29 Filament lamps

Refer to: R37 03-R6/C1, R99 00-S7

29.1 Effective date and Scope:

29.1.1 Effective date from 2006/7/1, the new vehicle variants of category symbols M, N and O, and from 2008/7/1 all vehicle variants of category symbols M, N and O, bulbs of lamp using of safety type approval for vehicle shall comply with this regulation.

29.1.2 Effective date from 2009/1/1, new vehicle variants of category symbols L1 and L3, and from 2011/1/1 all vehicle variants of category symbols L1, L2, L3 and L5, bulbs of lamp using of safety type approval for vehicle shall comply with this regulation.

29.1.3 The applicants applying for low volume safety approval could exempt from regulation of “Filament lamps” except large passenger vehicle and child-only vehicle.

29.1.4 Applying for vehicle-by-vehicle low volume safety approval, the vehicle could exempt from regulation of “Filament lamps”.

29.2 Definitions

29.2.1 Gas-discharge light source:

29.2.1.1 Gas-discharge light source: Light source in which the light is produced by a stabilized discharge arc.

29.2.1.2 Ballast: Specific electrical supply for the gas-discharge light source.

29.2.1.3 "Rated voltage": Input voltage marked on the ballast or on the light source in the case that the ballast is integrated with the light source.

29.2.1.4 "Rated wattage": Wattage marked on the gas-discharge light source and ballast.

29.2.1.5 "Test voltage": Voltage, at the input terminals of the ballast or at the terminals of the light source in the case that the ballast is integrated with the light source, for which the electrical and photometric characteristics of the gas-discharge light source are intended and are to be tested.

29.2.1.6 "Objective value": Design value of an electrical or photometric characteristic. To be achieved, within the specified tolerances, when the gas-discharge light source is energized by the ballast, optionally integrated with the light source, and operated at test voltage.

29.2.1.7 "Standard (etalon) gas-discharge light source": Special gas-discharge light source used for the testing of headlamps. It has reduced dimensional, electrical and photometric characteristics as specified on the relevant data sheet.

29.2.1.8 "Reference axis": An axis defined with reference to the cap and to which certain dimensions of the gas-discharge light source are referred.

29.2.1.9 "Reference plane": a plane defined with reference to the cap and to which certain dimensions of the gas-discharge light source are referred.

29.2.2 General bulbs:

29.2.2.1 "Filament light source (filament lamp)": a light source where the element for visible radiation is one or more heated filaments producing thermal radiation.

29.2.2.2 "Rated voltage": voltage (in volts) marked on the filament lamp;

29.2.2.3 "Rated wattage": wattage (in watts) marked on the filament lamp which may be incorporated into the international designation of the relevant category;

29.2.2.4 "Test voltage": voltage, at the filament lamp terminals for which the electrical and photometric characteristics of the filament lamp are intended and are to be tested.

29.2.2.5 "Objective values": values to be achieved, within the specified tolerances, when the filament lamp is supplied with current at its test voltage;

29.2.2.6 "Standard (etalon) filament lamp": a filament lamp emitting white or amber or red light with reduced dimensional tolerances, used for the photometric testing of lighting and light-signalling devices. Standard filament lamps are specified in only one voltage rating for each category;

29.2.2.7 "Reference luminous flux": specified luminous flux of a standard filament lamp to which the optical characteristics of a lighting device shall be referred;

29.2.2.8 "Measuring luminous flux": specified value of the luminous flux for testing a filament lamp in a standard headlamp as specified in paragraph 3.8.;

29.2.2.9 Reference axis: an axis defined with reference to the cap and to which certain dimensions of the filament lamp are referred;

29.2.2.10 Reference plane: a plane defined with reference to the cap and to which certain dimensions of the filament lamp are referred.

29.2.3 Standard filament lamps:

29.2.3.1 Bulbs of standard (etalon) filament lamps emitting white light shall not alter the CIE trichromatic coordinates of a luminous source having a color temperature of 2856 K by more than 0.010 units in the x and/or y direction.

29.2.3.2 For standard (etalon) filament lamps emitting amber or red light, changes of the bulb temperature shall not affect the luminous flux. Moreover, the color shall lie within the tolerance area.

