

Metric	P ≤ 2 W	2 W < P≤ 5 W	5 W < P ≤ 25 W	P > 25 W
$\kappa_{\text{displacement}}$ ($\cos\varphi_1$)	No limit	≥ 0,4	≥ 0,7	≥ 0,9
NOTE The values are practical examples and give guidance.				

Bibliography

IEC 60050-845, *International Electrotechnical Vocabulary – Lighting* (available at 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 60081:1997, *Double-capped fluorescent lamps – Performance specifications*

IEC 60598-1:2014, *Luminaires – Part 1: General requirements and tests*

IEC 60669 (all parts), *Switches for household and similar fixed-electrical installations*

IEC 61547, *Equipment for general lighting purposes – EMC immunity requirements*

IEC 62554, *Sample preparation for measurement of mercury level in fluorescent lamps*

IEC TR 62732, *Three-digit code for designation of colour rendering and correlated colour temperature*

ISO 2859 (all parts),*Sampling procedures for inspection by attributes*

ISO 3951 (all parts), *Sampling procedures for inspection by variables*

CIE 121, *The photometry and goniophotometry of luminaires*

CIE 84, *The Measurement of Luminous Flux*

CISPR 15, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

JIS Z 9112: 2012, *Classification of fluorescent lamps and solid state lighting products by chromaticity and colour rendering property*

NEMA SSL 7A-2013, *Phase Cut Dimming for Solid State Lighting: Basic Compatibility*

IEC 60969

Edition 2.0 2016-10

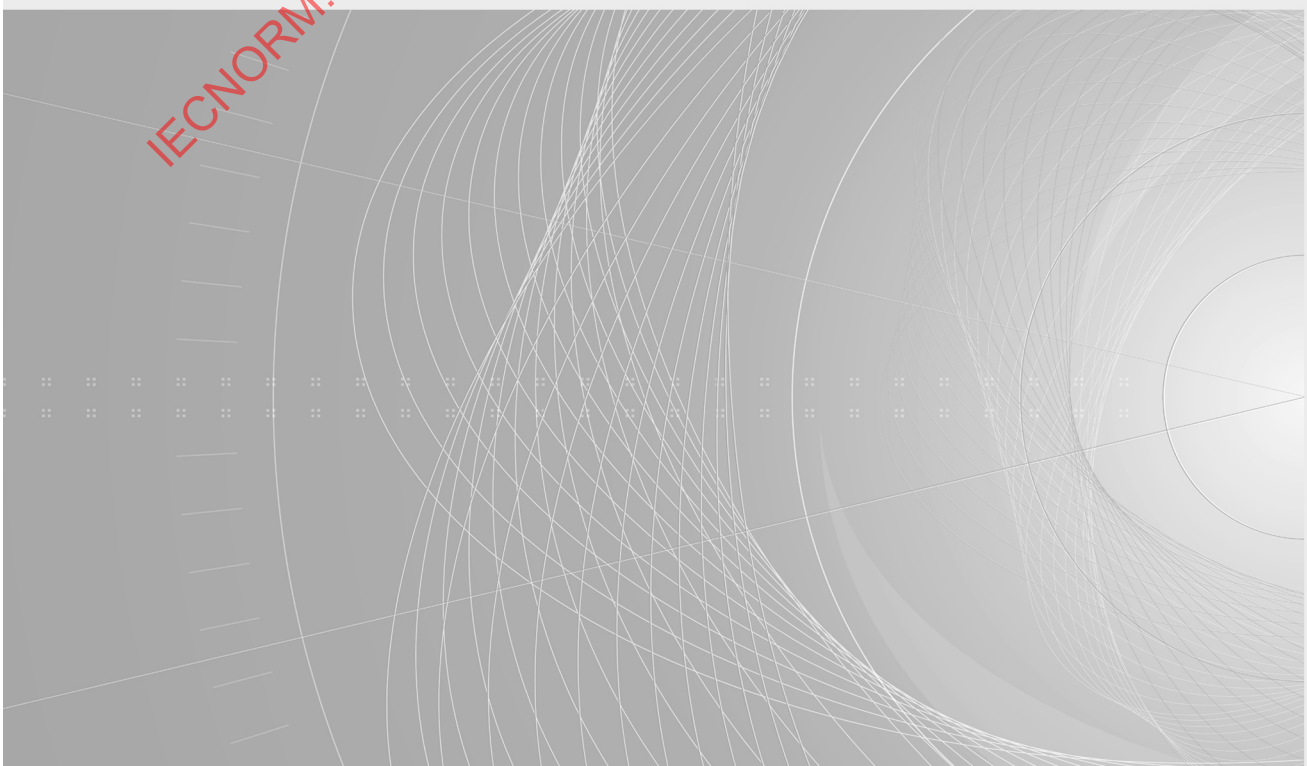
INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Self-ballasted compact fluorescent lamps for general lighting services – Performance requirements

Lampes à fluorescence compactes à ballast intégré pour l'éclairage général – Exigences de performances



IEC 60969:2016-10(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SELF-BALLASTED COMPACT FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICES – PERFORMANCE REQUIREMENTS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 60969 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamp and related equipment.

This second edition cancels and replaces the first edition published in 1988, Amendment 1:1991 and Amendment 2:2000. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) title change;
b) scope is now limited to compact fluorescent lamps, but expanded to cover all lamps of voltages greater than 50 V and all power ratings;
c) introduction of requirements for lamp equivalency claims, switching withstand, starting time, low temperature, run up time, treatment of claims for different operating conditions;
d) enhanced assessment and compliance criteria especially for lifetime;
e) introduction in-rush test conditions and displacement factor.

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

FDIS	Report on voting
34A/1923/FDIS	34A/1945/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 2.

The committee has decided that the contents of this publication 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.

The contents of the corrigendum of January 2017 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

SELF-BALLASTED COMPACT FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICES – PERFORMANCE REQUIREMENTS

1 Scope

This document specifies performance requirements together with test methods and conditions required to show compliance of self-ballasted compact fluorescent lamps intended for general lighting services.

This document applies to self-ballasted compact fluorescent lamps of voltages > 50 V and all power ratings with lamp caps complying with IEC 60061-1.

NOTE Some features of this document could be applicable to self-ballasted compact fluorescent lamps of voltages ≤ 50 V and to other types of self-ballasted gas discharge lamps.

The requirements of this document relate only to type testing.

The performance requirements specified in this document are additional to the safety requirements specified in IEC 60968.

It can be expected that self-ballasted compact fluorescent lamps, which comply with this document, will start and operate satisfactorily at normal conditions (voltages between 92 % and 106 % of rated supply voltage, ambient air temperature of between -10 °C and 40 °C and in a luminaire complying with IEC 60598-1).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60630, *Maximum lamp outlines for incandescent lamps*

IEC 60968, *Self-ballasted fluorescent lamps for general lighting services – Safety requirements*

IEC 61000-3-2:2014, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current <= 16 A per phase)*

IEC 61000-4-7, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

IEC TR 61341, *Method of measurement of centre beam intensity and beam angle(s) of reflector lamps*

CIE 015-2004, *Colorimetry*

CIE 13.3, *Method of Measuring and Specifying Colour Rendering Properties of Light Source*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
self-ballasted lamp
integrated lamp
unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source

Note 1 to entry: A self-ballasted lamp is referred to as a lamp in this document.

[SOURCE: IEC 60968:2015, 3.1, modified – The admitted term and note have been added]

3.2
new lamp
lamp which has not been energized since manufacture

3.3
rated value
quantity value, assigned by the supplier, for a lamp characteristic under specified operating conditions

EXAMPLE Rated luminous flux.

3.4
test voltage
input voltage at which tests are carried out

[SOURCE: IEC 62612:2013, 3.2, modified – The word "input" has been added.]

3.5
initial value
photometric and electrical characteristic measured at the end of a 100 h ageing period

3.6
lamp failure
moment at which the lamp fails to light up, fails to remain alight or delivers low light output (in case of doubt, low light output refers to less than approximately 50 % of rated light output)

3.7
lamp life
<of an individual lamp> number of operating hours to lamp failure

3.8
median of lamp life
number of operating hours elapsed at which point 50 % of a representative group of lamps have failed, when operated under specified test conditions

3.9
starting time
time required for a lamp to develop an electrically stable arc discharge, the time being measured from the moment the lamp circuit is energized

3.10
run-up time
time required for a lamp to reach a specified percentage of its (stable) luminous flux, the time being measured from the moment the lamp circuit is energized

3.11
displacement factor
cosine of the phase-angle between the fundamental harmonic current and the mains voltage

Note 1 to entry: Displacement factor is explained in Annex J.

3.12
distortion factor
factor indicating the level of harmonic current distortion

Note 1 to entry: Distortion factor is explained in Annex J.

3.13
power factor
under periodic conditions, ratio of the absolute value of the active power to the apparent power

Note 1 to entry: Alternatively, the power factor is the product of the displacement and distortion factor.

3.14
lumen maintenance
luminous flux at a given time in the life of a lamp, divided by the initial luminous flux of the lamp

Note 1 to entry: Lumen maintenance is expressed as a percentage of the initial luminous flux.

3.15
lamp type
lamps that, independent of the type of cap, have identical rated values in relation to the relevant compliance test

3.16
lamp stabilization time
time required for a lamp to reach stable conditions for measurement

3.17
type test
test or series of tests made on a type test sample, for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard

[SOURCE: IEC 60598-1:2014, 1.2.44]

3.18
type test sample
sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of a type test

[SOURCE: IEC 60598-1:2014, 1.2.45]

3.19
luminous efficacy
quotient of the lamp luminous flux by the lamp power consumption

3.20
beam angle
angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 % of the centre beam intensity

[SOURCE: IEC TR 61341:2010, 2.4]

3.21
ageing
preconditioning of lamps by operating them at controlled conditions for a specified period

3.22
supplier
manufacturer, responsible vendor or importer

3.23
dimmable lamp
lamp that is capable of producing varying levels of light when paired with a control or dimmer

3.24
inrush current
<of lamp> transient current associated with energizing a lamp

3.25
chromaticity coordinates
ratio of each of a set of three tristimulus values to their sum

[SOURCE: IEC 60050-845:1987, 845-03-33, modified – The notes have been deleted]

3.26
correlated colour temperature
CCT
temperature of the Planckian radiator whose perceived colour most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions

Note 1 to entry: The correlated colour temperature is expressed in K.

