

92 Road illumination devices (RID)

Refer to: R149 00

92.1 Effective date and Scope:

92.1.1 Effective date from 2025/1/1, following new types of devices shall comply with this regulation and shall use the light source complying with “Filament lamps” and/or “LED light sources” of this Direction.

92.1.1.1 Headlamps emitting a driving-beam and/or an asymmetrical passing-beam for vehicles of categories L, M, and N.

92.1.1.2 Adaptive front-lighting systems (AFS) for vehicles of categories M and N.

92.1.1.3 Headlamps emitting a driving-beam and/or a symmetrical passing-beam for vehicles of categories L.

92.1.1.4 Front fog lamps for vehicles of categories L3, L5, M and N.

92.1.2 The applicants applying for low volume safety type approval may be exempt from “Road illumination devices” of this regulation except for large passenger vehicle and child-only vehicle.

92.1.3 Applying for vehicle-by-vehicle low volume safety type approval, the vehicle may be exempt from regulation of “Rear fog lamps” and “Daytime running lamps”.

92.1.4 Technical Service can carry out test according to UN Regulations that this direction harmonized with: UN R149 00 Series of amendments and following amendments of above-mentioned regulations.

92.2 Definitions:

92.2.1 The definitions given in the VSTD of “The installation of lighting and light-signaling devices” in force at the time of application for type approval shall apply, unless otherwise specified.

92.3 Road illumination devices shall according to suitable type and range of principle :

92.3.1 The same brand

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92.3.1.1 Lamps bearing the same brand but produced by different manufacturers are considered as being of different types.

92.3.1.2 Lamps produced by the same manufacturer differing only by the brand are considered as being of the same type.

In the case of a type of lamp differing only by the brand (or mark) from a type that has already been approved it shall be sufficient to submit:

(a) A declaration by the lamp manufacturer that the type submitted is identical (except in the brand or mark) with and has been produced by the same manufacturer as the type already approved, the latter being identified by its approval code.

(b) Two samples bearing the new brand name or mark or equivalent documentation.

92.3.2 The same characteristics of the optical system.

92.3.3 The same Inclusion of additional components capable of altering the optical effects by reflection, refraction, absorption and/or deformation during operation.

92.3.4 For headlamps: the same kind of beam produced (passing beam, driving beam or both).

92.3.5 For AFS: the same front-lighting function(s), mode(s) and classes produced.

92.3.6 For AFS: the same characteristic(s) of the signal(s), specified for the system.

92.3.7 The same category of light source(s) used and/or the LED module specific identification code(s).

92.3.8 A device intended for the installation on the left side of the vehicle and the corresponding device intended for the installation on the right side of the vehicle shall be considered to be of the same type.

92.4 General technical requirements

Each lamp submitted for approval shall conform to the requirements set forth in paragraph 92.4 and 92.5.

The requirements contained in paragraph 3-4.4. and 3-4.5 of "The installation of lighting and light-signaling devices", and their series of amendments in force at the time of application for the lamp type approval shall apply to this Regulation.

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The requirements pertinent to each lamp and to the category/ies of vehicle on which the lamp is intended to be installed shall be applied, where its verification at the moment of lamp type approval is feasible.

92.4.1 The lamps must be so designed and constructed that in normal conditions of use, and notwithstanding the vibrations to which they may be subjected in such use, their satisfactory operation remains assured and they retain the characteristics prescribed by this Regulation.

92.4.2 Lamps shall be so made that they give adequate illumination without dazzle when emitting the passing-beam, and good illumination when emitting the driving-beam.

Bend lighting may be produced by activating one additional filament light source, one or more additional LED light source(s), or one or more additional LED module(s) being part of a lamp producing a passing beam.

92.4.3 Lamps shall be fitted with a device enabling them to be so adjusted on the vehicles as to comply with the rules applicable to them. In case of the headlamps of classes AS, BS, CS, DS and ES, such a device may or may not provide horizontal adjustment, provided that the headlamps are so designed that they can maintain a proper horizontal aiming even after the vertical aiming adjustment.

92.4.4 Where a lamp producing a principal passing-beam and a lamp producing a driving-beam, each equipped with its own light source(s) or LED module(s), the adjusting device shall enable the principal passing-beam and the driving-beam to be adjusted individually. However, these provisions shall not apply to assemblies whose reflectors are indivisible

92.4.5 Light sources

92.4.5.1 Restrictions on light sources

92.4.5.1.1 The lamp shall only be equipped with light source(s) approved according to "VSTD" of "Filament lamps" and/or "LED light sources" of this Direction.

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92.4.5.1.2 Front fog lamps, irrespective of whether the light sources can be replaced or not, shall only be equipped with one or more light sources approved according to:

- (a) It shall conform to requirements concerning filament lamp of "Filament lamps" regulated in VSTD, or
- (b) It shall conform to requirements concerning gas-discharge light source of "Filament lamps" regulated in VSTD, or
- (c) It shall conform to requirements concerning gas-discharge light source of "LED light sources" regulated in VSTD, and/or one or more LED modules where the requirements in paragraph 92.11. to this Regulation shall apply.

92.4.5.1.3 Headlamps of class D shall only be equipped with:

92.4.5.1.3.1 In case of the principal passing beam, one gas-discharge light source.

A maximum of two additional light sources are permitted for the passing beam as follows:

- (a) One additional filament light source approved according to "Filament lamps" regulated in VSTD, one or more additional LED light source(s) approved according to "LED light sources" regulated in VSTD, or one or more additional LED module(s) may be used inside the passing beam headlamp to contribute to bend lighting.
- (b) One additional filament light source approved according to "Filament lamps" regulated in VSTD, one or more additional LED light source(s) approved according to "LED light sources" regulated in VSTD and/or one or more LED module(s) inside the passing beam headlamp, may be used for the purposes of generating infrared radiation. It/they shall only be activated at the same time as the gas discharge light source. In the event that the gas-discharge light source fails, this additional filament light source, LED light source(s) and/or LED module(s) shall be automatically switched off.

In the event of failure of an additional filament or LED light source or LED module, the headlamp shall continue to fulfil the requirements of the passing beam.

92.4.5.1.3.2 In case of the driving beam, one or more filament light sources approved according to “Filament lamps” regulated in VSTD, one or more gas-discharged light source approved according to “Filament lamps”, one or more LED light sources approved according to “LED light sources” regulated in VSTD and/or LED module(s). Where more than one light source is used to provide the driving beam, these light sources shall be operated simultaneously.

92.4.5.1.4 Headlamps of classes A and B shall only be equipped with:

92.4.5.1.4.1 In case of the principal passing beam, one filament light source approved according to “Filament lamps” regulated in VSTD, one or more LED light source(s) approved according to “LED light sources” regulated in VSTD or one or more LED module(s).

Additional light sources are permitted for the passing beam as follows:

- (a) One additional filament light source approved according to “Filament lamps” regulated in VSTD, one or more additional LED light source(s) approved according to “LED light sources” regulated in VSTD, or one or more additional LED module(s) may be used inside the passing beam headlamp to contribute to bend lighting.
- (b) One additional filament light source approved according to “Filament lamps” regulated in VSTD, one or more additional LED light source(s) approved according to “LED light sources” regulated in VSTD and/or one or more LED module(s) inside the passing beam headlamp, may be used for the purposes of generating infrared radiation. It/they shall only be activated at the same time as the principal passing beam. In the event that the principal light beam fails, this/these additional light source(s) and/or LED module(s) shall be automatically switched off.

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In the event of failure of an additional filament light source, one of more additional LED light source(s) or one or more additional LED module(s), the headlamp shall continue to fulfil the requirements of the passing beam.

92.4.5.1.4.2 In case of the driving beam, irrespective of the type of light source (LED module(s) or filament or LED light source(s)) used to produce the principal passing-beam, one or more filament light sources approved according to "Filament lamps" regulated in VSTD, one or more LED light source(s) approved according to "LED light sources" regulated in VSTD or one or more LED module(s).

92.4.5.1.5 Headlamps of classes AS, BS, CS, DS shall only be equipped with:

92.4.5.1.5.1 In case of the principal passing beam, one or two filament light sources approved according to "Filament lamps" regulated in VSTD, one or more LED light source(s) approved according to "LED light sources" regulated in VSTD and/or one or more LED module(s).