29.3 Bulbs shall according to suitable variants and range are of principle：

29.3.1 Brand.

29.3.2 Bulb design, in so far as these differences affect the optical results

29.3.3 Bulb colour (A selective-yellow bulb or an additional selective-yellow outer bulb, solely intended to change the colour but not the other characteristics of a filament lamp emitting white light, does not constitute a change of variant of the filament lamp)

29.3.4 Rated voltage

29.4 The gas-discharge light source

29.4.1 Visual Appearance

29.4.1.1 The bulb of the gas-discharge light source shall exhibit no scores or spots that might impair their efficiency and optical performance.

29.4.1.2 In the case of a colored (outer) bulb, after an operating period of 15 hours with the ballast or the light source with the ballast integrated at test voltage, the surface of the bulb shall be lightly wiped with a cotton cloth soaked in a mixture of 70% volume of n-heptane and 30% volume of toluol. After about five minutes, the surface shall be inspected visually. It shall not show any apparent changes.

29.4.2 Tests: The geometric dimension of the electrode shall be as specified on the relevant data sheet. The shape and the displacement of the arc shall conform to the requirements as given (after the ageing in paragraph 29.4.2.1). The position and dimension and transmission of the stripes shall comply with the requirements as given on the relevant data sheet. For starting, run-up and hot-restrike tests and for the measurement of electrical and photometric characteristics, the gas-discharge light source shall be operated in free air with an ambient temperature of 25 +/- 5 degrees C (after the ageing in paragraph 29.4.2.1).

29.4.2.1 Ageing: All tests shall be carried out with gas-discharge light sources which have been aged for a minimum 15 cycles having the following switching cycle：45 minutes on, 15 second off, 5 minutes on, 10 minutes off.

29.4.2.2 Starting test: When tested according to the conditions: the starting test shall be applied to light sources that have not been aged and have not been used for a period of at least 24 hours prior to the test, the gas-discharge light source shall start directly and remain alight.

29.4.2.3 Run-up test: The run-up test shall be applied to light sources that have not been used for a period of at least 1 hour prior to the test. For gas-discharge light sources having an objective luminous flux which exceeds 2000 lm. When measured, the gas-discharge light sources shall emit at least：

After 1 second：25 % of its objective luminous flux

After 4 seconds：80 % of its objective luminous flux

29.4.2.3.1 For gas-discharge light sources having an objective luminous flux which does not exceed 2000 lm. When measured according to the conditions, the gas-discharge light sources shall emit at least 800 lm after 1 second and at least 1000 lm after 4 seconds. The objective luminous flux as indicated on the relevant data sheet.

29.4.2.4 Hot re-strike test: The light source shall be started and be operated with the ballast (possibly integrated) at test voltage for a period of 15 minutes. Then the supply voltage to the ballast or the light source with the ballast integrated shall be switched off for a switch-off period as indicated on the relevant data sheet and be switched on again. When tested, the gas-discharge light sources shall restart directly after being switched-off for a period as indicated on the data sheet. After one second, the

light source shall emit at least 80 % of its objective luminous flux.

29.4.2.5 Electrical characteristics test: Before any measurement, the light source shall be stabilized for a period of 15 minutes. When measured, the voltage and wattage of the light source shall be within the limits given on the relevant data sheet.

29.4.2.6 Photometric test – luminous flux: Before any measurement, the light source shall be stabilized for a period of 15 minutes. When measured, the luminous flux shall be within the limits given on the relevant data sheet.

29.4.3 Color：

29.4.3.1 The colour of the light emitted shall be white or selective yellow. Moreover the colorimetric characteristics, expressed in CIE chromaticity coordinates, shall lie within the boundaries given on the relevant requirement.

29.4.3.2 The definitions of the colour of the light emitted, given in “031 The installation of lighting and light-signalling devices” and its series of amendments in force at the time of application for type approval shall apply to this Regulation.

29.4.3.3 The minimum red content of a gas-discharge light source shall be such that：

$$k_{red} = \frac{\int_{\lambda=610nm}^{780nm} E_e(\lambda) \cdot v(\lambda) \cdot d\lambda}{\int_{\lambda=380nm}^{780nm} E_e(\lambda) \cdot v(\lambda) \cdot d\lambda} \geq 0.05$$

Where：

E_e (lambda) [W / nm] is the spectral distribution of the radiant flux;

V (lambda) [I] is the spectral luminous efficiency;

λ (lambda) [nm] Is the wave length.

This value shall be calculated using intervals of one nanometre.