Note 2 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-845:1987, 845-03-50, modified – The abbreviated term has been added and the notes have been replaced]

3.27
colour rendering index
CRI
measure of the degree to which the psychophysical colour of an object illuminated by the test illuminant conforms to that of the same object illuminated by the reference illuminant, suitable allowance having been made for the state of chromatic adaptation

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC 60050-845:1987, 845-02-61]

3.28
colour code
3-digit code expressing the rated colour rendering index and the rated correlated colour temperature as described in IEC TR 62732

Note 1 to entry: The light colour designation is detailed in IEC TR 62732.

4 Marking

For this performance standard the following data shall be provided (in addition to the mandatory data required by IEC 60968) by the supplier and located as specified in Table 1. The rated values refer to performance claims under the general conditions for measurement as specified in Clause A.1.

Table 1 – Locations where marking of rated values is required

Parameter (rated)	Product	Product packaging	Product datasheets or leaflets
a) Initial luminous flux of the lamp (lm) (luminous flux for reflector lamps is under consideration)	-	x	x
b) Beam angle (degrees) and centre beam intensity (cd) measured in accordance with IEC TR 61341 for reflector lamps	-	x	x
c) Initial luminous efficacy (lm/W)	-	-	x
d) Correlated colour temperature (K) For the product a colour code is permissible.	x	x	x
e) Colour rendering index For the packaging a colour code is permissible.	-	x	x
f) Chromaticity coordinates	-	-	x
g) Median lamp life (h)	-	x	x
h) Lumen maintenance (%) Including operating hours at which lumen maintenance value(s) are claimed	-	-	x
i) Switching withstand (no. of cycles)	-	-	x
j) Special operating requirements e.g. dimming, orientation (base up/down), restricted operating temperature range	-	x	x
k) Starting time (s)	-	-	x
l) Low temperature starting time (s) (and temperature if different from -10 °C)	-	-	x
m) Run-up time (s)	-	x	x
n) Displacement factor	-	-	x
o) Dimensions (mm)	-	-	x
p) Performance claims for different conditions	-	-	x
q) Location of additional information (how to find product datasheets or leaflets)	-	x	-
(x = required, – = not required but optional) NOTE In Japan, the power factor is used instead of displacement factor and the requirement on colour classification and indication is specified in JIS Z9112.			

If equivalence with an incandescent lamp is claimed, the claimed equivalent incandescent lamp power (rounded to 1 W) for lamps with CCT values less than 4 500 K shall be that

corresponding in Table 2 below unless superseded by regional requirements. The intermediate values of both the luminous flux and the claimed incandescent lamp power (rounded to 1 W) shall be calculated by linear interpolation between two adjacent values.

Table 2 – Equivalency with non-directional incandescent lamps

Claimed equivalent incandescent lamp power W	(for 220-240 V regions) **Minimum rated luminous flux** lm	(for 110-120 V regions) **Minimum rated luminous flux** lm
15	125	
25	229	250
40	432	450
60	741	800
75	970	1 100
100	1 398	1 600
150	2 253	2 550
200	3 172	

5 Test conditions

Conditions for testing are given in Annex A.

For lamps with special features for example dimming and daylight sensing, the supplier shall provide advice on how to disable these features in order to test the lamp.

Where applicable, sample sizes and compliance conditions for various requirements are given in Table 3.

Where a supplier claims suitability for operation at different conditions (for instance, at higher voltage, temperature or humidity) then:

a) lamps shall be tested under claimed different conditions; and

b) lamps shall start and operate satisfactorily under claimed different conditions; and

c) lamps shall meet the performance claims under the claimed different conditions, which may differ from the general conditions for measurement specified in Clause A.1.

6 Performance criteria: assessment and compliance

6.1 General

A lamp, on which compliance with this document is claimed, shall comply with the requirements of IEC 60968.

A lamp shall be designed so that its performance is reliable in normal and accepted use. In general this can be achieved by satisfying the requirements of 6.2.

The requirements and information given apply to 95 % of production.

NOTE It can be expected that the type test samples submitted by the supplier for type test to the requirements and tolerances of this document will, in principle, consist of units having characteristics typical of the manufacturer's production and being as close to the production centre point values as reasonably possible.

It can be expected with the tolerances given in this document that products manufactured in accordance with the type test sample will comply with this document for the majority of production. Due to the production spread

however, it is inevitable that there will sometimes be products outside the specified tolerances. For guidance on sampling plans and procedures for inspection by attributes, refer to ISO 2859 and for inspection by variables refer to ISO 3951.

6.2 Performance requirements

Lamps shall be assessed against all the parameters listed in Table 3. Minimum sample sizes for each test are specified in column C, compliance conditions for all parameters and test conditions are listed in column D and column E.

Table 3 – Sample sizes, compliance criteria and test conditions

A	B	C	D	E
Row	**Parameter for test**	**Minimum type test sample size**	**Compliance**	**Test condition for compliance**
1	Initial power	10	Mean measured value shall not exceed 108 % of rated value, and all samples shall measure below 115 % of rated value.	Annex A
2	Displacement factor [a]	10	All samples shall measure equal to or greater than the rated displacement factor value minus 0,05. NOTE In Japan, the power factor instead of displacement factor is used.	Annex I
3	Distortion factor (harmonics) [a]	10	All samples shall be within limits for harmonics according to IEC 61000-3-2.	IEC 61000-3-2
4	Initial luminous flux	10	Mean measured value shall be greater than or equal to 90 % of rated value, and all samples shall measure greater than or equal to 85 % of rated value.	Annex D
5	Beam angle (reflector lamps)	1	Measured beam angle shall be within ±25 % of rated value.	IEC TR 61341
6	Centre beam intensity (reflector lamps)	1	Mean measured centre beam intensity shall be equal to or greater than 75 % of the rated value.	IEC TR 61341
7	Chromaticity coordinates[b]	10	Chromaticity coordinates of at least 90 % of the samples shall measure less than or equal to 5 SDCM (standard deviation of colour matching) from the rated value.	CIE 015
8	Colour rendering index (CRI)	10	All samples shall measure equal to or greater than the rated CRI value minus 3.	CIE 13.3
9	Starting time	6	Mean measured value shall be less than or equal to 1,5 s, and all samples shall start within 2,0 s. Mean measured value shall be ≤110% of rated value.	Annex B
10	Low temperature and low supply voltage starting	6	All lamps shall start within the time if specified by the supplier or within 10 s maximum.	Annex E
11	Run-up time	6	The mean measured time, to reach 60% of initial luminous flux, shall be less than or equal to 110 % of the rated time. All samples shall reach 60% of initial luminous flux within 150 % of the rated time.	Annex C
12	Lumen maintenance	10	Mean measured value(s) shall be equal to or greater than 90 % of the rated value(s). All samples shall measure equal or greater than 85 % of the rated value(s).	Annex D

A	B	C	D	E
Row	**Parameter for test**	**Minimum type test sample size**	**Compliance**	**Test condition for compliance**
13	Premature lamp failure rate (if claimed)	10	After the operating hours specified by the supplier have elapsed, the proportion of lamp failures shall be less than or equal to the rated value.	Annex G
14	Lifetime	10 or 20	Assess lifetime based on either of the following tests (Based on Weibull shape factor 3[c]): Test 10 samples to 100 % of rated life Pass if less than or equal to 6 failures Fail if equal or greater than 7 failures. Test 20 samples to 90 % of rated life Pass if less than or equal to 10 failures Fail if equal or greater than 11 failures.	Annex G
15	Switching withstand	10	Assess switching withstand based on the following test (Based on Weibull shape factor 3 [c]): Test 10 samples to the rated number of switching cycles Pass if less than or equal to 6 failures Fail if equal or greater than 7 failures.	Annex F
16	Dimensions	6	All samples shall comply with rated minimum and maximum specifications. Mean measured dimension shall be within 90 % and 110 % of rated value. [d] If dimensional equivalence with incandescent lamps is claimed then lamps shall comply with IEC 60630.	Physical measurements
17	Inrush current	1	Inrush current shall not exceed given limits.	Annex H
18	Performance under different conditions	In accordance with the relevant type test in this table	Claims for performance at different conditions (voltages or temperatures outside of normal conditions, including high humidity) shall be tested under those conditions using the relevant annexes to this document (altering test conditions to suit different conditions). Under these conditions: a) lamps shall start and operate satisfactorily, and b) lamps shall meet all performance claims, which may differ from the performance claims under the general conditions for measurement specified in Clause A.1.	In accordance with the relevant type test in this table

NOTE There are local and regional regulations for many of these and other parameters.

[a] The relationship between power factor, displacement and distortion factors are explained in Annex J.

[b] Preferred rated chromaticity coordinates are the standardised chromaticity coordinates for 2 700 K, 3 000 K, 3 500 K, 4 000 K, 5 000 K and 6 500 K as defined in IEC 60081, Annex D.

[c] Statistical tools, such as Weibull analysis and parametric fits may be used to estimate median lamp life of the sample.

[d] Supplier should advise sizes to allow assessment, and these should be clear if maximum or rated dimensions.

Annex A
(normative)

General conditions for measurement of photometric and electrical characteristics and requirements for test equipment

A.1 Method of measuring lamp characteristics

Sample sizes and compliance conditions are given in Table 3.

The visual appearance of all samples shall be checked before testing, and if required all samples shall be cleaned before photometric testing.

