
Modifications are indicated in red

Modifications to GRE-67-01 are indicated in blue

Modifications as in the pipeline of IEC (34A_1574_FDIS, Amd. 5 to Edition 2.4 of IEC60809) in green

Modifications as in the pipeline of IEC (34A_1496_CDV re IEC60810) do not affect this proposal.

I. Information

Proposal to IEC

Introductory note (not part of the proposal)

This proposal is to insert requirements to non-replaceable filament lamps. Reference is made from UNECE Regulations for signalling devices; requirements in UNECE are mandatory. The reason for this proposal is the danger of the use of low quality filament lamps:

- (a) Filament lamps can have a relative short lifetime;
- (b) Requirements concerning the light source quality are missing, like for lumen and colour maintenance, colour endurance, and resistance against vibration and shock.

Therefore, disadvantages may be noted for road safety and consumers, which could be avoided by replaceable solutions or by introducing appropriate requirements to non-replaceable solutions.

Conformity of production requirements are given in UN Regulations.

At this occasion, the colour definitions in IEC 60809 have been noted down as in UN Regulation 48; there is no change of substance.

IEC60809

Edition 2.4 including 34A_1574_FDIS (Amd. 5)

Contents, insert a new sub clause:

2.11. Non-replaceable filament lamps

Scope, replace by

This International Standard is applicable to replaceable and standardised lamps (filament lamps and discharge lamps) to be used in headlamps, fog-lamps and signalling lamps for road vehicles. In some applications, these (filament) lamps may be installed as non-replaceable filament lamps.

This standard is especially applicable to those lamps which are the subject of legislation. In particular, it includes the lamps contained in Regulations¹⁾ No.37 and No.99 and its series

¹⁾ United Nations Economic Commission for Europe (ECE), Regulation 37:~~1992~~, *Uniform provisions concerning the approval of filament lamps for use in approved lamp units of power-driven vehicles and of their trailers*

United Nations Economic Commission for Europe (ECE), Regulation 99:~~1996~~, *Uniform provisions concerning the approval of gas-discharge light sources for use in approved gas-discharge lamp units of power-driven vehicles*

of amendments of the Geneva Agreement of 20 March 1958 of the United Nations Economic Commission for Europe (ECE). However, the standard may be used for other lamps falling under the scope of this standard, as well as lamps which are subject of legislation but not contained in Regulations No. 37 and No. 99, i.e. the non-replaceable (filament) lamps.

For replaceable and standardised lamps, the standard specifies the technical requirements with methods of tests and basic interchangeability (dimensional, electrical and luminous) for lamps of normal production and for standard (étalon) lamps.

For most of the requirements given in this standard, reference is made to the "relevant lamp data sheet". For all lamps listed in clause 5, data sheets are contained in this standard or included by reference. For other lamps, the relevant data are supplied by the lamp manufacturer or responsible vendor. It could be based on national legislation.

Other requirements to replaceable and standardised lamps such as lamp life, lumen maintenance, torsion strength and resistance to vibration and shock are specified in IEC 60810. ~~The latter standard also gives information for guidance of lighting equipment design, such as temperature limits and maximum lamp outlines.~~ Such requirements to non-replaceable (filament) lamps are given in this standard.

For some test methods, reference is made to IEC 60810.

Road vehicle lamps for supplementary purposes which are not the subject of legislation are specified in IEC 60983.

In countries which legislate for approval, for example under the terms of the aforementioned ECE Regulations, it is suggested that reference is made to this standard for assessment of compliance. IEC 60810 and IEC 60983 are not intended for that purpose.

NOTE In the various vocabularies and standards, different terms are used for "incandescent lamp" (IEV 845-07-04) and "discharge lamp" (IEV 845-07-17). In this standard "filament lamp" and "discharge lamp" are used. However, where only "lamp" is written both types are meant, unless the context clearly shows that it applies to one type only.

New sub clause 1.3.21, insert:

1.3.21

non-replaceable filament lamp

filament lamp which cannot be removed from the device or luminaire

NOTE Non-replaceable filament lamps are usually intended as components for integration into the luminaire or device by manufacturers. They are designed and intended to be indivisible parts of a lighting or light signalling device, or of parts or modules or units of such devices.

New sub clause 1.3.22, insert:

1.3.22

life B10

constant of the Weibull distribution indicating the time during which 10 % of a number of the tested lamps of the same type have reached the end of their individual lives

New sub clause 1.3.23, insert:

1.3.23

lumen maintenance

ratio of the luminous flux of a lamp at a given time in its life to its initial luminous flux, the lamp being operated under specific conditions

Example 1 L_{70} is the time in h to 70% lumen maintenance

Example 2 L_{50} is the time in h to 50% lumen maintenance

New sub clause 1.3.24, insert:

1.3.24

initial luminous flux

luminous flux of a lamp measured after the ageing specified in Annex C for filament lamps or in Annex D of IEC 60810 for discharge lamps or in Annex I of IEC 60810 for LED light sources

Sub clause 2.2, replace by:

2.2 Lamp marking

The following information shall be legibly and durably marked on all filament lamps, **except for non-replaceable filament lamps**:

the trade name or mark of the manufacturer or responsible vendor;

the nominal voltage;

the international designation of the relevant category;

the nominal wattage (in the sequence: high wattage filament/low wattage filament for dual filament lamps); this need not be indicated separately if it is part of the international designation of the relevant filament lamp category.

Additionally, halogen filament lamps meeting the requirements of 2.9 shall be marked with a "U".

NOTE Halogen filament lamps are filament lamps whose category designation starts with the letter "H". **However, halogen filament lamps may have a category designation starting with another letter than "H" if complying with the requirements in sub-clause 2.9.**

Inscriptions other than the above may be affixed.

NOTE An example of such an inscription is the approval mark conferred by an administrative authority.

Compliance shall be checked by the following:

presence and legibility - by visual inspection;

durability - by applying the following test on unused lamps:

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

After this test the marking shall still be legible.

If the marking is on the bulb, it shall not adversely affect the luminous characteristics.