29.4.4 UV radiation: The UV radiation of a halogen lamp shall be such that the gas discharge light source is of the low UV type complying with：

$$k_{UV} = \frac{\int_{\lambda=250nm}^{400nm} E_e(\lambda) \cdot S(\lambda) \cdot d\lambda}{k_m \int_{\lambda=380nm}^{780nm} E_e(\lambda) \cdot v(\lambda) \cdot d\lambda} \leq 10^{-5} \quad W / lm$$

Where：

S(lambda) [l] is the spectral weighting function.

k_m = 683 lm / W is photometric radiation equivalent.

The UV radiation shall be weighted according to the values as indicated in the following table.

λ-lambda	S (λ-lambda)	λ-lambda	S(λ-lambda)
250	0.430	330	0.00041
255	0.520	335	0.00034
260	0.650	340	0.00028
265	0.810	345	0.00024
270	1.000	350	0.00020
275	0.960	355	0.00016
280	0.880	360	0.00013
285	0.770	365	0.00011
290	0.640	370	0.000090
295	0.540	375	0.000077
300	0.300	380	0.000064
305	0.060	385	0.000053
310	0.015	390	0.000044
315	0.003	395	0.000036
320	0.001	400	0.000030
325	0.00050		

29.4.5 Standard gas-discharge light sources：Standard (etalon) gas-discharge light sources shall comply with the requirements applicable to type approval light sources and to the specific requirements as stated in the relevant data sheet. In case of a type emitting white or selective yellow light, the standard light source shall emit white light.

29.5 General bulbs

29.5.1 Electrical and photometric measurements:

29.5.1.1 Filament lamps shall first be aged at their test voltage for approximately one hour. For dual-filament lamps, each filament shall be aged separately. In the case of filament lamps, for which more than one test voltage is specified, the highest test voltage value shall be used for ageing.

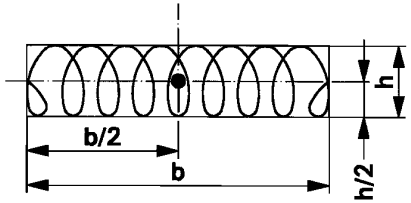
29.5.1.2 In case of a filament lamp having a coated bulb, after the ageing period corresponding to paragraph 29.5.1.1, the surface of the bulb shall be lightly wiped with a cotton cloth soaked in a mixture of 70 volume percent of n-heptane and 30 volume percent of toluol. After about five minutes, the surface shall be inspected visually. It shall not show any apparent changes.

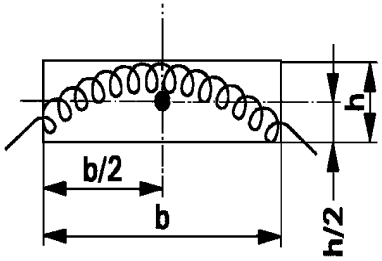
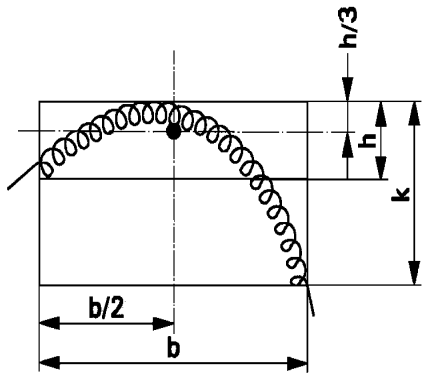
29.5.1.3 In the case where the selective-yellow color is allowed, the luminous flux of the filament lamp with the selective-yellow outer bulb shall be at least 85 % of the specified luminous flux of the relevant filament lamp emitting white light.

29.5.2 Filament position and dimensions:

29.5.2.1 The geometric shapes of the filament shall in principle be as specified on the filament lamp data sheets.

29.5.2.2 The position and dimensions of the filament shall be measured with the filament lamps being supplied with current at from 90 % to 100 % of the test voltage. In the case of filament lamps, for which more than one test voltage is specified, the highest test voltage value shall be used for measurement of the position and dimensions of the filament. If the filament is shown on the filament lamp data sheet in at least one view as a point, the position of the luminous centre shall be determined in conformity with the following table.

Item No.	Filament shapes	Observations
1		With b>1.5h, the deviation of the filament axis with respect to a plane normal to the reference axis shall not exceed 15°.

2		Only applicable to filaments which can be inscribed in a rectangle of b > 3h.
3		Applicable to filaments which can be inscribed in a rectangle of b □ 3h, whereby, however, k<2h.

29.5.2.3 The side lines of the circumscribed rectangles in Item Nos. 2 and 3 are parallel and perpendicular, respectively, to the reference axis. The luminous center is the intersection of the dash-dot lines.