Unless specified elsewhere all tests shall:

a) be made in a draught-free atmosphere at an ambient temperature of (25 ± 1) °C and a relative humidity of 65 % maximum. If lamp operation under different conditions is claimed by the supplier, operation at this atmosphere shall also be tested. Air movement shall be in accordance with CIE 121. For lamp ageing, the lamp life test and the switch withstand test, the ambient temperature of the room shall be in the range of 15 °C to 40 °C, and some draught is allowed but vibration and shock should be minimized.

b) be carried out at rated voltage and frequency if a single value is declared. If the rated voltage is a range, the lamp shall be aged and tested at the mean voltage of that range. For dual-voltage lamps, for example those intended for operation at 110 V to 130 V and 220 V to 240 V, ageing and testing shall be conducted at the mean voltage of each voltage range.

c) have a test voltage tolerance during ageing and luminous flux maintenance testing within 2 %. During lamp stabilization the voltage shall be within ±0,5 %. At the moment of measurement the tolerance shall be within ±0,2 % for voltage and ±0,2 % for frequency. The total harmonic content of the supply voltage shall not exceed 3 %. The harmonic content is defined as the R.M.S. summation of the individual harmonic components using the fundamental as 100 %. IEC 61000-3-2, Annex A, provides guidance on the supply voltage source.

d) be conducted with lamps operated in free air in a vertical base-up position for all tests including lumen maintenance tests. If a supplier has declared the lamp is suitable for use in a specific orientation only, then the lamp shall be mounted in the declared orientation during all tests.

A.2 Lamp stabilization

Measurements shall be made after the lamp stabilization time.

NOTE During shipping and normal handling of the lamps, for example rotating of the lamp, any excess amount of mercury could be distributed in small droplets within the discharge tube. Proper conditioning is reached when all the excess mercury has been collected at the coldest spot in the tube. Experience has shown that initially this process of lamp conditioning can take up to 16 h. When a lamp has passed this conditioning period it is ready for measurement.

For conditioning and warming up the lamp may be operated in a location, distant to the test location. When moving to the test location, provided that the lamp has been kept in the same orientation, not subjected to vibration or shock and no warm glass parts are touched (i.e. creating a parasitic cold spot), a stabilization period of 15 min to 60 min is necessary in the test location. To avoid cooling down of warm glass parts during moving the lamp to test location thermally insulating gloves or similar technique shall be used. The interruption of the supply should be as short as possible. If deviating from the values in Table A.1, the relevant specification of the supplier should be observed.

Measurements shall not start before stabilization is reached. Stabilization is achieved if the difference of maximum and minimum light output readings, taken at least once per minute, is less than 1 % within a 15 min observation period. If stabilization is not reached in the minimum period, the period is extended until 15 successive readings at 1 min intervals fulfil the requirement. If this cannot be achieved within 60 min, the measurement can be started and the fluctuation shall be stated. Table A.1 summarizes the relevant time periods.

Table A.1 – Conditioning, off time and stabilization time

Minimum conditioning time (hours)[a]	16
Maximum off time (transport to test location) (minutes)	5
Stabilization time (minutes)	15 to 60
[a] This can be part of ageing.	

A.3 Lamp ageing and life test

Unless specified elsewhere, lamp ageing shall take place in the ageing facility for the specified number of hours of operation.

For testing details, see Annex G.

Ageing hours and life hours shall only be deemed to have occurred during the periods when the lamp is ON.

A.4 Electrical measurement

Electrical measurements (power, current and power quality) shall be conducted on lamps aged for 100 h.

Instruments shall be of the true r.m.s. type, essentially free from waveform errors and of a precision appropriate to the requirements.

A.5 Photometric measurements

Photometric characteristics shall be measured in accordance with the relevant recommendations of the CIE (Commission Internationale de l'Eclairage).

Measurement of initial luminous flux, beam angle (reflector lamps), centre beam intensity (reflector lamps), chromaticity coordinates, colour rendering index (CRI) shall be conducted on lamps aged for 100 h.

A.6 Time and cycles measurement

Appropriate accuracy for time and cycle measurements are:

Starting time: ±0,1 s

Run-up time: ±3 s

Lamp life: ±100 h

Lumen maintenance: ±100 h

Ageing: ±5 h

Switching cycle time: ±3 s

Switching withstand cycles: ±200 cycles

Annex B
(normative)

Test for starting time

B.1 General

The starting time test shall be conducted on lamps aged for 100 h.

Prior to the test the lamps shall be stored in the planned test position for at least 22 h at 20 °C to 27 °C ambient temperature, and additional storing shall be at least 2 h at 25 °C ± 1 °C ambient temperature.

Sample sizes and compliance conditions are given in Table 3.

B.2 Test conditions

The test voltage for the starting test shall be the rated voltage using a supply as defined in A.1 c).

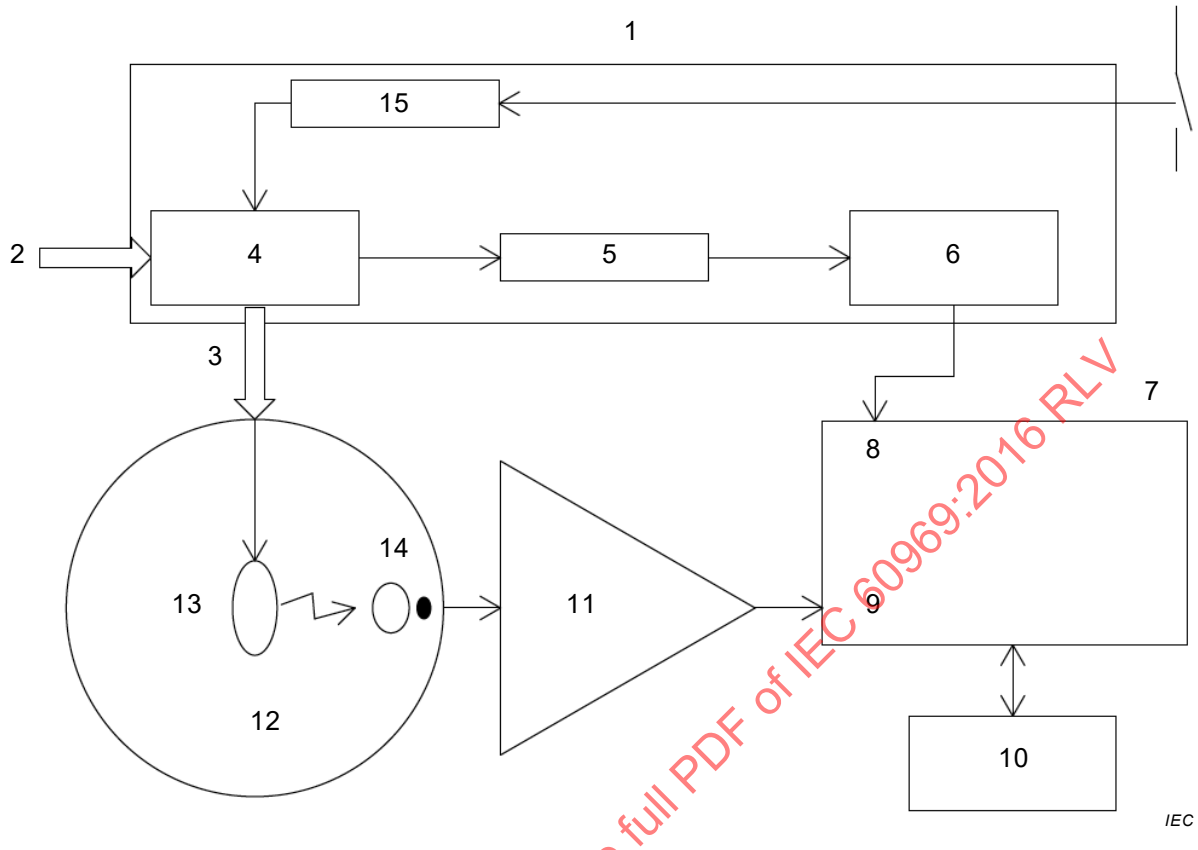
Additional tests for dimmable lamps are under consideration.

B.3 Test procedure

A typical test procedure is:

a) The test equipment and the measurement device(s) shall be in a state such that the lamp test can immediately be started.
b) Switch on power to the lamp and triggering equipment as required.
c) Record ambient temperature and relative humidity.
d) Record luminous flux over time.
e) The test shall run until the lamp starts fully and remains alight. If, after a reasonable period the lamp does not start, cease the test.

A typical test setup and equipment is shown in Figure B.1. Alternatively a picoammeter may be used to store sensor values.



Key

1 Control circuit
2 Power in
3 Power to lamp
4 Zero voltage switch
5 Trigger sense
6 Trigger conditioning
7 Data capture
8 Trigger
9 Signal
10 Display and PC
11 Amplifier – Sensor. Rise time less than 1 ms
12 Environment without stray light
13 Lamp
14 Photo sensor
15 De-bounce circuit

NOTE Data capture sampling rate equal or greater than 900/s and integration time less than 1 ms.

Figure B.1 – Typical setup for starting time test

B.4 Calculations

The starting time is determined as the period from the start of the test to when the lamp has fully completed the starting sequence (lamp is fully started and remains alight) as observed by the front edge of the first plateau in the envelope of the light output signal.

Annex C
(normative)

Test for run-up time

C.1 General

The run-up time test shall be conducted on lamps aged for 100 h.

Prior to the test the lamps shall be stored in the planned test position for at least 22 h at 20 °C to 27 °C ambient temperature, and additional storing shall be at least 2 h at 25 °C ± 1 °C ambient temperature.