In the case of the use of additional light source(s) and/or additional lighting unit(s) to provide bend lighting, only filament light sources approved according to "Filament lamps" regulated in VSTD, LED light sources approved according to "LED light sources" regulated in VSTD and/or LED modules(s) shall be used.

92.4.5.1.5.2 In case of the driving beam, irrespective of the type of light source (LED module(s) or filament or LED light source(s)) used to produce the principal passing-beam, one or more filament light sources approved according to "Filament lamps" regulated in VSTD, one or more LED light sources approved according to "LED light sources" regulated in VSTD or one or more LED module(s).

92.4.5.1.6 Headlamps of class ES shall only be equipped with:

92.4.5.1.6.1 In case of the principal passing beam, one gas-discharge light source approved according to "Filament lamps" regulated in VSTD, one or more LED light source(s) approved according to "LED light sources" regulated in

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VSTD or one or more LED module(s).

In the case of the use of additional light source(s) and/or additional lighting unit(s) to provide bend lighting, only filament light sources approved according to "Filament lamps" regulated in VSTD, LED light sources approved according to "LED light sources" regulated in VSTD and/or LED modules(s) shall be used.

92.4.5.1.6.2 In case of the driving beam, irrespective of the type of light source (LED module(s) or gas-discharge or LED light source(s)) used to produce the principal passing-beam, one or more gas-discharged light sources approved according to "Filament lamps" regulated in VSTD, one or more LED light sources approved according to "LED light sources" regulated in VSTD or one or more LED module(s).

92.4.5.1.7 AFS of classes C, E, V, W, R shall only be equipped with one or a combination of:

- (a) Filament light sources approved according to "Filament lamps" regulated in VSTD;
- (b) Gas-discharge light sources approved according to "Filament lamps" regulated in VSTD;
- (c) LED light sources approved according to "LED light sources" regulated in VSTD;
- (d) LED module(s).

However, the class C (basic) passing beam shall be equipped only with replaceable light sources or replaceable or non-replaceable LED modules.

92.4.5.2 General requirements for light sources

92.4.5.2.1 In case a light source category or categories or type(s) is restricted for use in lamps on vehicles in use and originally equipped with such lamps, the applicant for type approval of the lamp shall declare that the lamp is only intended for installation on those vehicles.

92.4.5.2.2 In case of replaceable light source(s),

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- (a) The design of the lamp shall be such that the light source(s) can be fixed in no other position but the correct one;
- (b) The light source(s) holder shall conform to the characteristics given in IEC Publication 60061. The holder data sheet relevant to the category of light source(s) used, applies.

92.4.5.2.3 Electronic light source control gear(s), if applicable, shall be considered to be part of the lamp; they may be part of the LED module(s).

92.4.5.2.4 The headlamp of class D and/or class ES and its ballast system or light source control gear shall not generate radiated or power line disturbances, which cause a malfunction of other electric/electronic systems of the vehicle.

92.4.5.2.5 Front fog lamps, designed to operate permanently with an additional system to control the intensity of the light emitted, or which are reciprocally incorporated with another function, using a common light source, and designed to operate permanently with an additional system to control the intensity of the light emitted, are permitted.

92.4.5.2.6 Except for AFS and cornering lamps, in case of a lamp incorporating one or more light source(s) or LED module(s) producing the principal passing-beam or the front fog beam and having a total objective luminous flux which exceeds 2,000 lumens, a reference shall be made in the report.

In case of an AFS incorporating light sources and/or LED module(s) producing the basic passing beam and having a total objective luminous flux of the lighting units which exceeds 2,000 lumen per side, a reference shall be made in the report.

The objective luminous flux of LED modules shall be measured as described in paragraph 92.11.5.

92.4.5.2.7 A LED module shall be:

- (a) Only removable from its device with the use of tools, unless it is stated in the communication sheet that the LED module is non-replaceable; and

(b) So designed that regardless of the use of tool(s), it is not mechanically interchangeable with any replaceable approved light source.

92.4.5.3 Specific requirements for light sources

92.4.5.3.1 For headlamps, AFS and front fog lamp equipped with LED light source(s) and/or LED module(s):

92.4.5.3.1.1 Electronic light source control gear(s) associated with the operation of LED module(s), if applicable, shall be considered to be part of the lamp; they may be part of the LED module(s).

92.4.5.3.1.2 The lamp and the LED module(s) themselves shall comply with the relevant requirements specified in paragraph 92.11 to this Regulation. The compliance with the requirements shall be tested.

92.4.5.3.1.3 In case of the headlamp of classes A, B, D and AFS, the total objective luminous flux of all LED light sources and/or LED modules producing the principal passing beam and measured as described in paragraph 92.11.5 (LED modules only) shall be equal or greater than 1,000 lumens.

92.4.5.3.1.4 In case of the headlamp of classes AS, BS, CS and DS, the total objective luminous flux of all LED light sources and/or LED modules producing the principal passing beam and measured as described in paragraph 92.11.5(LED modules only) shall be within the limits in Table 1.

	Headlamps Class AS	Headlamps Class BS	Headlamps Class CS	Headlamps Class DS
Passing beam minimum	150 lumen	350 lumen	500 lumen	1,000 lumen
Passing beam maximum	900 lumen	1,000 lumen	2,000 lumen	2,000 lumen

Table 1: "Classes AS, BS, CS and DS - Passing beam minimum and maximum limits for luminous flux

92.4.5.3.1.5 In case of headlamps of class ES, the total objective luminous flux of all LED light sources and/or LED

modules producing the principal passing beam and measured as described in paragraph 92.11.5 shall be within the limits in Table 2.

	Headlamps Class ES
Passing beam minimum	2,000 lumen

Table 2: "Class ES - Passing beam minimum limit for luminous flux"

92.4.5.3.1.6 In the case of a replaceable LED module the removal and replacement of this LED module, as described in paragraph 92.11.1.4.1. shall be demonstrated to the satisfaction of the Technical Service.

92.4.5.3.1.7 According to "The installation of lighting and light-signaling devices" of VSTD, LED modules may contain holders for other light sources.

92.4.5.3.2 In case of headlamps of classes AS, BS, CS and DS, the reference luminous flux at 13.2 V of each filament light source for the principal passing beam does not exceed 900 lm for classes AS and BS and 2,000 lm for classes CS and DS.

92.4.6 Testing of the lamp

Depending on the light source used, the following conditions shall apply.

92.4.6.1 In the case of replaceable filament light sources:

92.4.6.1.1 In the case of filament light sources operating directly under vehicle voltage system conditions:

The lamp shall be checked by means of colourless standard (etalon) filament light sources as specified in "Filament lamps" regulated in VSTD;

During the testing of the lamp, the power supply to the filament light source(s) shall be regulated so as to obtain the

reference luminous flux at 13.2 V as indicated on the relevant data sheet of "Filament lamps" regulated in VSTD.

However, if a filament light source of category H9 or H9B is used for the principal passing-beam, the applicant may choose the reference luminous flux at 12.2 V or 13.2 V as indicated in the relevant data sheet of "Filament lamps" regulated in VSTD.

92.4.6.1.2 In order to protect the standard (etalon) filament light source during the process of photometric measurement it is permissible to carry out the measurements at a luminous flux that differs from the reference luminous flux at 13.2 V. If the Technical Service chooses to carry out measurements in such a manner, the luminous intensity shall be corrected by multiplying the measured value by the individual factor F_{lamp} of the standard (etalon) filament light source in order to verify the compliance with the photometric requirements.

where:

$$F_{lamp} = \phi_{reference} / \phi_{test}$$

$\phi_{reference}$ is the reference luminous flux at 13,2 V as specified in the relevant data sheet of "Filament lamps" regulated in VSTD.

ϕ_{test} is the actual luminous flux used for the measurement.

However, where the reference luminous flux of 12.2 V as specified in the data sheet for the category H9 or H9B is chosen, this procedure is not permitted.

92.4.6.2 In the case of a gas-discharge light source:

A standard light source shall be used as specified in "Filament lamps" regulated in VSTD which has been aged during at least 15 cycles.