Sub clause 2.4.1, replace by:

2.4.1 Colour of light

The colour of the light emitted by the filament lamp shall be white, unless otherwise prescribed on the relevant filament lamp data sheet. For some categories other colour(s) of light are allowed.

The colorimetric characteristics of the light emitted, expressed in CIE chromaticity co-ordinates, shall lie within the following limits:

– finished filament lamps emitting white light:

W_{12}	green boundary:	$y = 0.150 + 0.640 x$
W_{23}	yellowish green boundary:	$y = 0.440$
W_{34}	yellow boundary:	$x = 0.500$
W_{45}	reddish purple boundary:	$y = 0.382$
W_{56}	purple boundary:	$y = 0.050 + 0.750 x$
W_{61}	blue boundary:	$x = 0.310$

with intersection points:

	x	y
$W_1:$	0.310	0.348
$W_2:$	0.453	0.440
$W_3:$	0.500	0.440
$W_4:$	0.500	0.382
$W_5:$	0.443	0.382
$W_6:$	0.310	0.283

– finished filament lamps emitting selective-yellow light:

SY_{12}	green boundary:	$y = 1.290 x - 0.100$
SY_{23}	the spectral locus	
SY_{34}	red boundary:	$y = 0.138 + 0.580 x$
SY_{45}	yellowish white boundary:	$y = 0.440$
SY_{51}	white boundary:	$y = 0.940 - x$

with intersection points:

	x	y
$SY_1:$	0.454	0.486
$SY_2:$	0.480	0.519
$SY_3:$	0.545	0.454

SY ₄ :	0.521	0.440
SY ₅ :	0.500	0.440

– finished filament lamps emitting amber light:

A ₁₂	green boundary:	$y = x - 0.120$
A ₂₃	the spectral locus	
A ₃₄	red boundary:	$y = 0.390$
A ₄₁	white boundary:	$y = 0.790 - 0.670 x$

with intersection points:

	x	y
A ₁ :	0.545	0.425
A ₂ :	0.560	0.440
A ₃ :	0.609	0.390
A ₄ :	0.597	0.390

– finished filament lamps emitting red light:

R ₁₂	yellow boundary:	$y = 0.335$
R ₂₃	the spectral locus	
R ₃₄	the purple line:	(its linear extension across the purple range of colours between the red and the blue extremities of the spectral locus).
R ₄₁	purple boundary:	$y = 0.980 - x$

with intersection points:

	x	y
R ₁ :	0.645	0.335
R ₂ :	0.665	0.335
R ₃ :	0.735	0.265
R ₄ :	0.721	0.259

The colour of the light emitted shall be measured by the method specified in Annex B.

Each measured value shall lie within the required tolerance area. Moreover, in the case of filament lamps emitting white light, the measured values shall not deviate more than 0,020 units in the x and/or y direction from a point of choice on the Planckian locus.

For conformity of production purposes amber and red colour only, at least 80 % of the measuring results shall lie within the required tolerance area.

Sub clause 2.5, replace by:

2.5 Lamp dimensions

The filament lamp dimensions shall comply with the limiting values given in the lamp drawing or on the relevant filament lamp data sheet.

The definition of and the measuring condition for the filament shape, length and position, shall be in accordance with the appropriate requirements of annexes A, D, E and F respectively; **this does not apply to non-replaceable filament lamps.**

Sub clause 2.6, replace by:

2.6. Caps and bases

Filament lamps shall have standard caps or bases as specified on the relevant filament lamp data sheet and shall comply with the relevant cap data sheet of IEC60061-1. **This requirement does not apply to non-replaceable filament lamps; in this case, filament lamps shall be equipped with bases that allow firm and secure fixation to the lighting or light signalling devices, or to parts/modules/units of such devices, for which these filament lamps are designed and intended for.**

Sub clause 2.9, insert as last line:

.....

In the case of non-replaceable filament lamps, compliance to UV radiation requirements may be exempted if this is specified in the relevant lamp data sheet.

New sub clause 2.11, insert:

2.11. Non-replaceable filament lamps

For non-replaceable filament lamps (either as part of a lighting or light signalling device (luminaire), or as part of parts/modules/units of such devices), **the applicant compliance shall be demonstrated, with a test report or other means, compliance with requirements to:**

- (a) lifetime, and
- (b) colour and colour endurance, and
- (c) lumen and colour maintenance, and
- (d) vibration and shock resistance,

as specified below.

A brief technical description (data sheet) of the non-replaceable filament lamp shall be submitted by the manufacturer or responsible vendor, stating in particular:

- the test voltage;
- the device (luminaire) the filament lamp is used for;
- whether "standard" or "heavy duty" test conditions apply for testing vibration and shock resistance.

For testing purposes, 20 type test samples shall be used for performing the testing of non-replaceable filament lamps.

For conformity of production of non-replaceable filament lamp(s), compliance shall be checked with the requirements to lifetime in sub-clause 2.11.2 and for colour coated filament lamps also with requirements to colour endurance as specified in sub-clause in 2.11.3.

For conformity of production test purposes, 20 test samples per year of normal production shall be used. In the case of colour coated non-replaceable filament lamps and the colour endurance requirement, a representative distribution over different lamps may be used provided that these are using the same colour coating technology and finishing, and that this representative distribution comprises lamps of the smallest and the largest diameter of the outer bulb, each at the highest rated wattage.

Alternatively to testing compliance, (previous) measurements or test reports of test samples may be used, under the condition that:

- the essential parameters of these test samples are identical in relation to the test under consideration;
- simulations may be used additionally, in case essential parameters of these test samples are not identical but similar in relation to the test under consideration.

2.11.1 Fixation

For testing purposes, non-replaceable filament lamps shall be used that are fixed firmly and secure to appropriate means necessary to conduct the test, or as specified by the respective test, and does not need to be installed in the devices for which these filament lamps have been designed and intended for; filament lamps may be fixed to the parts/modules/units of devices for which they have been designed and intended for.