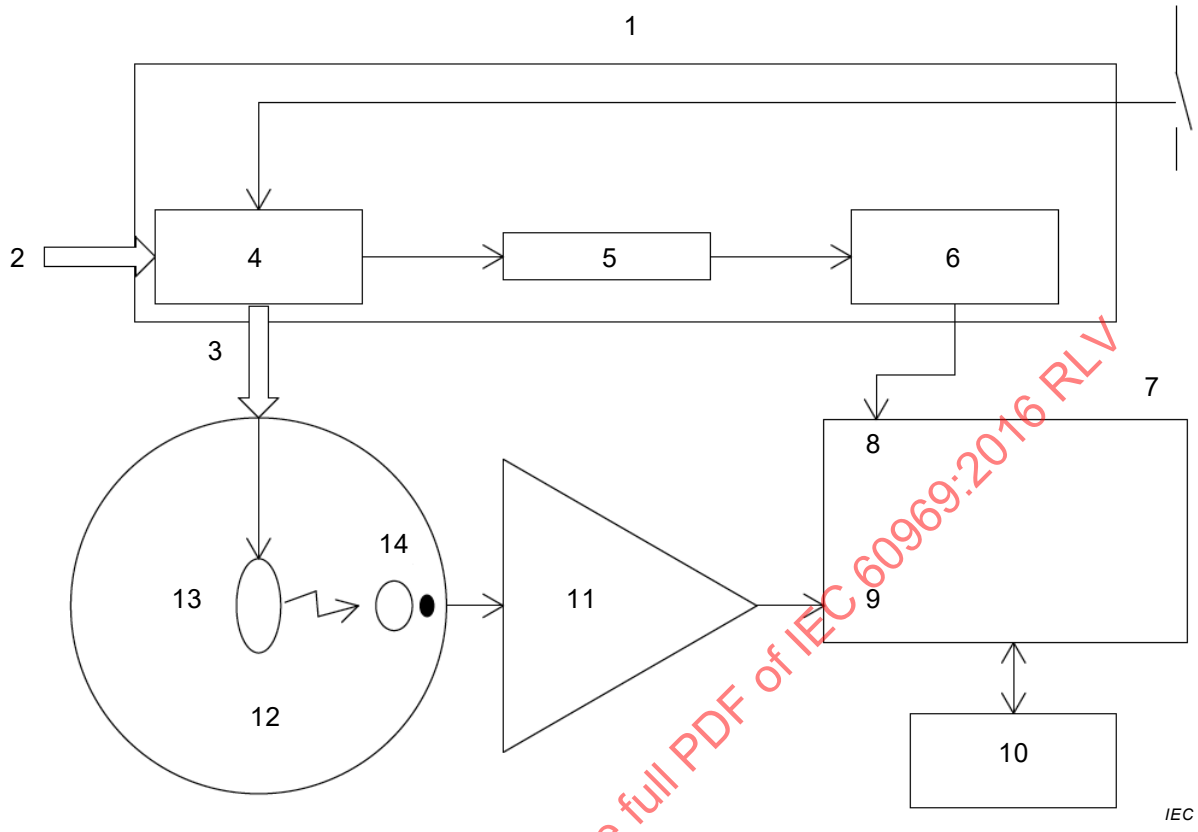
Sample sizes and compliance conditions are given in Table 3.

For the run-up time test an integrating sphere as per CIE 84 is the preferred method.

C.2 Test conditions

The test conditions and equipment shall be as specified in Annex A.

A typical test setup and equipment is shown in Figure C.1.



Key

1 Control circuit
2 Power in
3 Power to lamp
4 Zero voltage switch
5 Trigger sense
6 Trigger conditioning
7 Data capture
8 Trigger
9 Signal
10 Display and PC
11 Amplifier – Sensor. Rise time less than 1 ms
12 Environment without stray light
13 Lamp
14 Photo sensor

NOTE Data capture sampling rate equal or greater than 1/s and integration time less than n, multiplied by the mains period (ms), where n equals any integer from 1 to 40.

Figure C.1 – Typical setup for run-up time test

C.3 Test procedure

An example of test equipment setup is given in Figure C.1.

a) The test equipment and the measurement device(s) shall be in a state that the lamp test can immediately be started.

b) Switch on power to the lamp and triggering equipment as required.

c) Record ambient temperature and relative humidity.

d) Record luminous flux over time.

e) The test shall run until the lamp light output is stable as defined in Clause A.2.

C.4 Calculations

From the test data, determine the time taken from the start of the test, to when the lamp achieves the required percentage of its initial luminous flux.

Annex D
(normative)

Measurement of initial luminous efficacy and lumen maintenance

D.1 General

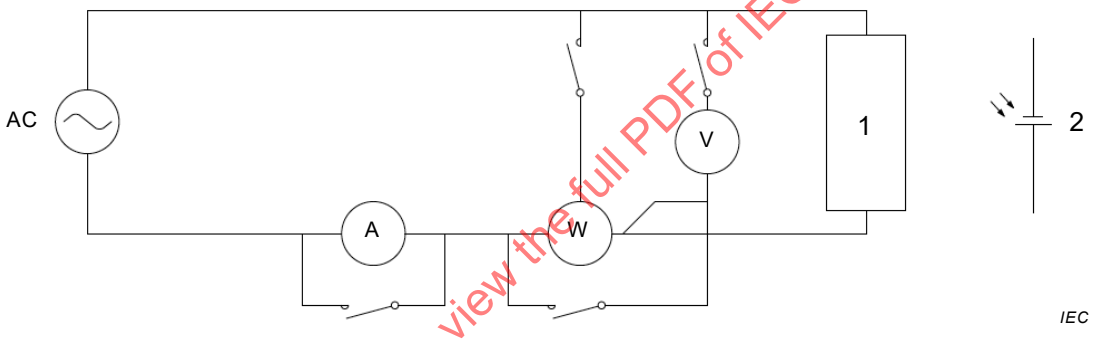
The measurement of initial luminous flux shall be conducted on lamps aged for 100 h.

Sample sizes and compliance conditions are given in Table 3.

D.2 Test conditions

The test conditions and equipment shall be as specified in Annex A.

The circuit in Figure D.1 should be used:



Key

1 Lamp

2 Photocell

Figure D.1 – Measurement of luminous flux

D.3 Test procedure

The lamp shall be left to reach a stable condition as defined in Clause A.2.

D.4 Initial luminous efficacy test

D.4.1 Test procedure

The test shall be conducted on lamps aged for 100 h.

Sample sizes and compliance conditions are given in Table 3.

During the procedure for measurement of luminous flux, simultaneously measure lamp power and record the data.

The luminous flux and the lamp power shall be measured from the same test lamp.

D.4.2 Calculations

Calculate the luminous efficacy as follows:

Luminous flux/lamp power. Units: lm/W.

D.5 Lumen maintenance test

The sample of lamps that underwent initial luminous efficacy tests, or new lamps shall be aged under the same conditions as described in Clause A.3 for the specified number of hours.

The luminous flux shall be measured after 100 h ageing and after other elapsed periods as required to demonstrate compliance with rated values.

The mean value at each specified elapsed period shall be calculated for the remaining, still-working lamps and the number of any non-working lamps shall be reported.

Annex E
(normative)

Test for low temperature and low supply voltage starting

E.1 General

The low temperature and low supply voltage starting test shall be conducted on lamps that have been aged for 100 h.

Sample sizes and compliance conditions are given in Table 3.

E.2 Test conditions

The test voltage shall be equal to 92 % of the lowest given rated voltage using a supply as defined in A.1 c)

Prior to the test, the lamps shall be stored in the planned test position for at least 20 h at or near the test temperature and additional storing shall be at least 4 h at the test temperature ±1 °C. If the lamp is to be moved to a test location, thermally insulating gloves or similar technique shall be used to avoid warming of cool parts.

The test temperature is the supplier's rated minimum starting temperature or, if a rated minimum starting temperature is not supplied, then the test temperature shall be –10 °C.

E.3 Test procedure

The test procedure is:

a) The lamp shall be switched on and a timing device used to record the time when the lamp starts fully and remains alight.

b) The ability of the lamp to start at the specified temperature shall be confirmed by visual inspection or other methods.

c) Cease the test if the lamp fails to start within 10 s.

Annex F
(normative)

Test for switching withstand

Sample sizes and number of cycles compliance conditions are given in Table 3.

The test conditions and equipment shall be as specified in Annex A for lamp ageing and life test. The switching cycle used for the switching withstand test shall be 1 min ON and 3 min OFF.

Annex G
(normative)

Test for lamp life

Sample sizes and compliance conditions are given in Table 3.

The sample of lamps shall be new or aged for a maximum of 100 h.

For lamp ageing and life testing, lamps shall be repeatedly cycled for 2 h 45 min ON followed by 15 min OFF.

The hours of operation until lamp failure occurs shall be recorded for each lamp. The lamp is deemed to have failed if it fails to light up, fails to remain alight or delivers less than approximately 50 % of its rated luminous flux as confirmed by visual inspection.

The hours of operation recorded shall only include the periods of the cycle when the lamp was switched ON. The hours of operation shall include any initial ageing period.

Annex H
(normative)

Tests for compatibility with dimmers and switches

H.1 Inrush current

The inrush current shall be limited to avoid damage to dimmers or switches.

For maximum allowed values and test conditions, see Table H.1 and Figures H.1, H.2 and H.3.

The waveform generator circuit for determining the inrush current is shown in Figure H.3.

The lamp shall be tested at rated voltage, as specified in A.1 b).