During testing of the lamp the voltage at the terminals of the ballast or at the terminals of the light source in case the ballast is integrated with the light source shall be regulated to maintain 13.2 V for a 12 V system, or at the vehicle voltage as specified by the applicant, with a tolerance of +/-0.1 V.

The objective luminous flux of the gas-discharge light source may differ from that specified in "Filament lamps" regulated in VSTD. In this case, the luminous intensity values shall be corrected accordingly.

92.4.6.3 In the case of replaceable LED light sources:

The lamp shall be checked by means of a standard light source as specified in "LED light sources" regulated in VSTD.

During testing of the lamp, the voltage supplied to the light source(s) shall be regulated to maintain 13.2 V or 13.5 V (optionally for cornering lamps only) for a 12 V system or 28 V for a 24 V system, or at the vehicle voltage as specified by the applicant, with a tolerance of +/-0.1 V.

The luminous intensity values produced shall be corrected. The correction factor is the ratio between the objective luminous flux and the value of the luminous flux found at the voltage applied.

In the case of more than one LED light source, the mean value of the correction factors shall be applied, while each individual correction factor shall not deviate more than 5 per cent from this mean value.

92.4.6.4 In the case of LED modules:

All measurements on lamps equipped with LED module(s) shall be made at 6.3 V, 13.2 V or 28.0 V respectively, if not otherwise specified within this Regulation. LED modules operated by an electronic light source control gear shall be measured with the input voltage as specified by the applicant or with a supply and operating device which replace this control gear for the photometric test.

92.4.6.5 In the case of non-replaceable light sources, only, if allowed according to the requirements of paragraph 92.4:

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All measurements on lamps equipped with non-replaceable light sources shall be made at 6.3 V or 6.75 V (optionally for cornering lamps only), 13.2 V or 13.5 V (optionally for cornering lamps only) or 28.0 V or at other vehicle voltage as specified by the applicant. The test laboratory may require from the applicant the special power supply needed to supply the light sources. The test voltages shall be applied to the input terminals of the lamp.

92.4.6.6 In the case of a lamp that uses a light source control gear being part of the lamp, the voltage declared by the applicant shall be applied to the input terminals of that lamp.

92.4.6.7 In the case of a lamp that uses a light source control gear not being part of the lamp the voltage declared by the applicant shall be applied to the input terminals of that light source control gear. The test laboratory shall require from the applicant the special light source control gear needed to supply the light source and the applicable functions. The identification of that light source control gear if applicable and/or the voltage applied, including the tolerances, shall be noted in the report.

92.4.6.8 In the case of headlamps or AFS equipped with different kinds of light sources, the part of the lamp equipped:

- (a) With replaceable filament light sources shall be tested according to paragraph 92.4.6.1;
- (b) With a gas-discharge light source shall be tested according to paragraph 92.4.6.2;
- (c) With replaceable LED light sources shall be tested according to paragraph 92.4.6.3;
- (d) With LED modules shall be tested according to paragraph 92.4.6.4. and then added to the previous result obtained from the light sources tested.

92.4.7 Testing of light transmitting components made of plastic material (except for cornering lamps and headlamps of classes AS).

92.4.7.1 If the outer lens of the lamp is made of plastic material tests shall be done according to the requirements in paragraph 92.10.

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92.4.7.2 The UV resistance of light transmitting components located inside a front fog lamp and made of plastic material shall be tested according to paragraph 92.10.4.7.2.

92.4.7.2.1 The test prescribed in paragraph 92.10.4.7.2. is not necessary if low-UV type light sources as specified either in the "Filament lamps" regulated in VSTD or in paragraph 92.11 are used, or if provisions are taken, to shield the relevant lamp components from UV radiation, e.g. by glass filters.

92.4.8 The sharpness and linearity of the cut-off, if applicable, shall be tested according to the requirements in paragraph 92.7 or 92.8 respectively.

92.4.9 Complementary tests shall be done according to the requirements in paragraph 92.9 to ensure that in use there is no excessive change in photometric performance.

92.4.10 Testing of mechanical or electromechanical structures

92.4.10.1 On headlamps or a system designed to provide alternately a driving-beam and a passing-beam, or a passing-beam and/or a driving-beam designed to become bend lighting, any mechanical, electromechanical or other device incorporated in the headlamp and lighting unit(s) for these purposes shall be so constructed that:

92.4.10.1.1 The device is robust enough to withstand 50,000 operations under normal conditions of use. In order to verify compliance with this requirement, the Technical Service responsible for approval tests may:

- (a) Require the applicant to supply the equipment necessary to perform the test;
- (b) Forego the test if the headlamp presented by the applicant is accompanied by a test report, issued by a Technical Service responsible for approval tests for headlamps of the same construction (assembly), confirming compliance with this requirement.

92.4.10.2 Headlamps of classes A, B and D:

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92.4.10.2.1 In the case of failure, the luminous intensity above the line H-H shall not exceed the values of a passing-beam according to paragraph 92.5.2.; in addition, on headlamps designed to provide a passing and/or a driving-beam to become a bend lighting, a minimum luminous intensity of at least 2,500 cd. shall be fulfilled in test point 25 V (VV line, 1.72D).

92.4.10.2.2 Either the principal passing-beam or the driving-beam shall always be obtained without any possibility of the mechanism stopping in between two positions.

92.4.10.3 Headlamps of classes AS, BS, CS, DS and ES:

92.4.10.3.1 Except for additional light source(s) and additional lighting unit(s) used to produce bend lighting, in the case of failure it must be possible to obtain automatically a passing beam or a state with respect to the photometric conditions which yields values not exceeding 1,200 cd in Zone 1 and at least 2400 cd at 0,86D-V by such means as e.g. switching off, dimming, aiming downwards, and/or functional substitution.

92.4.10.3.2 Except for additional light source(s) and additional lighting unit(s) used to produce bend lighting, either the passing beam or the driving beam shall always be obtained without any possibility of the mechanism stopping in between the two positions.

92.4.10.4 AFS:

92.4.10.4.1 Except in the case of adaptation of the driving-beam, either the passing-beam or the driving-beam shall always be obtained, without any possibility of remaining in an intermediate or undefined state; if this is not possible, such a state must be covered by the provisions according to paragraph 92.4.10.4.2.

92.4.10.4.2 In the case of failure it must be possible to obtain automatically a passing-beam or a state with respect to the photometric conditions which yields values not exceeding 1,300 cd in the zone III b (refers to paragraph 92.5.3) and at

least 3,400 cd in a point of "segment I_{max}".

When performing the tests to verify compliance with these requirements, the Technical Service responsible for approval tests shall refer to the instructions supplied by the applicant.

92.4.10.5 The user cannot, with ordinary tools, change the shape or position of the moving parts, or influence the switching device.

92.4.11 If applicable, the lamp shall be so made that a failure signal in order to comply with the relevant provisions of "The installation of lighting and light-signaling devices" of VSTD is provided.

92.4.12 The component(s) to which a replaceable light source is assembled shall be so made that the light source fits easily and, even in darkness, can be fitted in no position but the correct one.

92.4.13 For photometric adjustment and measuring conditions, see paragraph 92.6.

92.4.13.1 In the case of lamps with replaceable light sources, the lamp shall be considered acceptable if it meets the requirements of paragraph 92.5. with at least one standard (etalon) light source, which may be submitted with the lamp.

92.4.14 Colour of light emitted:

The colour of the light emitted shall be white for all lamps. However, for front fog lamps the colour of the light emitted may be selective yellow if requested by the applicant.

92.4.14.1 The colorimetric characteristics of the lamps incorporating LED modules shall be measured according to paragraph 92.11.4.3.2.