29.5.2.4 The length of a line filament shall be determined by its ends, defined - unless otherwise specified on the relevant data sheet - as the apices of the first and the last filament turn as seen in projection perpendicular to the reference axis of the filament lamp. Such an apex shall comply with the requirement that the angle formed by the legs shall not exceed 90°. In the case of coiled-coil filaments the apices of the secondary turns shall be taken into account.

29.5.2.5 For axial filaments, the extreme position of the apices considered shall be determined by rotating the filament lamp about its reference axis. The length shall then be measured in a direction parallel to the reference axis.

29.5.2.6 For transverse filaments, the filament axis shall be placed perpendicular to the direction of projection. The length shall be measured in a direction perpendicular to the reference axis.

29.5.3 Color:

29.5.3.1 The colour of the light emitted by the filament lamp shall be white unless otherwise specified on the relevant data sheet.

29.5.3.2 The colourimetric characteristics of the light emitted, expressed in CIE trichromatic coordinates, shall lie within the following limits: Each measured value shall lie within the required tolerance area. For amber colour only, at least 80 per cent of the measuring results shall lie within the required tolerance area.

29.5.3.2.1.The definitions of the colour of the light emitted is defined in “The installation of lighting and light-signaling devices” of the “Directions”.

29.5.4 Ultraviolet (UV) radiation：The UV radiation of a halogen lamp shall be such that：

$$k_1 = \frac{\int_{\lambda=315nm}^{400nm} E_e(\lambda) \cdot d\lambda}{683 \int_{\lambda=380nm}^{780nm} E_e(\lambda) \cdot V(\lambda) \cdot d\lambda} \leq 2 \times 10^{-4} \quad W/lm$$

$$k_2 = \frac{\int_{\lambda=250nm}^{315nm} E_e(\lambda) \cdot d\lambda}{683 \int_{\lambda=380nm}^{780nm} E_e(\lambda) \cdot V(\lambda) \cdot d\lambda} \leq 2 \times 10^{-6} \quad W/lm$$

Where：

E_e (lambda) [W/nm] is the spectral distribution of radiant flux;

V (lambda) [I] is the spectral luminous efficiency;

km = 683 (lm/W) is the photometric radiation equivalent;

λ [nm] is the wavelength.

This value shall be calculated using intervals of five nanometres.

29.5.5 Check on optical quality (Applies only to filament lamps of categories R2, H4 and HS1)

29.5.5.1 This check on optical quality shall be carried out at a voltage such that the measuring luminous flux is obtained.

29.5.5.2 For 12-volt filament lamps emitting white light：The sample which most nearly conforms to the requirements laid down for the standard filament lamp shall be tested in a standard headlamp as specified in paragraph 29.5.5.5, and it shall be verified whether the assembly comprising the aforesaid headlamp and the filament lamp being tested meets the light-distribution

requirements laid down for the passing-beam in the relevant Regulation.

29.5.5.3 For 6-Volt and 24-Volt bulbs emitting white light： The sample which most nearly conforms to the nominal dimension values shall be tested in a standard headlamp as specified in paragraph 29.5.5.5, and it shall be verified whether the assembly comprising the aforesaid headlamp and the filament lamp being tested meets the light-distribution requirements laid down for the passing-beam in the relevant Regulation. Deviations not exceeding 10% of the minimum values will be acceptable.

29.5.5.4 Filament lamps emitting selective-yellow light shall be tested in the same manner as described in paragraph 29.5.5.2 and 29.5.5.3 in a standard headlamp as specified in paragraph 29.5.5.5 to ensure that the illumination complies with at least 85% for 12-Volt filament lamps, and at least 77% for 6-Volt and 24-Volt filament lamps with the minimum values of the light-distribution requirements laid down for the passing-beam in the relevant Regulation. The maximum illumination limits remain unchanged. In the case of a filament lamp having a selective-yellow bulb, this test shall be left out if the approval is also given to the same type of bulb emitting white light.

29.5.5.5 A headlamp shall be deemed to be a standard headlamp if：

29.5.5.5.1It satisfies the pertinent conditions of approval.

29.5.5.5.2It has an effective diameter of not less than 160 mm.

29.5.5.5.3With a standard filament lamp it produces at the various points and in the various zones specified for the headlamp type concerned, illumination equal to：

29.5.5.5.3.1 not more than 90% of the maximum limits

29.5.5.5.3.2 not less than 120% of the minimum limits prescribed for the headlamp type concerned.