Table H.1 – Inrush current limitations and test conditions

Device under test		Test condition; source impedance		Compliance	
Lamp power W	**Lamp rated voltage** V rms	**Maximum resistance** Ω	**Maximum inductance** µH	**Maximum peak current** I_{peak} A	**Maximum inrush energy** I^2t A^2 s
P≤15	100-130	0,450	100	60	0,50
P≤15	200-250	0,2	400	20	0,08
15<P≤25	100-130	0,450	100	60	0,50
15<P≤25	200-250	0,2	400	35	0,15

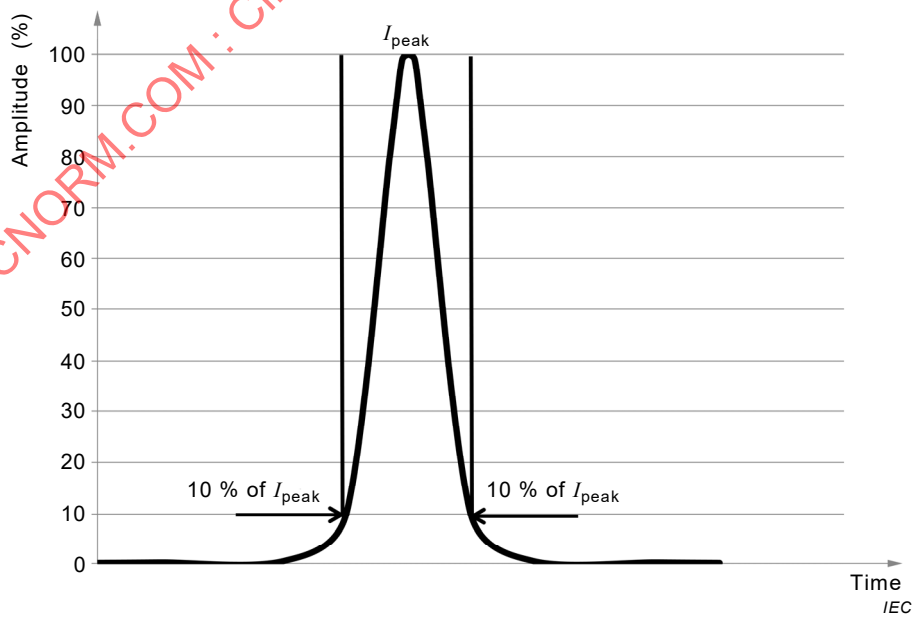


Figure H.1 – Typical inrush current profile

Only currents greater than 10 % of I_{peak} shall be included in the inrush energy integral. See Figure H.1.

When measuring the inrush current of self-ballasted lamps, prior to the occurrence of I_{peak}, one or more current spikes may be observed which exceed the subsequent I_{peak}. These spikes typically have durations of a few microseconds, where the actual inrush current has a duration of approximately 100 µs. Such spike(s) do not significantly contribute to the inrush current and can be neglected by use of a digital filter with 5 µs window or low pass filter with 5 µs time constant or equivalent means. See Figure H.2.

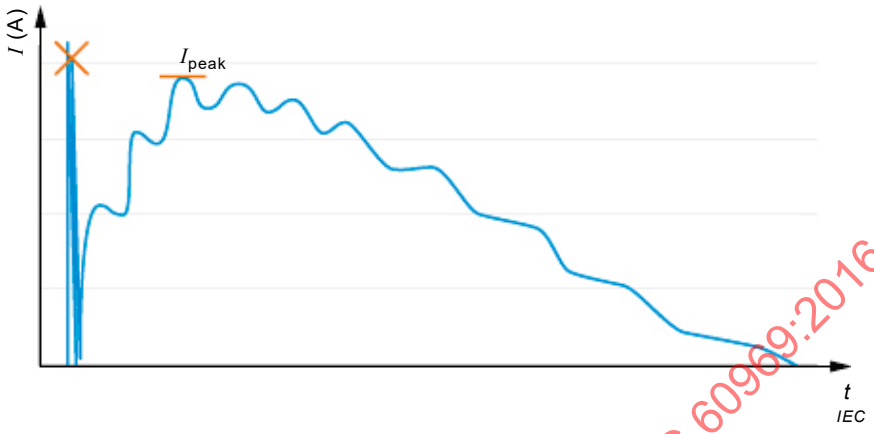
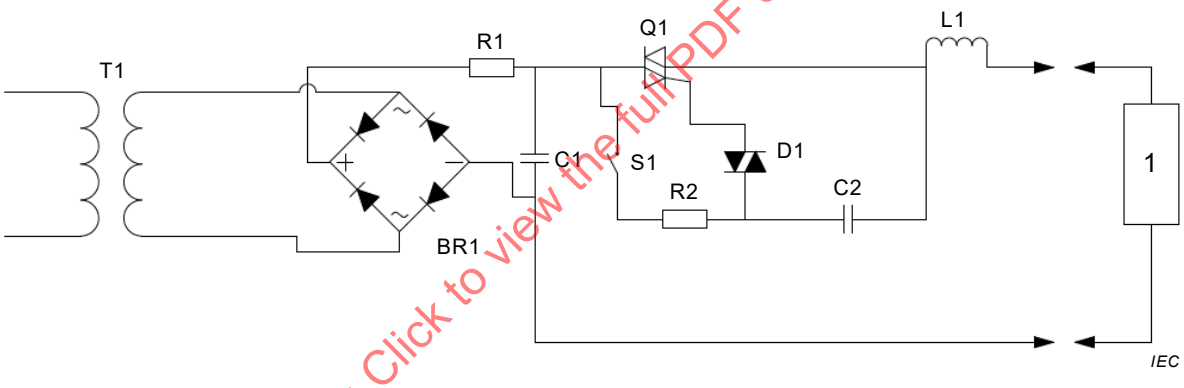


Figure H.2 – Current spikes before I_{peak} are ignored



Key

1	Lamp
BR1	Rectifier – suitable for voltage and current
C1	Capacitor > 750 µF and > 4 × lamp capacitance
C2	Capacitor 47 nF
D1	Diac DB3 or equivalent
L1	Inductor to match typical mains line characteristics. See Table H.1
Q1	Triac Q8025R5 or equivalent
R1	Resistor < 1 s / C1
	NOTE Full charging time between tests > 10 s
R2	Resistor 1 kΩ
S1	Switch – suitable for voltage and current
T1	Transformer Isolation – suitable for voltage and current

SOURCE: Adapted from NEMA SSL 7A -2013 Clause 4.5

Figure H.3 – Waveform generator circuit for inrush current

H.2 Specific requirements for dimmable lamps

Under consideration.

Annex I
(normative)

Measurement of displacement factor

I.1 General

The phase-angle (φ_1) of the displacement factor (cos φ_1) of 3.11 shall be measured according to the definition of Clause I.2 and with the measurement requirements of Clause I.3.

I.2 Phase-angle definition

The phase-angle (φ_1) between the fundamental harmonic current (I_1) and the mains-voltage (U_{mains}) is determined as described in Figures I.1 and I.2.

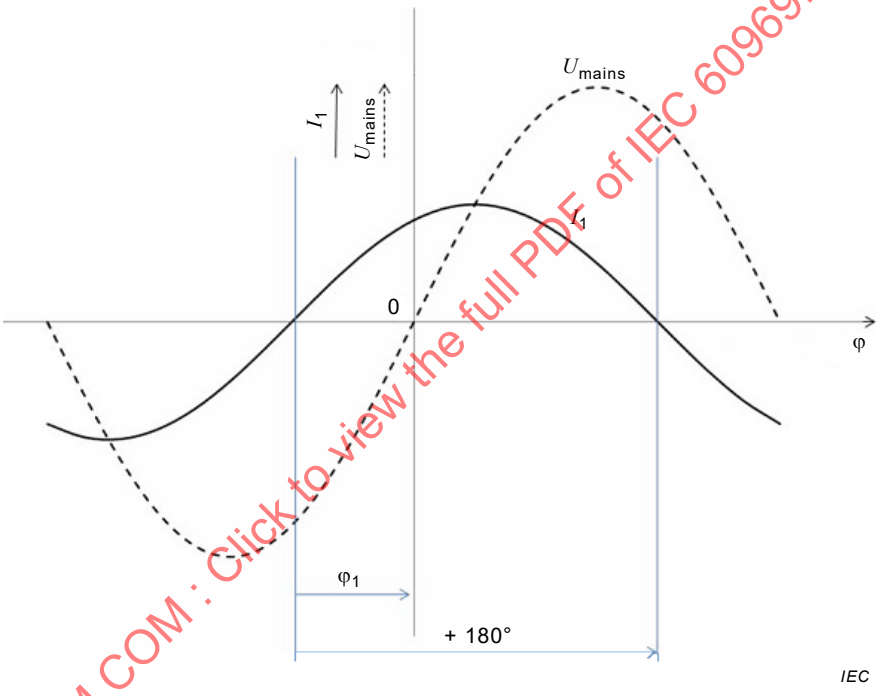


Figure I.1 – Definition of the first harmonic current phase-angle (φ_1) (I_1 leads U_{mains}), $\varphi_1 > 0$)

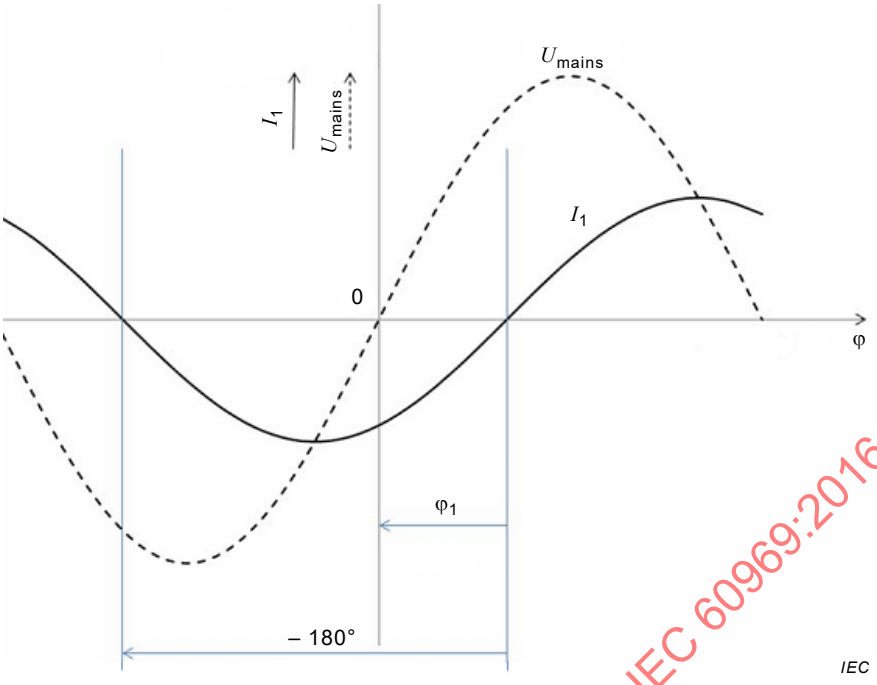


Figure I.2 – Definition of the first harmonic current phase-angle (φ_1) (I_1 lags U_{mains}), $\varphi_1 < 0$)

I.3 Measurements requirements

I.3.1 Measurement circuit and supply source

The measurement circuit and the supply source are defined in Annex A of IEC 61000-3-2:2014.