92.4.15 In the case of headlamps or AFS with adjustable reflector, for verification the following procedure shall be used:

92.4.15.1 Each applied position is realized on the test goniometer with respect to a line joining the centre of the light source and point HV on a aiming screen. The adjustable reflector/ system or part(s) thereof is then moved into such a position that the light pattern on the screen corresponds to the relevant aiming prescriptions;

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92.4.15.2 With the reflector/system or part(s) thereof initially fixed according to paragraph 92.4.17.1., the device or part(s) thereof must meet the relevant photometric requirements of paragraphs 92.5.1 to 92.5.4;

92.4.15.3 Additional tests shall be made after the reflector/system or part(s) thereof has been moved vertically ± 2 deg. or at least into the maximum position, if less than 2 deg., from its initial position by means of the headlamps/systems or part(s) thereof adjusting device. Having re-aimed the headlamp/system or part(s) thereof as a whole (by means of the goniometer for example) in the corresponding opposite direction the light output in the following directions shall be controlled and lie within the required limits:

92.4.15.3.1 passing-beam:

For headlamp points B50L and 75 R (B50R and 75 L, respectively);

For AFS points B50L and 75R, or 50R if applicable;

For class AS, BS, CS, DS, and ES, points HV and 0.86D-V;

92.4.15.3.2 Driving-beam: IM and point HV (percentage of I_M).

92.4.15.4 If the applicant has indicated more than one mounting position, the procedure of paragraphs 92.4.15.1. to 92.4.15.3. shall be repeated for all other positions.

92.4.15.5 If the applicant has not asked for special mounting positions, the headlamp/system or part(s) thereof shall be aimed for measurements of paragraphs 92.5.1. to 92.5.4. with the relevant adjusting device(s) in its mean position. The additional test of paragraph 92.4.15.3 shall be made with the reflector/system or part(s) thereof moved into its extreme positions (instead of ± 2 deg.) by means of the relevant adjusting device(s).

92.5 Specific Technical Requirements

92.5.1 Technical requirements concerning driving-beam of the Class A, B, D (GDL), BS, CS, DS or ES (GDL) (symbols "R", "HR", "DR",
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"XR", "R-BS", "WR-CS", "WR-DS" or "WR-ES")

92.5.1.1 In the case of a road illumination device designed to provide a driving-beam and a passing-beam, measurements of the luminous intensity of the driving-beam shall be taken with the same alignment as for measurements under paragraphs 92.5.2. to 92.5.4.

In the case of a road illumination device providing a driving-beam only, it shall be so adjusted that the area of maximum luminous intensity is centred on the point of intersection of lines H-H and V-V; such a device needs to meet only the requirements referred to in paragraph 92.5.1.3.

For devices where more than one light source is used to provide the driving-beam, these light sources shall be operated simultaneously to determine the maximum value of the luminous intensity (I_M). It is also possible that a part of the driving beam produced by one of these light sources will be used exclusively for short time signals "flash to pass" as declared by the applicant. This shall be indicated in the relevant drawing and a remark shall be made in the report.

92.5.1.2 Irrespective of the type of light source used to produce the principal passing-beam, several light sources are allowed to be used for each individual driving-beam.

92.5.1.3 Requirements for the luminous intensity distribution of the driving-beams:

92.5.1.3.1 Referring to Figure 2 the luminous intensity distribution of the driving-beam shall meet the following requirements.

		Class A Headlamp	Class B Headlamp	Class D Headlamp
Test point	Angular coordinates	Required luminous intensity	Required luminous intensity	Required luminous intensity
	Degrees	cd	cd	cd
		Min	Min	Min
I_M		27,000	40,500	43,800
H-5L	0.0, 5.0 L	3,400	5,100	6,250
H-2.5L	0.0, 2.5 L	13,500	20,300	25,000
H-2.5R	0.0, 2.5 R	13,500	20,300	25,000
H-5R	0.0, 5.0 R	3,400	5,100	6,250

Table 3: Luminous intensity requirements for driving-beam

92.5.1.3.2 Referring to Figure 3 the luminous intensity distribution of a primary driving-beam shall meet the following requirements.

Test point number	Test point angular coordinates - degrees*	Required luminous intensity [cd]					
		Class BS		Class CS		Class DS, ES	
		MIN	MAX	MIN	MAX	MIN	MAX
1	H-V	16,000	---	20,000	---	30,000	---
2	H-2.5 deg. R and 2.5 deg. L	9,000	---	10,000	---	20,000	---
3	H-5 deg. R and 5 deg. L	2,500	---	3,500	---	5,000	---
4	H-9 deg. R and 9 deg. L	---	---	2000	---	3,400	---
5	H-12 deg. R and 12 deg. L	---	---	600	---	1,000	---
6	2 deg. U-V	---	---	1000	---	1,700	---
	MIN luminous intensity of the maximum (I_M)	20,000	---	25,000	---	40,000	---
	MAX luminous intensity of the maximum (I_M)	---	215,000	---	215,000	---	215,000

* 0.25 deg. tolerance allowed independently at each test point for photometry unless indicated otherwise.

Table 4: Luminous intensity distribution of a primary driving-beam

92.5.1.3.3 Referring to Figure 4 the luminous intensity distribution of a secondary driving-beam shall meet the following requirements.

Test point number	Test point angular coordinates - degrees*	Required luminous intensity [cd]					
		Class BS		Class CS		Classes DS, ES	
		MIN	MAX	MIN	MAX	MIN	MAX
1	H-V	16,000	---	20,000	---	30,000	---
2	H-2.5 deg. R and 2.5 deg. L	9,000	---	10,000	---	20,000	---
3	H-5 deg. R and 5 deg. L	2,500	---	3,500	---	5,000	---
6	2 deg. U-V	---	---	1,000	---	1,700	---
	MIN luminous intensity of the maximum (I_M)	20,000	---	25,000	---	40,000	---
	MAX luminous intensity of the maximum (I_M)	---	215,000	---	215,000	---	215,000

* 0.25 deg. tolerance allowed independently at each test point for photometry unless indicated otherwise.

Table 5: Luminous intensity distribution of a secondary driving-beam

92.5.1.3.4 Except for classes BS, CS, DS and ES, the point of intersection (HV) of lines h h and v v shall be situated within the isocandela 80 per cent of maximum luminous intensity(I_{max})

92.5.1.3.5 The maximum value (I_M) shall in no circumstances exceed 215,000 cd.

92.5.1.3.6 The reference mark (I'_M) of the maximum luminous intensity shall be obtained by the ratio:

$$I'_M = I_M / 4,300$$

This value shall be rounded off to the value 5 - 7.5 - 10 - 12.5 - 17.5 - 20 - 25 - 27.5 - 30- 37.5 - 40 - 45 - 50.

92.5.2 Technical requirements concerning headlamps to provide a passing-beam of the Class A, B and D (GDL) (symbols "C", "HC" and "DC")

92.5.2.1 The headlamp shall be aimed according to paragraph 92.7.1.2.

If, however, vertical adjustment cannot be performed repeatedly to the required position within the allowed tolerances, the instrumental method of paragraph 92.7.2. shall be applied to test compliance with the required minimum quality of the "cut-off" line and to perform the beam vertical adjustment.

92.5.2.1.1 When so aimed, the headlamp shall:

- (i) If its approval is sought solely for provision of a passing-beam, comply with the requirements set out in paragraph 92.5.2.2;
- (ii) If it is intended to provide both a passing-beam and a driving-beam, comply with the requirements set out in paragraphs 92.5.2.2. and 92.5.1.

92.5.2.1.2 Where a headlamp so aimed does not meet the requirements set out in paragraphs 92.5.2.2. and 92.5.1., its alignment may be changed according to the provisions in paragraph 92.7.1.2.3.

92.5.2.2 The passing-beam shall meet the luminous intensities at the test points referred to in Table 6 and in Figures 5 or 6.

Passing-beam headlamps with gas-discharge light sources shall meet these luminous intensities only after more than 10 minutes after ignition.