2.11.2. Lifetime

The life B10 of non-replaceable filament lamps shall not be less than the value given in the following table*, and not less than 50% of that value, in the case of non-replaceable filament lamps that are an indivisible part of parts/modules/units of lighting or light signalling devices:

Devices (Luminaires) in which non-replaceable filament lamp(s) are used	Life B10	Corresponding UN Regulations (for information only)
Rear registration plate lamps	2200**	No. 4
Direction indicator lamps	500	No. 6, 50
Front and rear position lamps	2200**	No. 7, 50
Stop-lamps	1000	No. 7, 50
End-outline marker lamps	2200	No. 7
Reversing lamps	100	No. 23
Rear fog lamps	100	No. 38
Parking lamps	2200	No. 77
Daytime running lamps	4000	No. 87
Side marker lamps	2200**	No. 91
Cornering lamps	200	No. 119

* typical "on"- times for different functions per 200000 km drive distance with an average speed of 33,6 km/h, based on the New European Driving Cycle (NEDC)

** in case these light sources are intended for vehicles where these functions are also switched ON together with the DRL function, then the value of 6200 shall be used

Compliance is checked by life tests as prescribed in Annex A of IEC 60810.

In the case of dual non-replaceable filament lamps the applicable filament shall be considered that is used for the specified device.

2.11.3. Colour and colour endurance

Non-replaceable filament lamps shall comply with the colour endurance requirements as specified in par. 2.4 of this publication.

2.11.4. Lumen and colour maintenance

The lumen maintenance shall not be less than 70% at life B10.

In the case of amber and red coloured non-replaceable filament lamps, the colour of the light emitted by these filament lamps shall be measured at the moment of lumen maintenance and be within the colour boundaries as defined in sub-clause 2.4.1. These measurements shall be made at test voltage as indicated in the relevant datasheet and at an ambient temperature of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ using a suitable integrating photometer.

In the case of dual non-replaceable filament lamps the applicable filament shall be considered that is used for the specified device.

Testing may be combined with the lifetime test.

2.11.5. Vibration and shock resistance

To assess the performance influenced by vibration or shock, the test methods and schedules detailed in Annex B of IEC 60810 shall be used.

The non-replaceable filament lamps are deemed to have satisfactorily completed the wideband or narrowband random vibration test as described in Annex B of IEC 60810, if they continue to function during and after the test.

The number of non-replaceable filament lamps failing one of the tests shall not be more than 2.

CLAUSE 4, REPLACE BY:

4. SAMPLING AND CONDITIONS OF COMPLIANCE

Requirements for sampling and conditions of compliance, **except from for non-replaceable filament lamps**, are specified in the relevant regulation for example ECE Regulations No. 37 and No. 99.

Requirements for sampling and conditions of compliance for non-replaceable filament lamps, are specified in the relevant regulation for devices, using non-replaceable filament lamps, for example ECE Regulations Nos. 4, 6, 7, 23, 38, 50, 77, 87, 91 and 119.

IEC60810 (including 34A 1496 CDV)

Sub clause A.2, replace by:

A.2 Test voltage

Measurements shall be carried out at the test voltage specified in Clause 5 of this standard which shall be a stable d.c. or a.c. voltage with a frequency between 40 Hz and 60 Hz.

In the case of non-replaceable filament lamps (defined in IEC 60809), the filament lamp shall be operated at the test voltage specified in the relevant data sheet. In case an electronic regulator is used, such as pulse width modulation (PWM), this non-replaceable filament lamp should be operated in such a way that it does not negatively affect the lifetime of the filament lamp.

NOTE The test voltage is deemed to be stable when the momentary fluctuations do not exceed 1 % and the deviation of the average over the test period does not exceed 0,5 % of the specified value.

Sub clause A.3, replace by:

A.3 Operating position and operating conditions

Filament lamps shall be operated on a vibration-free test rack with both lamp axis and filament(s) horizontal. In the special case of double-filament lamps which include a shield, this shall be under the dipped or lower-beam filament (H-H line horizontal). In the case of filament lamps with an axial filament, the longer filament support shall be positioned above the filament.

The lamps shall be tested under normal ambient temperature conditions; assumption is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$.

Sub clause A.5, replace by:

A.5 Lumen and colour maintenance

Tests may be interrupted for determination of the lumen and colour maintenance.

Sub clause B.2.4, replace by:

B.2.4 Conditioning

Filament lamps shall be aged for 30 min at test voltage as given in the relevant data sheets of IEC 60809 or in the relevant data sheets of non-replaceable filament lamps. No ageing period is required for discharge lamps, but lamps which fail before starting a vibration test shall be omitted from the test results.

Sub clause B.3, replace by:

B.3 Test conditions

The test voltage for filament lamps shall be in accordance with IEC 60809 or with the specification in the relevant data sheets of non-replaceable filament lamps. For discharge lamps, the conditions of Clause D.2 of this standard apply.

The specific vibration test conditions are given as follows:

Narrowband random vibration test	Standard test conditions	Table B.1
	Heavy-duty test conditions	Table B.2
Wideband random vibration test	Standard test conditions	Table B.3

Relevant sections of IEC60809 and IEC60810

Referenced to from the proposal above

IEC60809 including 34A_1574_FDIS (Amd. 5)

2.4 Colour

2.4.1. See proposal above

2.4.2 Colour endurance

Replace the existing Subclause 2.4.2 by the following:

Filament lamps, **but for conformity of production purposes only colour coated lamps**, for use in light signalling devices shall be operated under test conditions for colour endurance measurements as specified in Annex K.

Thereafter the colour of the light shall be measured by the method specified in Annex B, and all measuring results, but for amber and red colour at least 80 % of the measuring results for conformity of production purposes, shall be within the limits specified in 2.4.1.

In case of colour filter coatings, no cracks in these coatings shall be visible without specific optical tools.

Test samples that have been operated under conditions as specified in Annex K shall no longer be used in light signalling devices and are to be considered end of life for that purpose.