I.3.2 Requirements for measurement equipment

The requirements for measurement equipment are defined in IEC 61000-4-7.

I.3.3 Test conditions

The test conditions for the measurements of the displacement/phase-angle associated with some types of equipment are given in Clause C.5 of IEC 61000-3-2:2014.

Annex J
(informative)

Explanation of displacement and distortion factors

J.1 General

The metric power factor (λ) is a composite metric and consists of the primary metrics displacement factor ($\kappa_{\text{displacement}}$) and distortion factor ($\kappa_{\text{distortion}}$).

The relation between the composite metric λ and its primary metrics $\kappa_{\text{displacement}}$ and $\kappa_{\text{distortion}}$ is:

$$\lambda = K_{\text{displacement}} \cdot K_{\text{distortion}}$$

with

$$K_{\text{displacement}} = \cos\varphi_1$$

and

$$K_{\text{distortion}} = \frac{1}{\sqrt{1+THD^2}}$$

resulting in

$$\lambda = \frac{\cos\varphi_1}{\sqrt{1+THD^2}}$$

Angle φ_1 is the phase angle between the fundamental of the supply voltage and the fundamental of the mains current. The total harmonic distortion (THD) is quantified by the harmonics of the mains current, according to IEC 61000-3-2. The relation between the individual harmonics of the mains current and the THD is in the below equation:

$$THD = \sqrt{\sum_{n=2}^{40}\left(\frac{I_n}{I_1}\right)^2}$$

Where I_n is the amplitude of the n^{th} harmonic of the mains current.

J.2 Recommended values for displacement factor

No negative effects on the power grid are to be expected from self-ballasted compact fluorescent lamps when complying with the recommendations in Table J.1.

Table J.1 – Recommended values for displacement factor

Metric	P ≤ 2 W	2 W < P≤ 5 W	5 W < P ≤ 25 W	P > 25 W
$\kappa_{\text{displacement}}$ ($\cos\varphi_1$)	No limit	≥ 0,4	≥ 0,7	≥ 0,9
NOTE The values are practical examples and give guidance.				

Bibliography

IEC 60050-845, *International Electrotechnical Vocabulary – Lighting* (available at 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 60081:1997, *Double-capped fluorescent lamps – Performance specifications*

IEC 60598-1:2014, *Luminaires – Part 1: General requirements and tests*

IEC 60669 (all parts), *Switches for household and similar fixed-electrical installations*

IEC 61547, *Equipment for general lighting purposes – EMC immunity requirements*

IEC 62554, *Sample preparation for measurement of mercury level in fluorescent lamps*

IEC TR 62732, *Three-digit code for designation of colour rendering and correlated colour temperature*

ISO 2859 (all parts),*Sampling procedures for inspection by attributes*

ISO 3951 (all parts), *Sampling procedures for inspection by variables*

CIE 121, *The photometry and goniophotometry of luminaires*

CIE 84, *The Measurement of Luminous Flux*

CISPR 15, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*

JIS Z 9112: 2012, *Classification of fluorescent lamps and solid state lighting products by chromaticity and colour rendering property*

NEMA SSL 7A-2013, *Phase Cut Dimming for Solid State Lighting: Basic Compatibility*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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LAMPES À FLUORESCENCE COMPACTES À BALLAST INTÉGRÉ POUR L'ÉCLAIRAGE GÉNÉRAL – EXIGENCES DE PERFORMANCES

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La Norme internationale IEC 60969 a été établie par le sous-comité 34A: Lampes, du comité d'études 34 de l'IEC: Lampes et équipements associés.

Cette deuxième édition annule et remplace la première édition parue en 1988, l'Amendement 1:1991 et l'Amendement 2:2000. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) modification du titre;
b) le domaine d'application se limite désormais aux lampes à fluorescence compactes, mais a été élargi pour couvrir toutes les lampes présentant des tensions supérieures à 50 V et toutes les puissances;

c) ajout d'exigences pour les déclarations d'équivalence de lampe, la résistance aux cycles de commutation, le temps d'amorçage, la basse température, le temps de stabilisation, le traitement des déclarations concernant des conditions de fonctionnement différentes;

d) amélioration des critères d'évaluation et de conformité, en particulier concernant la durée de vie;

e) ajout de conditions d'essais de courant d'appel et facteur de déphasage.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
34A/1923/FDIS	34A/1945/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

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- reconduite,
- supprimée,
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- amendée.

Le contenu du corrigendum de janvier 2017 a été pris en considération dans cet exemplaire.

IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de cette publication indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer cette publication en utilisant une imprimante couleur.

LAMPES À FLUORESCENCE COMPACTES À BALLAST INTÉGRÉ POUR L'ÉCLAIRAGE GÉNÉRAL – EXIGENCES DE PERFORMANCES

1 Domaine d'application

Le présent document spécifie les exigences de performances, les méthodes d'essais et les conditions exigées pour démontrer la conformité des lampes à fluorescence compactes à ballast intégré destinées à l'éclairage général.

Le présent document s'applique aux lampes à fluorescence compactes à ballast intégré présentant des tensions > 50 V et de toutes puissances avec des culots de lampes satisfaisant à l'IEC 60061-1.

NOTE Certaines caractéristiques du présent document peuvent être applicables à des lampes à fluorescence compactes à ballast intégré présentant des tensions ≤ 50 V ainsi qu'à d'autres types de lampes à décharge dans un gaz à ballast intégré.

Les exigences du présent document s'appliquent seulement aux essais de type.

Les exigences de performances spécifiées dans le présent document s'ajoutent aux exigences de sécurité spécifiées dans l'IEC 60968.

Il peut être attendu que les lampes à fluorescence compactes à ballast intégré, qui satisfont au présent document, soient amorcées et fonctionnent de manière satisfaisante dans des conditions normales (tensions comprises entre 92 % et 106 % de la tension d'alimentation assignée, à une température de l'air ambiant comprise entre -10 °C et 40 °C et au sein d'un luminaire satisfaisant à l'IEC 60598-1).

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60630, *Encombrement maximal des lampes à incandescence*

IEC 60968, *Lampes à fluorescence à ballast intégré pour l'éclairage général – Règles de sécurité*

IEC 61000-3-2:2014, *Compatibilité électromagnétique (CEM) – Partie 3-2: Limites – Limites pour les émissions de courant harmonique (courant appelé par les appareils <= 16 A par phase)*

IEC 61000-4-7, *Compatibilité électromagnétique (CEM) – Partie 4-7: Techniques d'essai et de mesure – Guide général relatif aux mesures d'harmoniques et d'interharmoniques, ainsi qu'à l'appareillage de mesure, applicable aux réseaux d'alimentation et aux appareils qui y sont raccordés*

IEC TR 61341, *Méthode de mesure de l'intensité dans l'axe du faisceau et de l'angle (ou des angles) d'ouverture des lampes à réflecteur*

CIE 015-2004, *Colorimetry* (disponible en anglais seulement)

CIE 13.3, *Method of Measuring and Specifying Colour Rendering Properties of Light Source* (disponible en anglais seulement)

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
lampe à ballast intégré
ensemble qui ne peut être démonté sans se trouver endommagé de façon permanente, muni d'un culot de lampe et incorporant une source ainsi que les éléments complémentaires nécessaires à l'amorçage et au fonctionnement stable de la source lumineuse

Note 1 à l'article: Une lampe à ballast intégré est désignée dans le présent document par le terme de lampe.

[SOURCE: IEC 60968:2015, 3.1, modifiée – Le terme "lampe autoballastée" a été supprimé et la note a été ajoutée]

3.2
nouvelle lampe
lampe n'ayant pas été alimentée depuis sa fabrication

3.3
valeur assignée
valeur de grandeur, attribuée par le fournisseur, pour une caractéristique de lampe dans les conditions de fonctionnement spécifiées

EXEMPLE Flux lumineux assigné.

3.4
tension d'essai

tension d'entrée à laquelle les essais sont réalisés

[SOURCE: IEC 62612, 3.2, modifiée – Le mot "d'entrée" a été ajouté.]

3.5
valeur initiale
caractéristiques photométriques et électriques mesurées à la fin d'une période de vieillissement de 100 h

3.6
défaillance de la lampe
moment auquel la lampe ne s'allume pas, ne parvient pas à rester allumée ou produit une faible émission de lumière (en cas de doute, une faible émission de lumière fait référence à une valeur inférieure à environ 50 % de l'émission de lumière assignée)

3.7
durée de vie
<d'une lampe individuelle> nombre d'heures de fonctionnement jusqu'à la défaillance de la lampe

3.8
durée de vie médiane de la lampe
nombre d'heures de fonctionnement écoulées au bout duquel 50 % d'un groupe représentatif de lampes ont présenté une défaillance, lorsqu'il fonctionne dans les conditions d'essais spécifiées

3.9
temps d'amorçage
temps requis par une lampe pour que s'établisse une décharge en arc électriquement stable, le temps étant mesuré à partir du moment où la lampe est alimentée

3.10
temps de stabilisation
temps requis pour qu'une lampe atteigne un pourcentage spécifié de son flux lumineux initial (stable), le temps étant mesuré à partir du moment où la lampe est alimentée

3.11
facteur de déphasage
cosinus de l'angle de phase entre le courant harmonique fondamental et la tension du secteur

Note 1 à l'article: Le facteur de déphasage est expliqué à l'Annexe J.