Headlamps for RH Passing beam of		Class A	Class B	Class D
P a r	See beam pattern in paragraph 92.6	Figure 5	Figure 5	Figure 6
	Position in degrees			

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t	A	No.	Element	horizontal		vertical						
				at/from	to	at	min	max	min	max	min	max
		1	B50L	3.43 L		0.57 U		350		350		350
		2	BR	2.50 R		1.00 U		1,750		1,750		
		3	Zone III (see Part C)					625		625		625
		4	50R	1.72 R		0.86 D	5,100		10,100		12,500	
		5	75R	1.15 R		0.57 D	5,100		10,100		12,500	
		6	50V	V		0.86 D			5,100		7,500	
		7	50L	3.43 L		0.86 D	3,550	13,200*	6,800	13,200*		18,480
		8	75L	3.43 L		0.57 D		10,600		10,600		
		9	25L1	3.43L		1.72 D						18,800
		10	25L2	9.00 L		1.72 D	1,250		1,700		2,500	
		11	25R1	9.00 R		1.72 D	1,250		1,700		2,500	
		12	25L3	15.00 L		1.72 D					1,250	
		13	25R2	15.00 R		1.72 D					1,250	
		14	15L	20.00 L		2.86 D					625	
		15	15R	20.00 R		2.86 D					625	
			Segment IA to B	5.15 L	5.15 R	0.86 D					3,750	
			Segment IC to D	2.50 R		1.00 U						1,750
			Segment III and under	9.37 L	8.50 R	4.29 D						12,500
			Zone IV	5.15 L to 5.15 R – 0.86D to 1.72D			1,700		2,500			
			Zone I	9.00 L to 9.00 R – 1.72 D to 4.00 D				17,600		< 2I**		
			E _{max} R	Vertical above 1.72D, right of V-V line								43,800

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Headlamps for RH Passing beam of					Class A		Class B		Class D		
Part A		See beam pattern in paragraph 92.6			Figure 5		Figure 5		Figure 6		
		Position in degrees									
		horizontal		vertical							
	No.	Element	at/from	to	at	min	max	min	max	min	max
	E _{max} L	Left of V-V line									31,300

Headlamps for RH			
Part B	Test point	Angular coordinates Degrees	Required luminous intensity in cd
	B1	4.00 U – 8.00 L	Points B1+B2+B3 190 min.
	B2	4.00 U – 0	
	B3	4.00 U – 8.00 R	
	B4	2.00 U – 4.00 L	Points B4+B5+B6 375 min.
	B5	2.00 U – 0	
	B6	2.00 U – 4.00 R	
	B7	0 – 8.00 L	65 min.
	B8	0 – 4.00 L	125 min.

Zone III (bounded by the following coordinates in degree)								
Part C	8.00 L	8.00 L	8.00 R	8.00 R	6.00 R	1.50 R	V-V	4.00 L
	1.00 U	4.00 U	4.00 U	2.00 U	1.50 U	1.50 U	H-H	H-H

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Notes:

Letter L means that the point is located on the left of VV line.

Letter R means that the point is located on the right of VV line.

Letter U means the point is located above HH line.

Letter D means the point or segment is located below HH line.

* In case where a headlamp in which LED modules are producing a passing-beam in conjunction with an electronic light source control gear, the measured value shall not be more than 18,500 cd.

** Actual measured value at points 50R / 50L respectively.

Table 6: Luminous intensities of passing-beam (all intensities expressed in cd)

92.5.2.3 There shall be no lateral variations detrimental to good visibility in any of the zones I, III and IV.

92.5.2.4 The requirements in paragraph 92.5.2.2. shall also apply to headlamps designed to provide bend lighting and/or that include the additional light source(s) or LED module(s) referred to in paragraph 92.5.2.5.2.

In the case of a headlamp designed to provide bend lighting its alignment may be changed, provided that the axis of the beam is not displaced vertically by more than 0.2 deg.

92.5.2.4.1 If bend lighting is obtained by:

92.5.2.4.1.1 Swivelling the passing-beam or moving horizontally the kink of the elbow of the cutoff, the measurements shall be carried out after the complete headlamp assembly has been reaimed horizontally, e.g. by means of a goniometer;

92.5.2.4.1.2 Moving one or more optical parts of the headlamp without moving horizontally the kink of the elbow of the cut-off, measurements shall be carried out with these parts being in their extreme operating position;

92.5.2.4.1.3 Means of additional light source(s) or LED module(s) without moving horizontally the kink of the elbow of the

cut-off, measurements shall be carried out with this/these light source(s) or LED module(s) activated.

92.5.2.5 Only one filament light source, one gas-discharge light source, one or more LED light source(s) or one or more LED module(s) are permitted for the principal passing-beam. Additional light sources or LED modules are permitted only as follows:

92.5.2.5.1 One additional filament light source according to " Filament lamps" regulated in VSTD, one or more additional LED light source(s) according to "LED light sources" regulated in VSTD or one or more additional LED module(s) may be used inside the passing-beam headlamp to contribute to bend lighting;

92.5.2.5.2 One additional filament light source according to " Filament lamps" regulated in VSTD, one or more additional LED light source(s) according to "LED light sources" regulated in VSTD and/or one or more LED module(s), inside the passing-beam headlamp, may be used for the purposes of generating infrared radiation. It/they shall only be activated at the same time as the principal light source or LED module(s). In the event that the principal light source or (one of) the principal LED module(s) fails, this additional light source and/or LED module(s) shall be automatically switched off;

92.5.2.5.3 In the event of failure of an additional filament light source, one or more additional LED light source(s) or one or more additional LED module(s), the headlamp shall continue to fulfil the requirements of the passing-beam.

92.5.3 Technical requirements concerning adaptive front-lighting systems (AFS) (symbols "XC", "XCE", "XCV", "XCW" and "XR")

92.5.3.1 General provisions

92.5.3.1.1 Each system shall provide a Class C passing-beam according to paragraph 92.5.3.2.4. and one or more passing-beam(s) of additional class(es); it may incorporate one or more additional modes within each class of passing-beam and the front-lighting functions according to paragraph 92.5.3.3.

92.5.3.1.2 The system shall provide automatic modifications, such, that good road illumination is achieved and no discomfort

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is caused, neither to the driver nor to other road users.

92.5.3.1.3 The system shall be considered acceptable if it meets the relevant photometric requirements of paragraphs 92.5.3.2. and 92.5.3.3.

92.5.3.1.4 Photometric measurements shall be performed according to the applicant's description:

92.5.3.1.4.1 At neutral state;

92.5.3.1.4.2 At V-signal, W-signal, E-signal, T-signal whichever apply;

92.5.3.1.4.3 If applicable, at any other signal(s) and combinations of them, according to the applicant's specification.

92.5.3.1.4.4 In case of a headlamp using a gas-discharge light source with the ballast not integrated with the light source, four seconds after ignition of a headlamp that has not been operated for 30 minutes or more:

92.5.3.1.4.4.1 At least 37,500 cd shall be attained at point HV, for a system producing driving-beam only.

92.5.3.1.4.4.2 At least 3,100 cd shall be attained at point 50 V when the Class C passing-beam is activated, for systems producing passing-beam only or alternately producing passingbeam and driving-beam functions as described in paragraphs 92.4.10.1. and 92.4.10.4.

92.5.3.1.4.4.3 In either case the power supply shall be sufficient to secure the required rise of the high current pulse.

92.5.3.2 Provisions concerning the passing-beam

The system shall, prior to the subsequent test procedures, be set to the neutral state, emitting the Class C passing-beam.

92.5.3.2.1 For each side of the system (vehicle) the passing-beam in its neutral state shall produce from at least one lighting unit a "cut-off" as defined in paragraph 92.7 or,

92.5.3.2.1.1 The system shall provide other means, e.g. optical features or temporary auxiliary beams, allowing for unambiguous and correct aiming.

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92.5.3.2.2 The system or part(s) thereof shall be aimed according to the requirements of paragraph 92.7.1 so that the position of the cut-off complies with the requirements indicated in the Table 8.

If, however, vertical adjustment cannot be performed repeatedly to the required position within the allowed tolerances, the instrumental method of paragraph 92.7.2 shall be applied to test compliance with the required minimum quality of the "cut-off" line and to perform the beam vertical adjustment.

92.5.3.2.3 When so aimed, the system or part(s) thereof,

- (a) If its approval is sought solely for provision of the passing-beam, needs to comply with the requirements set out in the relevant paragraphs below;
- (b) If it is intended to provide additional lighting or light signalling functions according to the scope of this Regulation, it shall comply in addition with the requirements set out in the relevant paragraphs below, if not being adjustable independently.

92.5.3.2.4 When emitting a specified mode of the passing-beam, the system shall meet the requirements in the respective section (C, V, E, W) of Table 7 (photometric values) and in Table 8 (I_{max} and "cut-off" positions), as well as paragraph 1 ("cut-off" requirements) of 92.7.