2.9 UV radiation

The UV radiation of a halogen filament lamp shall be such that:

$$k_1 = \frac{\int_{315 \text{ nm}}^{400 \text{ nm}} \Phi_{\lambda} d\lambda}{\int_{380 \text{ nm}}^{780 \text{ nm}} \Phi_{\lambda} V(\lambda) d\lambda} \leq 2 \times 10^{-4} \text{ W/lm}$$

$$k_2 = \frac{\int_{250 \text{ nm}}^{315 \text{ nm}} \Phi_{\lambda} d\lambda}{\int_{380 \text{ nm}}^{780 \text{ nm}} \Phi_{\lambda} V(\lambda) d\lambda} \leq 2 \times 10^{-6} \text{ W/lm}$$

where

$k_m = 683 \text{ [lm/W]}$;

$\Phi_{\lambda} \text{ [W/nm]}$ is the spectral distribution of the radiant flux;

$V(\lambda) \text{ [1]}$ is the spectral luminous efficiency;

$\lambda \text{ [nm]}$ is the wavelength.

These values shall be calculated using intervals of five nanometres.

For working group review purposes only

Annex B
(normative)

Measurement method of the colour of filament lamps

B.1 General

Measurements shall be made on finished lamps. Filament lamps with a secondary (outer) bulb acting as a colour filter shall be handled in the same way as filament lamps with a primary bulb.

Tests shall be made at an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

Tests shall be made at test voltage as specified in the relevant filament lamp data sheet.

Filament lamps shall be measured preferably in the normal operating position.

In case of dual filament lamps, the high wattage (major or driving-beam) filament shall be operated only.

Before starting a test, the stabilisation of the temperature of the filament lamp shall be obtained by operating at test voltage for 10 min.

B.2 Colour

Colour tests shall be made with a measuring system that determines CIE chromaticity co-ordinates of the received light with an accuracy of $\pm 0,002$.

The chromaticity co-ordinates shall be measured with a colorimetric receiver integrating over a right circular cone subtending an angle of minimum 5° and maximum 15° at the centre of the filament.

B.3 Measuring directions

B.3.1 General

Initially, the receiver shall be positioned perpendicular to the lamp axis and to the filament axis (or plane in case of a curved filament). After measurement, the receiver shall be moved around the filament lamp in bi-directional steps of about 30° until the area specified in B.3.2 or B.3.3 is covered. In each position, a measurement shall be made. However, no measurement shall be made when:

- the centreline of the receiver coincides with the filament axis; or
- the line of sight between the receiver and the filament is blocked by opaque (non-transmit tent) parts of the light source, such as lead wires or a second filament, if any.

B.3.2 Filament lamps used in headlamps

Measurements shall be made in directions around the filament lamp with the centreline of the receiver aperture located within an angle $\pm 30^{\circ}$ from the plane perpendicular to the lamp axis and with the origin in the centre of the filament (see Figure B.1). In case of filament lamps with two filaments, the centre of the driving-beam filament shall be taken.

B.3.3 Filament lamps used in light signalling devices

Measurements shall be made around the filament lamp (see figure B.2), with exception of:

- the area claimed or covered by the cap of the filament lamp; or
- the immediate transition area along the cap

In case of filament lamps with two filaments, the centre of the major filament shall be taken.

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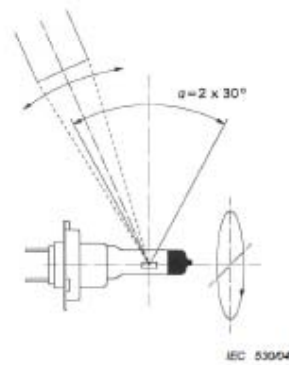


Figure B.1 – Figure illustrating the positions of the colorimetric receiver when measuring lamps used in headlamps

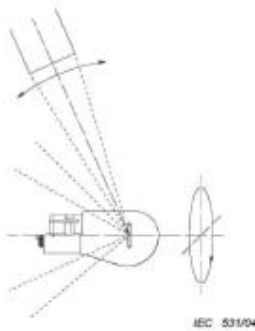


Figure B.2 – Figure illustrating the positions of the colorimetric receiver when measuring lamps used in light signalling devices

Annex C (normative)

Test conditions for electrical and luminous characteristics

- C.1 Filament lamps shall be aged at their test voltage for approximately 1 h. The test voltage is indicated on the relevant filament lamp data sheet. For dual-filament lamps each filament shall be aged separately.
- C.2 Electrical and photometric measurements shall be carried out at the test voltage.
- C.3 Electrical measurements shall be carried out with instruments being of a precision appropriate to the requirements (at least class 0,2 according to IEC 51).
- C.4 The luminous flux shall be measured in a suitable integrating photometer.

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Annex K (normative)

Test conditions for colour endurance measurements

K.1 General

The test conditions for colour endurance measurements shall apply to **coloured** filament lamps for use in light signalling devices. The applicable set of test conditions are indicated in Tables K.1.a and K.1.b:

- switching modes (see K.6) in Table K.1.a.;
- boxes in which the filament lamps shall be mounted (see K.5) in Table K.1.b.

Tables K.1 – Applicable set of test conditions for filament lamps subjected to colour endurance measurements

Table K.1.a. – Applicable switching modes

Filament lamps		Applicable test conditions
Emitting	For use in	
Amber light	Intermittent operation	Figure K.5
Red light	Intermittent and continuous operation	Figure K.6
White light	Continuous operation	Figure K.7

Table K.1.b. – Applicable boxes of the test racks

Filament lamps' maximum wattage ^a				Applicable box in Table K.2
>	0 W	and	≤ 10 W	A
>	10 W	and	≤ 20 W	B
>	20 W	and	≤ 30 W	C
>	30 W	and	≤ 45 W	D
^a Wattage – when operating at test voltage; – of the higher wattage (major or driving beam) filament in case of dual filament lamps. (IEC60809: rated wattage; ECE/R37: objective value of wattage)				

K.2 Calibration and ageing Ageing

The climate chamber shall be calibrated while empty and before filament lamps on test racks are placed in the climate chamber.

Filament lamps shall be aged at their test voltage for 60 min ± 5 min. For dual filament lamps, each filament shall be aged separately. Filament lamps which fail during the ageing period shall be replaced and the ageing process re-applied.

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K.3 Test voltage

Filament lamps shall be operated at the test voltage as specified in the relevant filament lamp data sheet.