3.12
facteur de distorsion
facteur indiquant le niveau de distorsion du courant harmonique

Note 1 à l'article: Le facteur de distorsion est expliqué à l'Annexe J.

3.13
facteur de puissance
en régime périodique, rapport entre la valeur absolue de la puissance active et la puissance apparente

Note 1 à l'article: En variante, le facteur de puissance est le produit du facteur de déphasage et du facteur de distorsion.

3.14
conservation du flux lumineux
flux lumineux à un moment donné de la durée de vie de la lampe, divisé par le flux lumineux initial de la lampe

Note 1 à l'article: La conservation du flux lumineux est exprimée en pourcentage du flux lumineux initial.

3.15
type de lampe
lampes qui, indépendamment du type de culot, présentent des valeurs assignées identiques concernant l'essai de conformité correspondant

3.16
temps de stabilisation de la lampe
temps requis pour qu'une lampe atteigne des conditions de mesure stables

3.17
essai de type
essai ou série d'essais exécutés sur un échantillon pour essai de type, ayant pour but de vérifier la conformité de la conception d'un produit donné aux exigences de la norme appropriée

[SOURCE: IEC 60598-1:2014, 1.2.44]

3.18
échantillon pour essai de type
échantillon consistant en une ou plusieurs unités similaires, présenté par le fabricant ou le vendeur responsable, en vue d'un essai de type

[SOURCE: IEC 60598-1:2014, 1.2.45]

3.19
efficacité lumineuse
quotient du flux lumineux de la lampe par la puissance consommée par la lampe

3.20
angle du faisceau
angle compris entre deux lignes imaginaires situées dans un plan contenant l'axe optique du faisceau et tel que ces lignes passent par le centre de la face avant de la lampe et par les points dont l'intensité lumineuse est égale à 50 % de l'intensité dans l'axe du faisceau

[SOURCE: IEC TR 61341:2010, 2.4]

3.21
vieillissement
préconditionnement des lampes en les faisant fonctionner dans des conditions contrôlées pendant une durée spécifiée

3.22
fournisseur
fabricant, vendeur responsable ou importateur

3.23
lampe à intensité variable
lampe capable de produire des niveaux variables de lumière lorsqu'elle est associée à une commande ou à un variateur

3.24
courant d'appel
<d'une lampe> courant transitoire associé à la mise sous tension d'une lampe

3.25
coordonnées trichromatiques
rapport de chacune des trois composantes trichromatiques à leur somme

[SOURCE: IEC 60050-845:1987, 845-03-33, modifiée – Les notes ont été supprimées]

3.26
température de couleur proximale
CCT
température du radiateur de Planck dont la couleur perçue ressemble le plus, dans des conditions d'observation spécifiées, à celle d'un stimulus donné de même luminosité

Note 1 à l'article: La température de couleur proximale est exprimée en K.

Note 2 à l'article: L'abréviation "CCT" est dérivée du terme anglais développé correspondant "correlated colour temperature".

[SOURCE: IEC 60050-845:1987, 845-03-50, modifiée – Le terme abrégé a été ajouté et les notes ont été remplacées]

3.27
indice de rendu des couleurs
CRI
évaluation quantitative du degré d'accord entre la couleur psychophysique d'un objet éclairé par l'illuminant en essai et celle du même objet éclairé par l'illuminant de référence, l'état d'adaptation chromatique ayant été correctement pris en compte

Note 1 à l'article: L'abréviation "CRI" est dérivée du terme anglais développé correspondant "colour rendering index".

[SOURCE: IEC 60050-845:1987, 845-02-61]

3.28
codage couleur
code à 3 chiffres exprimant l'indice de rendu des couleurs assigné ainsi que la température de couleur proximale assignée tels que décrits dans l'IEC TR 62732

Note 1 à l'article: La désignation des couleurs de la lumière est détaillée dans l'IEC TR 62732.

4 Marquage

Pour la présente norme de performance, les données suivantes doivent être fournies (en supplément des données obligatoires exigées par l'IEC 60968) par le fournisseur et placées comme cela est spécifié dans le Tableau 1. Les valeurs assignées font référence aux déclarations de performance dans les conditions générales de mesure telles que spécifiées à l'Article A.1.

Tableau 1 – Emplacements où le marquage des valeurs assignées est exigé

Paramètre (assigné)	Produit	Emballage produit	Fiches techniques ou brochures produits
a) Flux lumineux initial de la lampe (lm) (le flux lumineux des lampes à réflecteur est à l'étude)	-	x	x
b) Angle du faisceau (degrés) et intensité dans l'axe du faisceau (cd) mesurés conformément à l'IEC TR 61341 pour les lampes à réflecteur	-	x	x
c) Efficacité lumineuse initiale (lm/W)	-	-	x
d) Température de couleur proximale (K) Un codage couleur peut être utilisé pour le produit.	x	x	x
e) Indice de rendu des couleurs Un codage couleur peut être utilisé pour l'emballage.	-	x	x
f) Coordonnées trichromatiques	-	-	x
g) Durée de vie médiane de la lampe (h)	-	x	x
h) Conservation du flux lumineux (%) Sont incluses les heures de fonctionnement pendant lesquelles la ou les valeurs de conservation du flux lumineux sont déclarées	-	-	x
i) Résistance aux cycles de commutation (nombre de cycles)	-	-	x
j) Exigences de fonctionnement spécifiques par ex. variation d'intensité, orientation (culot en haut/en bas), plage de températures de fonctionnement restreinte	-	x	x
k) Temps d'amorçage (s)	-	-	x
l) Temps d'amorçage à basse température (s) (et température si différente de -10 °C)	-	-	x

Paramètre (assigné)	Produit	Emballage produit	Fiches techniques ou brochures produits
m) Temps de stabilisation	-	x	x
n) Facteur de déphasage	-	-	x
o) Dimensions (mm)	-	-	x
p) Déclarations de performance pour des conditions différentes	-	-	x
q) Emplacement des informations complémentaires (où trouver les fiches techniques ou les brochures produits)	-	x	-
(x = exigé, – = non exigé mais en option) NOTE Au Japon, le facteur de puissance est utilisé à la place du facteur de déphasage et les exigences relatives à l'indication et à la classification des couleurs sont spécifiées dans la JIS Z9112.			

Si l'équivalence à une lampe à incandescence est déclarée, la puissance de la lampe à incandescence équivalente déclarée (arrondie à 1 W) pour les lampes avec des valeurs de CCT supérieures à 4 500 K doit être celle correspondant au Tableau 2 ci-dessous, sauf exigences régionales prioritaires. Les valeurs intermédiaires du flux lumineux et de la puissance de la lampe à incandescence équivalente déclarée (arrondie à 1 W) doivent être calculées par interpolation linéaire entre deux valeurs adjacentes.

Tableau 2 – Équivalence à des lampes à incandescence non dirigées

Puissance d'une lampe à incandescence équivalente déclarée W	(pour les régions 220-240 V) **Flux lumineux minimum assigné** lm	(pour les régions 110-120 V) **Flux lumineux minimum assigné** lm
15	125	
25	229	250
40	432	450
60	741	800
75	970	1 100
100	1 398	1 600
150	2 253	2 550
200	3 172	

5 Conditions d'essais

Les conditions d'essais sont données dans l'Annexe A.

Pour les lampes possédant des fonctionnalités spéciales, par exemple à intensité variable et détection de la lumière du jour, le fournisseur doit inclure des conseils relatifs à la désactivation de ces fonctionnalités afin de soumettre la lampe à essai.

Le cas échéant, les tailles d'échantillon et les conditions de conformité pour les diverses exigences sont données au Tableau 3.

Si un fournisseur déclare l'adéquation du fonctionnement dans des conditions différentes (par exemple, à une tension, une température ou une humidité supérieure):

a) les lampes doivent être soumises à essai dans les conditions différentes déclarées; et

b) les lampes doivent être amorcées et fonctionner de manière satisfaisante dans les conditions différentes déclarées; et

c) les lampes doivent satisfaire aux déclarations de performance dans les conditions différentes déclarées, qui peuvent être différentes des conditions générales de mesure spécifiées à l'Article A.1.

6 Critères de performance: évaluation et conformité

6.1 Généralités

Une lampe pour laquelle la conformité au présent document est déclarée doit satisfaire aux exigences de l'IEC 60968.

Une lampe doit être conçue de sorte que ses performances soient fiables dans le cadre de son utilisation normale et acceptée. Cela peut généralement être réalisé en satisfaisant aux exigences de 6.2.

Les exigences et informations fournies s'appliquent à 95 % de la production.

NOTE Il peut être attendu que les échantillons pour essai de type présentés par le fournisseur pour l'essai de type concernant les exigences et tolérances du présent document soient constitués, en principe, d'unités présentant des caractéristiques typiques de la production du fabricant et aussi proches que raisonnablement possible des valeurs centrales de sa production.

Il peut être attendu, compte tenu des tolérances données dans le présent document, que les produits fabriqués en conformité à l'échantillon pour essai de type satisfassent au présent document pour la majorité de la production. Cependant, en raison de la répartition de la production, il est inévitable que des produits ne soient parfois pas conformes aux tolérances spécifiées. Pour obtenir des lignes directrices sur les plans d'échantillonnage et les procédures de contrôle par attributs, consulter l'ISO 2859, et pour les contrôles par mesures, consulter l'ISO 3951.

6.2 Exigences de performances

Les lampes doivent être évaluées conformément à l'ensemble des paramètres énoncés dans le Tableau 3. Les tailles minimales d'échantillons pour chaque essai sont spécifiées dans la Colonne C, tandis que les conditions de conformité pour tous les paramètres et toutes les conditions d'essais sont énoncées dans la Colonne D et la Colonne E.