92.5.3.2.5 A bending mode may be emitted, provided that:

92.5.3.2.5.1 The system meets the respective requirements of part B of Table 7 (photometric values) and item B of Table 8 ("cut-off" provisions), when measured according to the procedure indicated in paragraph 92.5.3.4., relevant to the category (either category 1 or category 2) of the bending mode, for which approval is sought;

92.5.3.2.5.2 When the T-signal corresponds to the vehicle's smallest turn radius to the left (or right), the sum of the luminous intensity values provided by all contributors of the right or the left side of the system shall be at least 2,500 cd at one or more points in the zone extending from H-H to 2 degrees below H-H and from 10 to 45

degrees left (or right).

92.5.3.2.5.3 If approval is sought for a category 1 bending mode, the use of the system is restricted to vehicles where provisions are taken such that the horizontal position of the "kink" of the "cut-off" which is provided by the system, complies with the relevant provisions of "The installation of lighting and light-signaling devices" of VSTD;

92.5.3.2.5.4 If approval is sought for a category 1 bending mode, the system is designed so that, in the case of a failure affecting the lateral movement or modification of the illumination, it must be possible to obtain automatically either photometric conditions corresponding to paragraph 92.5.3.2.4. or a state with respect to the photometric conditions which yields values not exceeding 1,300 cd in the zone IIIb, and at least 3,400 cd in a point of "segment I_{max}".

However, this is not needed if, for positions relative to the system reference axis up to 5 degrees left, at 0.3 degree up from H-H, and greater than 5 degrees left, at 0.57 degree up, a value of 880 cd is in no case exceeded.

92.5.3.2.6 The system shall be checked on the basis of the relevant instructions of the manufacturer.

92.5.3.2.7 The system shall be so made that:

92.5.3.2.7.1 Any specified passing-beam mode provides at least 2,500 cd at point 50V from each side of the system. The mode(s) of the Class V passing-beam are exempted from this requirement.

92.5.3.2.7.2 Other modes:

When signal inputs according to paragraph 92.5.3.1.4.3 apply, the requirements of the paragraph 92.5.3.2. shall be fulfilled.

Tabled requirements expressed in <i>cd</i>			Position / deg.			Passing beam							
			horizontal		vertical	Class C		Class V		Class E		Class W	
No.	Element	At/from	to	at	min	max	min	max	min	max	min	max	
Part A	1	B50L	L 3.43	-	U 0.57	50 ^{4/}	350	50	350	50	625 ^{7/}	50	625
	3	BR	R 2.50	-	U 1.00	50 ^{4/}	1750	50	880	50	1750	50	2650
	4	Segment BRR	R 8.00	R 20	U 0.57	50 ^{4/}	3550	-	880	-	3550	-	5300
	5	Segment BLL	L 8.00	L 20	U 0.57	50 ^{4/}	625	-	880	-	880	-	880
	6	P	L 7.00	-	H	63	-	-	-	-	-	63	-
	7	Zone III	As specified in Table 9			-	625	-	625	-	880	-	880
	8a	S50+S50LL+S50RR ⁵	-	-	U 4.00	190 ^{6/}	-	-	-	190 ^{6/}	-	190 ^{6/}	-
	9a	S100+S100LL+S100RR ⁵	-	-	U 2.00	375 ^{6/}	-	-	-	375 ^{6/}	-	375 ^{6/}	-
	10	50 R	R 1.72	-	D 0.86	-	-	5100	-	-	-	-	-
	11	75 R	R 1.15	-	D 0.57	10100	-	-	-	15200	-	20300	-
	12	50 V	V	-	D 0.86	5100	-	5100	-	10100	-	10100	-

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13	50 L	L 3.43	-	D 0.86	3550	13200 ^{8/}	3550	13200 ^{8/}	6800	-	6800	26400 ^{8/}
14	25 LL	L 16.00	-	D 1.72	1180	-	845	-	1180	-	3400	-
15	25 RR	R 11.00	-	D 1.72	1180	-	845	-	1180	-	3400	-
16	Segment 20 and below	L 3.50	V	D 2.00	-	-	-	-	-	-	-	17600 ^{2/}
17	Segment 10 and below	L 4.50	R 2.00	D 4.00	-	12300 ^{1/}	-	12300 ^{1/}	-	12300 ^{1/}	-	7100 ^{2/}
18	I _{max} ³	-	-	-	16900	44100	8400	44100	16900	79300 ^{7/}	29530	70500 ^{2/}

Part B (bending mode): Above-mentioned Table applies, however with the lines Nos. 1,7,13 and 18 being replaced by those listed hereunder

Part B	1	B50L	L 3.43	-	U 0.57	50 ⁴	530	50	350	50	625	50	625
	7	Zone III	As specified in Table 9			-	880	-	880	-	880	-	880
	13	50 L	L 3.43	-	D 0.86	1700	-	1700	-	3400	-	3400	-
	18	I _{max}	-	-	-	10100	44100	5100	44100	10100	79300 ^{7/}	20300	70500 ^{2/}

Notes:

1 Max 15900 cd, if the system is designed to provide also a Class W passing-beam.

2 Requirements according to the provisions indicated in Table 10 apply in addition

3 Position requirements according to the provisions of Table 8 ("Segment I_{max}").

4 The contribution of each side of the system (for segment BLL and BRR: of at least one point), when measured according to paragraph 92.6 shall not be less than 50 cd.

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5 Position requirements according to the provisions of Table 11.

6 One pair of position lamps, being incorporated with the system or being intended to be installed together with the system may be activated according to the indications of the applicant.

7 Requirements according to the provisions indicated in Table 12 apply in addition.

8 The max. value may be multiplied by 1.4, if it is guaranteed according to the manufacturer's description that this value will not be exceeded in use, either by means of the system or, if the system's use is confined to vehicles, providing a corresponding stabilization/limitation of the system's supply, as indicated in the communication form.

Table 7: Passing-beam photometric requirements of AFS

	<i>Beam part designation and requirement</i>	<i>Class C passing-beam</i>		<i>Class V passing-beam</i>		<i>Class E passing-beam</i>		<i>Class W passing-beam</i>	
		<i>Horiz.</i>	<i>Vert.</i>	<i>Horiz.</i>	<i>Vert.</i>	<i>Horiz.</i>	<i>Vert.</i>	<i>Horiz.</i>	<i>Vert.</i>
A	Angular position / extend in degrees for segment I _{max} The maximum luminous intensity in "Segment I _{max} " as indicated in this Table shall be within the limits as prescribed in Table 7, No. 18.	0.5 L to 3 R	0.3 D to 1.72D		0.3 D to 1.72D	0.5 L to 3 R	0.1 D to 1.72D	0.5 L to 3 R	0.3 D to 1.72D
B	The "cut-off" and part(s) of shall comply with the requirements of paragraph 92.7.1								
	The "cut-off" and part(s) of shall be positioned with its "flat horizontal part"		at V = 0.57 D		not above 0.57D not below 1.3D		not above 0.23D ¹ not below 0.57D		not above 0.23D not below 0.57D

Note:

1 Requirements according to the provisions indicated in Table 7 apply in addition

Table 8: Passing-beam elements angular position/extend, additional requirements

Angular position in degrees	Corner point No.	1	2	3	4	5	6	7	8
Zone III a for Class C or Class V Passing Beam	horizontal	8 L	8 L	8 R	8 R	6 R	1.5 R	V-V	4 L
	vertical	1 U	4 U	4 U	2 U	1.5 U	1.5 U	H-H	H-H
Zone III b for Class W or Class E Passing Beam	horizontal	8 L	8 L	8 R	8 R	6 R	1.5 R	0.5 L	4 L
	vertical	1 U	4 U	4 U	2 U	1.5 U	1.5 U	0.34 U	0.34 U

Table 9: Passing-beam zones III, defining corner points

Definition and requirements for segments E, F1, F2, and F3 (not shown in Table 7 and Figure 7).
Not more than 175 cd is allowed: a) on a segment E extending at U 10 deg from L20 to R20 deg and b) on three vertical segments F1, F2 and F3 at horizontal positions L10 degrees, V and R10 degrees, each extending from U10 to U60 degrees.
Alternative/ Additional set of requirements for I_{max} , segment 20 and segment 10: Table 7 Part A or B applies, however with the max requirements in lines No. 16, 17 and 18 being replaced by those indicated hereunder.
If, according to the applicants specification a Class W passing-beam is designed to produce on segment 20 and below it not more than 8,800 cd and on segment 10 and below it not more than 3,550 cd, the design value for I_{max} of that beam shall not exceed 88,100 cd.