K.4 Operating position

Filament lamps shall be operated on test racks. The test racks shall be positioned horizontally in a climate chamber in such a way that temperature and relative humidity around each test rack are as specified in Clause K.6. To facilitate air distribution the use of a fan is recommended. The test rack shall then be positioned so that the bulbs of the filament lamps are not facing the fan. Test racks shall not be stacked or overlapped.

K.5 Test rack

The test rack shall consist of a horizontal array of boxes as specified in Figures K.1 and K.2 and in Table K.2. Front and bottom of the box shall be open. The other faces shall be closed using 1 mm thick stainless steel. In case of an array of boxes total thickness of adjoining sides shall be 1 mm. Filament lamps shall be mounted on their normal cap holders with both lamp axis and filament(s) horizontal, and their positions relative to the box as specified by Figures K.1 and K.2. In case normal cap holders would not be resistant to temperatures as specified in this annex other means may be applied to position filament lamps as prescribed.

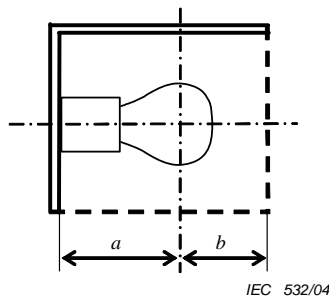


Figure K.1 – Side view of box

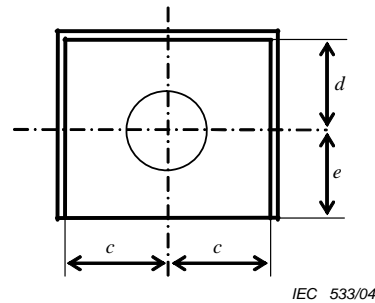


Figure K.2 – Front view of box

Table K.2 – Dimensions of the applicable boxes and the relative position of the centre of the filament

Box	<i>a</i> mm	<i>b</i> mm	<i>c</i> mm	<i>d</i> mm	<i>e</i> mm
A	13	11	7,75	8	12
B	28	15	13	14	26
C	42	18	19	19	40
D	42	18	19	19	40

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K.6 Operating cycles

Filament lamps shall be operated in the climate chamber following 10 times a 24 h cycle of varying temperature, relative humidity and switching modes, as specified in Tables K.1, K.3 and K.4 and Figures K.3 to K.7.

Table K.3 – Timing during one operating cycle

Beginning of cycle												End of cycle
t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}
h	h	h	h	h	h	h	h	h	h	h	h	h
0	1	5	5:20	7	8	12	12:20	20	21	21:20	23	24

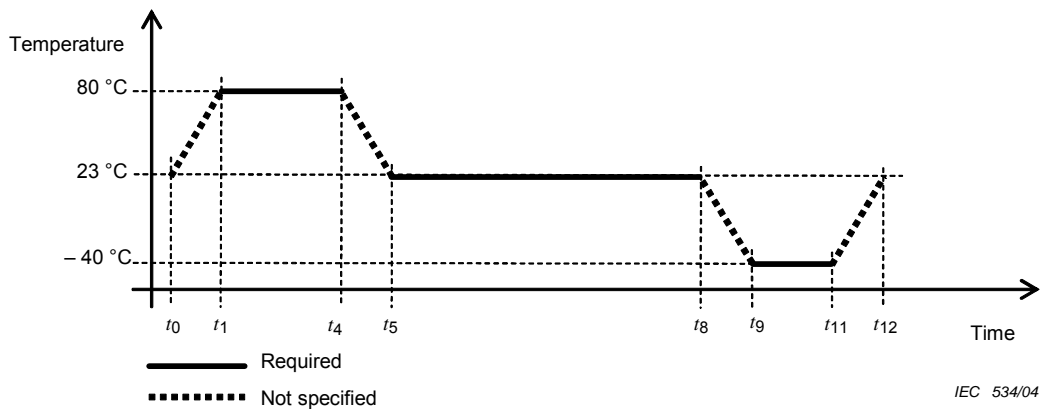


Figure K.3 – Temperature in the climate chamber during one operating cycle

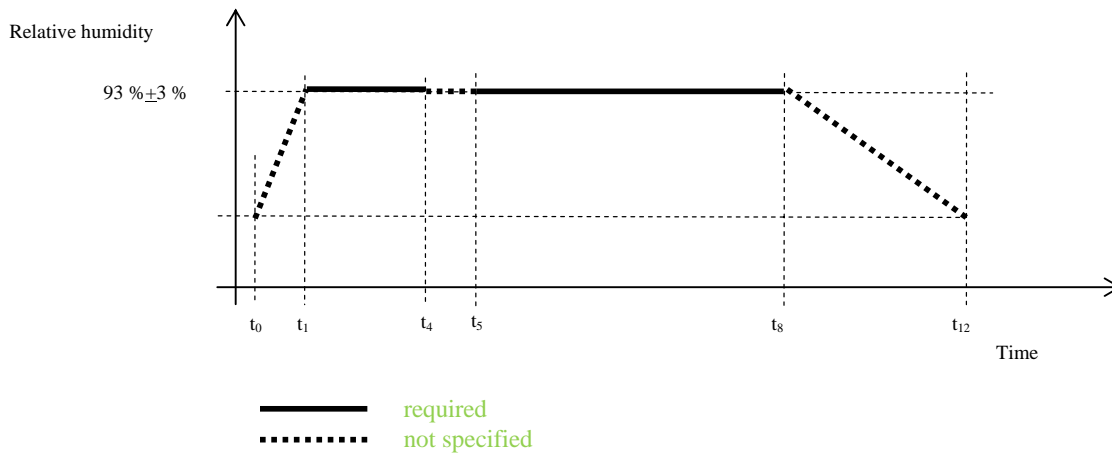


Figure K.4 – Relative humidity in the climate chamber during one operating cycle

For working group review purposes only

Table K.4 – Switching modes of the filament lamps

Mode	Filament switched	Common name of mode
1	Off	'Off' mode
2	For 15 s in intermittent operation with flashing frequency 90/min and on/off ratio 1:1; for 15 s off	'Intermittent' mode
3	In intermittent operation with flashing frequency 90/min and on/off ratio 1:1	'Flashing' mode
4	For 5 min on; for 5 min off	'Interrupted on' mode
5	On	'On' mode