Tableau 3 – Tailles d'échantillons, critères de conformité et conditions d'essais

A	B	C	D	E
Rangée	**Paramètre d'essai**	**Taille minimale de l'échantillon pour essai de type**	**Conformité**	**Condition d'essai concernant la conformité**
1	Puissance initiale	10	La valeur moyenne mesurée ne doit pas être supérieure à 108 % de la valeur assignée, et tous les échantillons doivent être inférieurs à 115 % de la valeur assignée.	Annexe A
2	Facteur de déphasage [a]	10	Tous les échantillons doivent être supérieurs ou égaux à la valeur assignée du facteur de déphasage moins 0,05. NOTE Au Japon, le facteur de puissance est utilisé à la place du facteur de déphasage.	Annexe I
3	Facteur de distorsion (harmoniques) [a]	10	Tous les échantillons doivent se situer dans les limites d'harmoniques conformément à l'IEC 61000-3-2.	IEC 61000-3-2
4	Flux lumineux initial	10	La valeur moyenne mesurée doit être supérieure ou égale à 90 % de la valeur assignée, et tous les échantillons doivent être supérieurs ou égaux à 85 % de la valeur assignée.	Annexe D
5	Angle du faisceau (lampes à réflecteur)	1	L'angle du faisceau mesuré doit se situer dans une plage égale à ±25 % de la valeur assignée.	IEC TR 61341
6	Intensité dans l'axe du faisceau (lampes à réflecteur)	1	L'intensité dans l'axe du faisceau moyenne mesurée doit être égale ou supérieure à 75 % de la valeur assignée.	IEC TR 61341
7	Coordonnées trichromatiques[b]	10	Les coordonnées trichromatiques d'au moins 90 % des échantillons doivent être inférieures ou égales à 5 SDCM (*Standard Deviation Of Colour Matching* – écart-type de correspondance des couleurs) de la valeur assignée.	CIE 015
8	Indice de rendu des couleurs (CRI)	10	Tous les échantillons doivent être supérieurs ou égaux au CRI assigné moins 3.	CIE 13.3
9	Temps d'amorçage	6	La valeur moyenne mesurée doit être inférieure ou égale à 1,5 s, et tous les échantillons doivent être amorcés dans un délai de 2 s. La valeur moyenne mesurée doit être supérieure ou égale à 110 % de la valeur assignée.	Annexe B
10	Amorçage à basse température et à basse tension d'alimentation	6	Toutes les lampes doivent être amorcées dans le délai spécifié par le fournisseur, ou dans un délai maximum de 10 s.	Annexe E
11	Temps de stabilisation	6	La durée moyenne mesurée pour atteindre 60 % du flux lumineux initial doit être inférieure ou égale à 110 % de la durée assignée. Tous les échantillons doivent atteindre 60 % du flux lumineux initial dans un délai de 150 % de la durée assignée.	Annexe C

A	B	C	D	E
Rangée	**Paramètre d'essai**	**Taille minimale de l'échantillon pour essai de type**	**Conformité**	**Condition d'essai concernant la conformité**
12	Conservation du flux lumineux	10	La ou les valeurs moyennes mesurées doivent être égales ou supérieures à 90 % de la ou des valeurs assignées. Tous les échantillons doivent être supérieurs ou égaux à 85 % de la ou des valeurs assignées.	Annexe D
13	Taux de défaillance prématurée d'une lampe (si déclaré)	10	Une fois les heures de fonctionnement spécifiées par le fournisseur écoulées, la proportion des défaillances d'une lampe doit être inférieure ou égale à la valeur assignée.	Annexe G
14	Durée de vie	10 ou 20	Évaluer la durée de vie à partir de l'un des essais suivants (d'après le facteur de forme de Weibull 3[c]): Soumettre à essai 10 échantillons à 100 % de la durée de vie assignée Réussite si 6 défaillances ou moins Échec si 7 défaillances ou plus. Soumettre à essai 20 échantillons à 90 % de la durée de vie assignée Réussite si 10 défaillances ou moins Échec si 11 défaillances ou plus.	Annexe G
15	Résistance aux cycles de commutation	10	Évaluer la résistance aux cycles de commutation à partir de l'essai suivant (d'après le facteur de forme de Weibull 3 [c]): Soumettre à essai 10 échantillons au nombre assigné de cycles de commutation Réussite si 6 défaillances ou moins Échec si 7 défaillances ou plus.	Annexe F
16	Dimensions	6	Tous les échantillons doivent satisfaire aux spécifications assignées minimales et maximales. La dimension moyenne mesurée doit être comprise entre 90 % et 110 % de la valeur assignée [d]. Si l'équivalence dimensionnelle avec des lampes à incandescence est déclarée, les lampes doivent alors satisfaire à l'IEC 60630.	Mesures physiques
17	Courant d'appel	1	Le courant d'appel ne doit pas dépasser les limites données.	Annexe H

A	B	C	D	E
Rangée	**Paramètre d'essai**	**Taille minimale de l'échantillon pour essai de type**	**Conformité**	**Condition d'essai concernant la conformité**
18	Performances dans des conditions différentes	Conformément à l'essai de type correspondant dans le présent tableau	Les déclarations de performance dans des conditions différentes (tensions ou températures en dehors des conditions normales, y compris une humidité élevée) doivent être soumises à essai dans ces conditions à l'aide des annexes correspondantes du présent document (en adaptant les conditions d'essais aux conditions différentes). Dans ces conditions: a) les lampes doivent être amorcées et fonctionner de manière satisfaisante, et b) les lampes doivent satisfaire à l'ensemble des déclarations de performance, qui peuvent différer des déclarations de performance dans les conditions générales de mesure spécifiées à l'Article A.1.	Conformément à l'essai de type correspondant dans le présent tableau

NOTE Il existe des réglementations locales et régionales pour un grand nombre de ces paramètres et d'autres paramètres.

[a] La relation entre le facteur de puissance et les facteurs de déphasage et de distorsion est expliquée à l'Annexe J.

[b] Les coordonnées trichromatiques assignées préférées sont les coordonnées trichromatiques normalisées pour 2 700 K, 3 000 K, 3 500 K, 4 000 K, 5 000 K et 6 500 K telles que définies dans l'IEC 60081, Annexe D.

[c] Les outils statistiques, tels que l'analyse de Weibull et les données paramétriques, peuvent être utilisés pour estimer la durée de vie médiane de l'échantillon.

[d] Il convient que le fournisseur fournisse des conseils concernant les tailles afin de permettre leur évaluation, et il convient que ces conseils soient clairs en cas de dimensions maximales ou assignées.

Annexe A
(normative)

Conditions générales relatives à la mesure des caractéristiques photométriques et électriques et aux exigences relatives à l'équipement d'essai

A.1 Méthode de mesure des caractéristiques des lampes

Les tailles d'échantillon et les conditions de conformité sont données au Tableau 3.

L'aspect visuel de tous les échantillons doit être vérifié avant les essais et, si cela est exigé, tous les échantillons doivent être nettoyés avant les essais photométriques.

Sauf spécification contraire, tous les essais doivent:

a) être effectués dans une salle sans courant d'air à une température ambiante de (25 ± 1) °C et dans une humidité relative d'au plus 65 %. Si le fonctionnement de la lampe dans des conditions différentes est déclaré par le fournisseur, le fonctionnement dans cette atmosphère doit également être soumis à essai. Le mouvement de l'air doit être conforme à la CIE 121. Concernant le vieillissement de la lampe, l'essai de sa durée de vie ainsi que l'essai relatif à sa résistance aux cycles de commutation, la température ambiante de la pièce doit être comprise entre 15 °C et 40 °C, et les courants d'air peuvent être autorisés dans une certaine mesure, mais il convient de réduire le plus possible les vibrations et les chocs.

b) être effectués à une tension et une fréquence assignées si une seule valeur est déclarée. Si la tension assignée est une plage, la lampe doit être vieillie et soumise à essai à la tension moyenne de cette plage. Pour les lampes à deux plages de tension, par exemple les lampes destinées à fonctionner de 110 V à 130 V et de 220 V à240 V, le vieillissement et les essais doivent être menés à la tension moyenne de chaque plage de tension.

c) présenter une tolérance de tension d'essai au cours du vieillissement et des essais de conservation du flux lumineux équivalente à 2 %. Lors de la stabilisation de la lampe, la tension doit être égale à ±0,5 %. Au moment de la mesure, la tolérance doit être égale à ±0,2 % pour la tension et à ±0,2 % pour la fréquence. La teneur en harmoniques totale de la tension d'alimentation ne doit pas excéder 3 %. La teneur en harmoniques est définie comme la racine quadratique moyenne de la somme des harmoniques individuels, la fondamentale étant prise égale à 100 %. L'IEC 61000-3-2, Annexe A, fournit des lignes directrices relatives à la source de tension d'alimentation.

d) être menés avec des lampes fonctionnant à l'air libre, en position verticale, culot en haut, pour tous les essais, y compris l'essai de conservation du flux. Si un fournisseur a déclaré que la lampe convenait pour une utilisation dans une seule orientation spécifique, la lampe doit alors être montée dans l'orientation déclarée pendant l'ensemble des essais.

A.2 Stabilisation de la lampe

Les mesures doivent être effectuées à l'issue du temps de stabilisation de la lampe.

NOTE Pendant le transport et la manipulation normale des lampes, par exemple la rotation de la lampe, quelques quantités de mercure en excès peuvent être dispersées en petites gouttes à l'intérieur du tube à décharge. Une préparation appropriée consiste à réunir tous les excès de mercure au point le plus froid du tube. L'expérience a montré que ce processus de conditionnement de la lampe pouvait initialement prendre jusqu'à 16 h. Après cette période de conditionnement, la lampe est prête pour les mesures.

Pour être conditionnée et chauffée, la lampe peut être préparée dans un lieu distant du lieu d'essai. Quand la lampe est déplacée vers le lieu d'essai, si la lampe a été tenue dans la même orientation et n'a pas été soumise à une vibration ou à un choc et qu'aucune partie de verre chaud n'a été touchée (par ex. créant un point froid parasite), une période de