Table 10: Additional provisions for Class W passing-beam, expressed in cd

Point designation	S50LL	S50	S50RR	S100LL	S100	S100RR
Angular position in degrees	4 U / 8 L	4 U / V-V	4 U / 8 R	2 U / 4 L	2 U / V-V	0 U / 4 R

Table 11: Overhead sign requirements, angular position of measurement points

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Table 7, Part A or B and Table 8 apply, however with the lines No.1 and 18 of Table 7 and item B of Table 8 being replaced as indicated hereunder			
<i>Designation</i>	<i>Line 1 of Table 7, Part A or B</i>	<i>No.18 of Table 7, Part A or B</i>	<i>Item B of Table 8</i>
<i>Data Set</i>	<i>EB50L in cd</i>	<i>I_{max} in cd</i>	<i>cut-off flat part aimed in degrees</i>
	max	max	not above
E1	530	70500	0.34 D
E2	440	61700	0.45 D
E3	350	52900	0.57 D

Table 12: Additional provisions for Class E passing-beam

<i>Part A</i>	<i>Test point</i>	<i>Position / Deg.</i>		<i>Max. intensity**</i>
		<i>Horizontal</i>	<i>Vertical</i>	<i>(cd)</i>
	Line 1 Left Oncoming vehicle at 50 m in the case of right-hand traffic	4.8°L to 2°L	0.57°Up	625
	Line 1 Right Oncoming vehicle at 50 m in the case of left-hand traffic	2°R to 4.8°R	0.57°Up	625
	Line 2 Left Oncoming vehicle at 100 m in the case of right-hand traffic	2.4°L to 1°L	0.3°Up	1 750

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Line 2 Right Oncoming vehicle at 100 m in the case of left-hand traffic	1°R to 2.4°R	0.3°Up	1 750
Line 3 Left Oncoming vehicle at 200 m in the case of right-hand traffic	1.2°L to 0.5°L	0.15°Up	5 450
Line 3 Right Oncoming vehicle at 200 m in the case of left-hand traffic	0.5°R to 1.2°R	0.15°Up	5 450
Line 4 Preceding vehicle at 50 m in the case of right-hand traffic	1.7°L to 1.0°R	0.3°Up	1 850
	>1.0° R to 1.7°R		2 500
Line 4 Preceding vehicle at 50 m in the case of left-hand traffic	1.7°R to 1.0°L		1 850
	>1.0° L to 1.7°L		2 500
Line 5 Preceding vehicle at 100 m in the case of right-hand traffic	0.9° L to 0.5°R	0.15°Up	5 300
	>0.5°R to 0.9°R		7 000
Line 5 Preceding vehicle at 100 m in the case of left-hand traffic	0.9° R to 0.5°L		5 300
	>0.5°L to 0.9°L		7 000
Line 6 Preceding vehicle at 200 m in the case of left-hand traffic and right-hand traffic	0.45°L to 0.45°R	0.1°Up	16 000

<i>Part B</i>	<i>Test Point</i>	<i>Position /degrees*</i>		<i>Min. Intensity**</i>
		<i>Horizontal</i>	<i>Vertical</i>	<i>(cd)</i>

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	50R	1.72 R	D 0.86	5 100
	50V	V	D 0.86	5 100
	50L	3.43 L	D 0.86	2 550
	25LL	16 L	D 1.72	1 180
	25RR	11 R	D 1.72	1 180

* Angular positions are indicated for right-hand traffic.

** The photometric requirements for each single measuring point (angular position) of this lighting function apply to half of the sum of the respective measured values from all lighting units of the system applied for this function.

Each of the lines defined in part A of Table 13, in conjunction with the test points as prescribed in part B of Table 13 shall be measured individually corresponding to the signal provided by the signal generator.

In the case where the passing-beam, which meets the requirements of paragraph 92.5.3.2., is continuously operated in conjunction with the adaptation of the driving-beam, the photometric requirements in Part B of the Table 13 shall not be applied.

Table 13: Requirements concerning the adaptation of the driving-beam

92.5.3.3 Provisions concerning the driving-beam

The system shall, prior to the subsequent test procedures, be set to the neutral state.:

92.5.3.3.1 The lighting unit(s) of the system shall be adjusted, according to the instructions of the manufacturer, such that the area of maximum illumination is centred on the point (HV) of intersection of the lines H-H and V-V;

92.5.3.3.1.1 Any lighting unit(s) which is/are not independently adjustable, or, for which the aiming was done with respect

to any measurements under paragraphs 92.5.3.2., shall be tested in its/their unchanged position.

92.5.3.3.2 When measured according to the provisions laid down in paragraph 92.5.1. the luminous intensity shall meet the requirements of Class B in Table 3 and of paragraph 92.5.1.3.4..

92.5.3.3.3 The illumination or part thereof emitted by an AFS may be automatically laterally moved (or modified to obtain an equivalent effect), provided that:

92.5.3.3.3.1 The system meets the requirements of the paragraphs 92.5.1.3.1. class B and 92.5.1.3.4. above with each lighting unit measured according to the relevant procedure indicated in paragraph 92.5.3.4.

92.5.3.3.4 The system shall be so made that:

92.5.3.3.4.1 The lighting unit(s) of the right side and of the left side each provide at least 16,200 cd at the point HV.

92.5.3.3.5 If the specified beam requirements are not met, a re-aiming of the beam position within 0.5 degree up or down and/or 1 degree to the right or left, with respect to its initial aiming is allowed; in the revised position all photometric requirements shall be met. These provisions do not apply to lighting units as indicated under paragraph 92.5.3.3.1.1.

92.5.3.3.6 In the case of adaptation of the driving-beam function the system shall meet the requirements of the above paragraphs only when it is in the maximum condition of activation.

92.5.3.3.7 During adaptation, the driving-beam function shall meet the requirements for all the cases of right-hand and left-hand traffic specified in Part A of Table 13. These requirements shall be verified during the type approval testing in conjunction with a signal generator to be provided by the applicant. This signal generator shall reproduce the signals provided by the vehicle and cause the adaptation of the driving-beam and in particular shall represent the settings so that the photometric compliance can be verified.

92.5.3.4 Measurement conditions with respect to bending modes

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92.5.3.4.1 In the case of a system or part(s) thereof, which provide a bending mode, the requirements of paragraphs 92.5.3.2. (passing-beam), and /or 92.5.3.3. (driving-beam) apply for all states, corresponding to the turn radius of the vehicle.

For verification with respect to the passing-beam and the driving-beam the following procedure shall be used:

92.5.3.4.1.1 The system shall be tested in the neutral state (central/straight), and, in addition in the state(s) corresponding to the smallest turn radius of the vehicle in both directions using the signal generator, if applicable.

92.5.3.4.1.1.1 Compliance with the requirements of paragraphs 92.5.3.2.5.2. and 92.5.3.2.5.4. shall be checked for both category 1 and category 2 bending modes without additional horizontal re-aim.

92.5.3.4.1.1.2 Compliance with the requirements of paragraphs 92.5.3.2.5.1. and 92.5.3.3., whichever applies, shall be checked:

- (a) In case of a category 2 bending mode: without additional horizontal re-aim;
- (b) In case of a category 1 or a driving-beam bending mode: after having horizontally re-aimed the relevant installation unit (by means of the goniometer for example) in the corresponding opposite direction.

92.5.3.4.1.2 When testing a category 1 or category 2 bending mode, for a turn radius of the vehicle other than specified in paragraph 92.5.3.4.1.1. it shall be observed whether the light distribution is substantially uniform and no undue glare occurs. If this cannot be confirmed the compliance with the requirement laid down in Table 7 shall be checked.

92.5.3.5 Other provisions

92.5.3.5.1 It shall be stated by means of a form conforming to the model, which lighting unit(s) provide a "cut-off", that projects into a zone extending from 6 deg left to 4 deg right and upwards from a horizontal line positioned at 0.8 deg down.