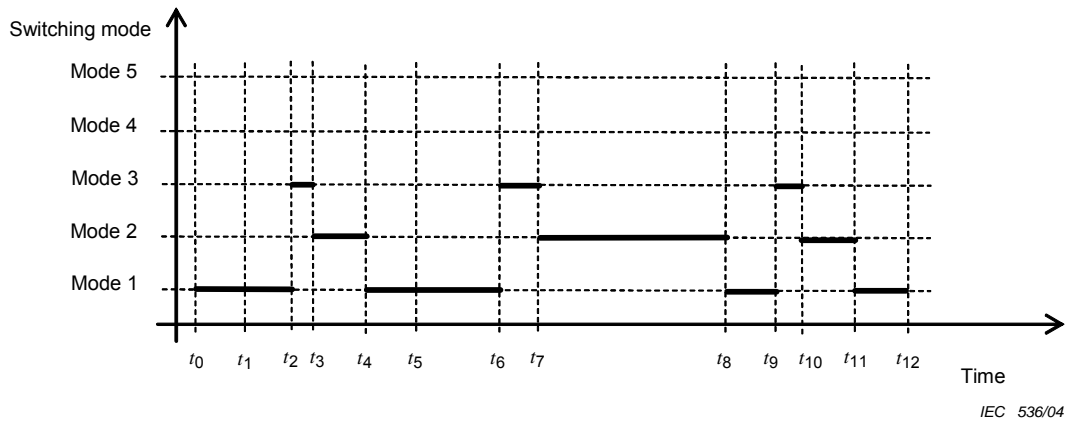


Figure K.5 – Switching modes of filament lamps for intermittent operation during one operating cycle

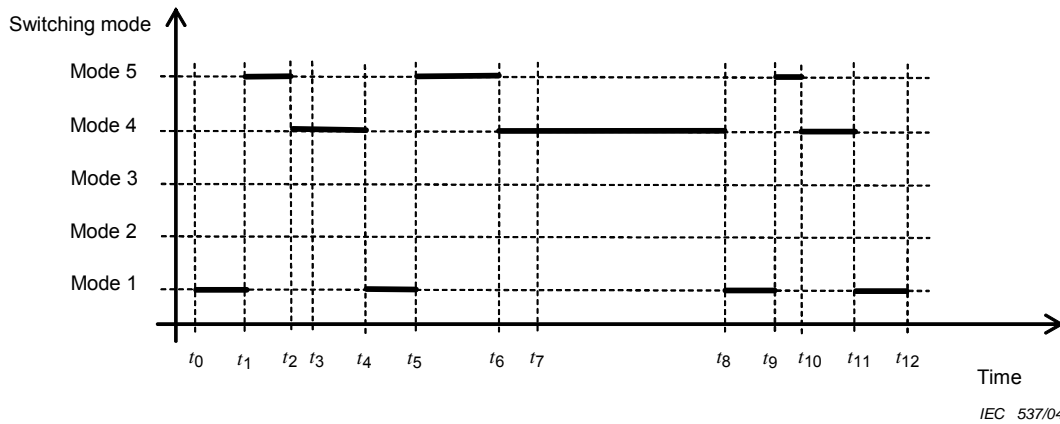


Figure K.6 – Switching modes of filament lamps for intermittent and continuous operation during one operating cycle

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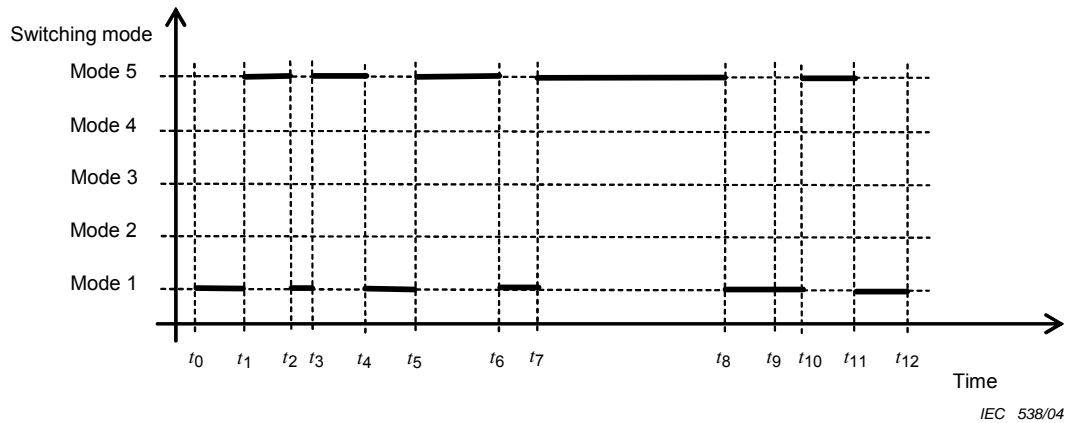


Figure K.7 – Switching modes of filament lamps for continuous operation during one operating cycle

K.7 Closure

Filament lamps shall be held at rest, switched off, at a room temperature of $23\text{ °C} \pm 2\text{ °C}$ for at least 2 h after the end of the 10 operating cycles and shall no longer be used in light signalling devices but to be considered end of life for that purpose.

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Annex A (normative)

Life test conditions for filament lamps

A.1 Ageing

Filament lamps shall be aged at their test voltage for approximately 1 h. For dual-filament lamps, each filament shall be aged separately. Filament lamps which fail during the ageing period shall be omitted from the test results.

A.2 Test voltage

Measurements shall be carried out at the test voltage specified in Clause 5 of this standard which shall be a stable d.c. or a.c. voltage with a frequency between 40 Hz and 60 Hz.

NOTE The test voltage is deemed to be stable when the momentary fluctuations do not exceed 1 % and the deviation of the average over the test period does not exceed 0,5 % of the specified value.

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A.3 Operating position

Filament lamps shall be operated on a vibration-free test rack with both lamp axis and filament(s) horizontal. In the special case of double-filament lamps which include a shield, this shall be under the dipped or lower-beam filament (H-H line horizontal). In the case of filament lamps with an axial filament, the longer filament support shall be positioned above the filament.

A.4 Switching cycle

A.4.1 Single-filament lamps

A.4.1.1 Filament lamps for continuous operation

Filament lamps shall be switched off twice daily for periods of not less than 15 min, such periods not being considered as part of the life.

A.4.1.2 Filament lamps for intermittent operation

Filament lamps for intermittent operation as used in stop-lamps and flashing direction indicators shall be operated in the following switching cycle:

- 15 s on for intermittent (flashing) operation;
- 15 s off;
- flashing frequency: 90/min;
- on/off ratio 1:1.

The whole flashing operation time is considered as life.

A.4.2 Dual-filament lamps for headlamps

The filaments shall be operated alternately according to the following cycle and starting with the lower beam filament:

- dipped or lower-beam filament: 15 h on/45 min off;
- main or upper-beam filament: 7,5 h on/45 min off.

The end of the life is determined by failure of either filament.

The off periods are not considered as part of the life.

NOTE The life of the lower-beam filament represents two-thirds of the total life, the life of the upper-beam filament one-third.

A.4.3 Dual-filament lamps for light signalling equipment

Life testing shall be carried out for each filament separately. Life testing of the low-wattage filament shall be carried out on filament lamps other than those used for life testing of the high-wattage filament.

A.4.3.1 Filaments for continuous operation

The switching cycle shall be as specified in A.4.1.1.

A.4.3.2 Filaments for intermittent operation

The switching cycle shall be as specified in A.4.1.2.

A.5 Lumen maintenance

Tests may be interrupted for determination of the lumen maintenance.

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Annex B (normative)

Vibration tests

B.1 General

These tests are designed to ensure that lamps satisfactorily completing this schedule will not be adversely affected by shock and vibration in normal service.

Two levels of test are specified which are referred to as "standard test" and "heavy-duty test" and the appropriate level must be selected for the intended vehicle usage.

The acceleration levels and frequency spectra used in these tests are based on extensive investigations into the characteristics experienced at lamp mounting positions on a wide range of vehicles and in normal service conditions.

Although the standard test relates to normal vehicle service conditions, investigations have shown that the more arduous conditions given by heavy goods vehicles require lamps of a greater mechanical strength.

Within the constraints of dimensional and photometric specifications, the ultimate strength of an incandescent lamp is limited by the properties of the filament material. These restrict the mechanical stress to which a lamp can be subjected.

Higher vibration levels may impair the performance of lamps.

Two tests methods are specified:

- a) a wideband random vibration test (WBR);
- a) a narrowband random vibration test (NBR).

The WBR test is the preferred one, as simulation of service conditions can be achieved most accurately by the use of WBR equipment. However, studies have indicated that a relationship exists between WBR and NBR vibrations. For the purpose of this standard, both tests are equal for testing motor vehicle lamps to vibration resistance.

Analysis of vibration measurements, taken under transient conditions such as door, boot and bonnet closures, shows compatibility with the significant features of both the WBR and NBR test programmes.

The generally accepted requirements of a fatigue life of 10^7 reversals is encompassed by the schedule in IEC 60068-2-6.

Measurements of vibration and shock characteristics in service reveal frequencies of up to 20 000 Hz.

A vibration level is expressed as acceleration spectral density (ASD). It is the spectral density of an acceleration variable and is given in units of acceleration squared per unit frequency.

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ASD spectrum defines the way ASD varies within the frequency range.

The ASD levels at frequencies above 1 000 Hz are, however, so low as to be insignificant, as the resonant frequencies of the critical construction features of most automobile lamps fall within the range of 200 Hz to 800 Hz. This, together with problems in the design of fixtures suitable for operation at frequencies above this level, has led to the adoption of 1 000 Hz as the maximum limit for the test schedules (excluding half bandwidth).

B.2 Test conditions

Figure B.1 details the preferred arrangement of equipment for the testing of lamps of WBR or NBR tests.

In order to be assured of reliable and reproducible test results the following procedures should be followed.

B.2.1 Mounting (see IEC 60068-2-47)

The lamp caps shall be fastened rigidly to the work holders on the vibration head. This may be achieved by clamping, soldering or embedding. Electrical connection to the lamps shall be made by the use of soldered wires or other means such that electrical connection is ensured during the whole test.

On tests including higher frequencies, it is essential that fixtures are designed in such a way that the propagation path (the distance between lamp and moving coil) is always shorter than the one-quarter wavelength of the velocity of sound in the fixture material.

B.2.2 Measuring points

A measuring point is the position at which measurements are made to ensure that the test requirements are met. The measuring point shall be on the fixture as close as possible to the position at which the lamp is held and the detector shall be rigidly connected to it.

If several lamps are mounted on a single fixture, the measuring point may be related to the fixture generally rather than the lamp fixing points.

The resonant frequency of the fully loaded fixture shall always be higher than the maximum test frequency.

B.2.3 Control point

The signal from the transducer mounted at the measuring point shall be used as a means of maintaining the specified vibration characteristics.

B.2.4 Conditioning

Filament lamps shall be aged for 30 min at test voltage as given on the relevant data sheets of IEC 60809. No ageing period is required for discharge lamps, but lamps which fail before starting a vibration test shall be omitted from the test results.

B.2.5 Axis of vibration

Field measurements on vehicles have shown that automobile lamps are usually subjected to greater stresses in the vertical plane than in either of the horizontal planes. It is therefore recommended that a vertical direction of excitation be used for testing with the principal lamp axis and filament(s) horizontal.

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B.2.6 WBR test – Basic motion

The basic motion of the control point on the test fixture (see Figure B.1) shall be rectilinear and of a stochastic nature with a normal (Gaussian) distribution of instantaneous acceleration values. Peak values are limited to three times the r.m.s. value as determined by the ASD profile and its frequency range (i.e. "3 σ -clipping"). Experience has shown that a peak factor set to 2,3 at the exciter corresponds to a 3 σ test signal at the control point because of filtering by the vibrator (see ISO 5344).

B.3 Test conditions

The test voltage for filament lamps shall be in accordance with IEC 60809. For discharge lamps, the conditions of Clause D.2 of this standard apply.

The specific vibration test conditions are given as follows:

Narrowband random vibration test	Standard test conditions	Table B.1
	Heavy-duty test conditions	Table B.2
Wideband random vibration test	Standard test conditions	Table B.3

B.3.1 Narrowband random vibration tests

Table B.1 – Vibration test on motor vehicle lamps – Standard test conditions

<i>Narrowband random vibration test</i>		
1	Frequency range	30 Hz to 1 050 Hz
2	Bandwidth	100 Hz
3	Sweep range	80 Hz to 1 000 Hz
4	Sweep rate	1 octave/min
5	Sweep duration (full cycle)	7,3 min
6	ASD spectrum	0,12 g ² /Hz (= 3,5 g eff.) from 80 Hz to 150 Hz 0,014 g ² /Hz (= 1,2 g eff.) from 150 Hz to 1 000 Hz
7	Tolerance of the acceleration values	±1 dB
8	Test duration	20 h
9	Switching cycle	20 min lit to 10 min unlit
10	Compressor speed	10 dB/s

Table B.2 – Vibration test on motor vehicle lamps – Heavy-duty test conditions

<i>Narrowband random vibration test</i>		
1	Frequency range	30 Hz to 1 050 Hz
2	Bandwidth	100 Hz
3	Sweep range	80 Hz to 1 000 Hz
4	Sweep rate	1 octave/min
5	Sweep duration (full cycle)	7,3 min
6	ASD spectrum	0,36 g ² /Hz (= 6,0 g eff.) from 80 Hz to 150 Hz 0,09 g ² /Hz (= 3,0 g eff.)

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		from 150 Hz to 1 000 Hz
values	7 Tolerance of the acceleration	±1 dB
	8 Test duration	20 h
	9 Switching cycle	10 min lit to 10 min unlit
	10 Compressor speed	10 dB/s

B.3.2 Wideband random vibration tests

Test requirements are given in Table B.3 for standard service.

Requirements for heavy-duty service are under consideration.

Table B.3 – Vibration test on motor vehicle lamps – Standard test conditions

<i>Wideband random vibration test</i>		
values	1 Frequency range	12 Hz to 1 002 Hz
	2 ASD spectrum	Hz g^2/Hz
		12 0,01
		12-24 0,01-0,15
		24-54 0,15
		54-1 002 0,15-0,0082
	3 Total r.m.s. acceleration level	5,4 $g \pm 1$ dB ^a
	4 Tolerance of the true ASD	±3 dB ^a
	5 Switching cycle	20 min lit to 10 min unlit
	6 Test duration	20 h
<p>NOTE 1 The acceleration level increases logarithmically with the logarithm of the frequency in the range 12 Hz to 24 Hz (12 dB/octave) and it decreases in the range 54 Hz to 1 002 Hz (-3 dB/octave). Outside the specified frequency range, the ASD levels has to decrease with gradients as steep as possible.</p> <p>NOTE 2 All data are provisional.</p>		
<p>^a This represents "reproducibility high" according to IEC 60068-2-64.</p>		

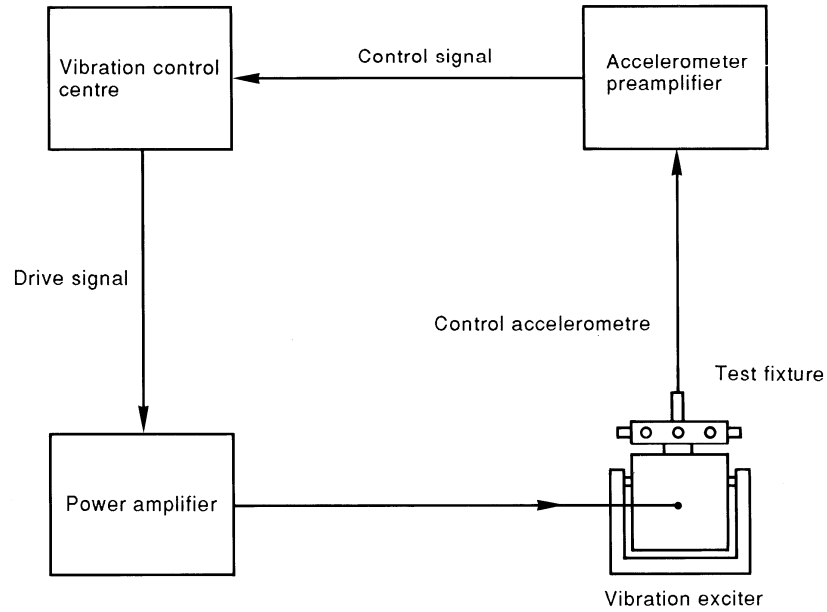


Figure B.1 – Recommended equipment layout for vibration testing ^{IEC 315/02}

Annex D (normative)

Life and lumen maintenance test conditions for discharge lamps

D.1 Ageing

No ageing period is required, but lamps which fail before starting the life test shall be omitted from the test results.

For lamps subject to the lumen maintenance test, the initial luminous flux shall be measured after 10 switching cycles as prescribed in Clause D.4

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Annex I
(normative)

Lumen maintenance test conditions for LED light sources

I.1 Ageing

LED light sources shall be aged at their test voltage for 48 h under the operating conditions specified in I.3. LED light sources which fail during the ageing period shall be omitted from the test results.

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The total duration of one switching cycle is 120 min, during which the lamp is switched on for 79,8 min and switched off for 40,2 min. The time during which the lamp is switched off is not considered as part of the life.

Life tests may be interrupted for the purpose of the lumen maintenance test.

D.5 Lumen maintenance

The lumen maintenance is measured after the lamp has been operated 75 % of the characteristic life as declared by the manufacturer.