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92.5.3.5.2 It shall be stated by means of a form conforming to the model, which class E passing beam mode(s), if any, comply with a "data set" of Table 12.

92.5.4 Technical requirements concerning headlamps to provide a passing-beam of the Class AS, BS, CS, DS and ES (symbols "C-AS", "C-BS", "WC-CS", "WC-DS" and "WC-ES")

92.5.4.1 Aiming procedure

92.5.4.1.1 For a correct aiming the passing beam shall produce a sufficiently sharp "cut-off" to permit a satisfactory visual adjustment with its aid

The aiming shall be carried out using a flat vertical screen set up at a distance of 10 or 25 m forward of the headlamp and at right angles to the H-V. The screen shall be sufficiently wide to allow examination and adjustment of the "cut-off" of the passing beam over at least 3 deg. on either side of the V-V line

The "cut-off" shall be substantially horizontal and shall be as straight as possible from at least 3 deg. L to 3 deg. R.

92.5.4.1.2 The headlamp shall be aimed according to paragraph 92.8.3. If, however, vertical adjustment cannot be performed repeatedly to the required position within the allowed tolerances, the instrumental method of paragraphs 92.8.4 and 92.8.5 shall be applied to test compliance with the required minimum quality of the "cut-off" line and to perform the beam vertical adjustment.

92.5.4.2 When so aimed, the headlamp must, if its approval is sought solely for provision of a passing beam, comply with the requirements set out in paragraphs 92.5.4.4.; if it is intended to provide both a passing beam and a driving beam, it shall comply with the requirements set out in paragraphs 92.5.4.4. and 92.5.1.

92.5.4.3 Where a headlamp so aimed does not meet the requirements set out in paragraphs 92.5.4.4. and 92.5.1., its alignment may be changed, except for headlamps that have no mechanism to adjust horizontal aim, on condition that the axis of the

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beam is not displaced laterally by more than 0.5 degree to the right or left and vertically by not more than 0.25 degree up or down. To facilitate alignment by means of the "cut-off", the headlamp may be partially occulted in order to sharpen the "cut-off". However, the "cut-off" should not extend beyond the line H-H.

92.5.4.4 The passing beam shall meet the requirements as shown in the applicable table below and the applicable figure as shown in paragraph 92.6.

Notes:

For Class ES headlamps the voltage applied to the terminals of the ballast(s) is either 13.2 V +/- 0.1 V for 12 V systems or as otherwise specified.

"D" means under the H-H line.

"U" means above the H-H line.

"R" means right of the V-V line.

"L" means left of the V-V line.

92.5.4.4.1 For Class AS headlamps (Figure 8):

Test point / line / zone	Angular coordinates - degrees*		Required luminous intensity in cd
Any point in Zone 1	0 deg. to 15 deg. U	5 deg. L to 5 deg. R	≤ 320 cd
Any point on line 25L to 25R	1.72 deg. D	5 deg. L to 5 deg. R	≥ 1,100 cd
Any point on line 12.5L to 12.5R	3.43 deg. D	5 deg. L to 5 deg. R	≥ 550 cd

Note

* 0.25 deg. tolerance allowed independently at each test point for photometry unless indicated otherwise.

Table 14: Passing-beam Class AS

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92.5.4.4.2 For Class BS headlamps (Figure 9):

Test/point/line/zone	Angular coordinates - degrees*		Required luminous intensity in cd
Any point in Zone 1	0 deg. to 15 deg. U	5 deg. L to 5 deg. R	≤ 700 cd
Any point on line 50L to 50R except 50V	0.86 deg. D	2.5 deg. L to 2.5 deg. R	$\geq 1,100$ cd
Point 50V	0.86 deg. D	0	$\geq 2,200$ cd
Any point on line 25L to 25R	1.72 deg. D	5 deg. L to 5 deg. R	$\geq 2,200$ cd
Any point in Zone 2	0.86 deg. D to 1.72 deg. D	5 deg. L to 5 deg. R	$\geq 1,100$ cd

Note

* 0.25 deg. tolerance allowed independently at each test point for photometry unless indicated otherwise.

Table 15: Passing-beam Class BS

92.5.4.4.3 For Class CS, DS or ES headlamp (Figure 10):

Test point / line / zone	Test point angular coordinates degrees *		Required luminous intensity in cd			
			Minimum			Maximum
			Class CS	Class DS	Class ES	Classes CS, DS, ES
1	0.86 deg. D	3.5 deg. R	2,000	2,000	2,500	13,750
2	0.86 deg. D	0	2,450	4,900	4,900	-
3	0.86 deg. D	3.5 deg. L	2,000	2,000	2,500	13,750
4	0.50 deg. U	1.50 deg. L and 1.50 deg. R	--	--	--	900
5	2.00 deg. D	15 deg. L and 15 deg. R	550	1,100	1,100	--
6	4.00 deg. D	20 deg. L and 20 deg. R	150	300	600	-
7	0	0	--	--	--	1,700
Line 1	2.00 deg. D	9 deg. L to 9 deg. R	1,350	1,350	1,900	-
8**	4.00 deg. U	8.0 deg. L	sigma 8 + 9 + 10 ≥ 150 cd **			700
9**	4.00 deg. U	0				700
10**	4.00 deg. U	8.0 deg. R				700
11**	2.00 deg. U	4.0 deg. L	sigma 11 + 12 + 13 ≥ 300 cd **			900
12**	2.00 deg. U	0				900
13**	2.00 deg. U	4.0 deg. R				900
14**	0	8.0 deg. L and 8.0 deg. R	50 cd**	50 cd**	50 cd**	-
15**	0	4.0 deg. L and 4.0 deg. R	100 cd**	100 cd**	100 cd**	900
Zone 1	1 deg. U/8 deg. L-4 deg. U/8 deg. L-4 deg. U/8 deg. R-1 deg. U/8 deg. R-0/4 deg. R-0/1 deg. R-0.6 deg. U/0-0/1 deg. L-0/4 deg. L-1 deg. U/8 deg. L		--	--	--	900
Zone 2	>4U to <15 U	8 deg. L to 8 deg. R	--	--	--	700

Notes

* 0.25 deg. tolerance allowed independently at each test point for photometry unless indicated otherwise.

** On request of the applicant during measurement of these points, the approved front position lamp; if combined, grouped, or reciprocally incorporated-shall be switched ON.

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Table 16: Passing-beam Class CS, DS or ES

92.5.4.4.4 The light shall be as evenly distributed as possible within zones 1 and 2 for Class CS, DS or ES headlamps.

92.5.4.4.5 Either one or two filament light sources (Classes AS, BS, CS, DS) or one gas discharge light source (Class ES) or one or more LED light source(s) or LED module(s) (Classes AS, BS, CS, DS, ES) are permitted for the passing beam.

92.5.4.5 Additional light source(s) and/or additional lighting unit(s) used to produce bend lighting is (are) permitted for vehicles of categories L, provided that:

92.5.4.5.1 The following requirement regarding illumination shall be met, when the principal passing beam(s) and corresponding additional light source(s) used to produce bend lighting are activated simultaneously:

(a) Left bank (when the motorcycle is rotated to the left about its longitudinal axis) the luminous intensity values shall not exceed 900cd in the zone extending from HH to 15 deg above HH and from VV to 10 deg left.

(b) Right bank (when the motorcycle is rotated to the right about its longitudinal axis) the luminous intensity values shall not exceed 900cd in the zone extending from HH to 15 deg above HH and from VV to 10 deg right.

92.5.4.5.2 This test shall be carried out with the minimum bank angle specified by the applicant simulating the condition by means of the test fixture etc.

92.5.4.5.3 For this measurement, at the request of the applicant, principal passing beam and additional light source(s) used to produce bend lighting, may be measured individually and the photometric values obtained combined to determine compliance with the specified luminous intensity values.

92.5.5 Technical requirements concerning front fog lamps of the Class F3 (symbol "F3")

92.5.5.1 Photometric adjustment and measuring conditions

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92.5.5.1.1 The front fog lamp shall be aimed according to paragraph 92.8.3.

If, however, vertical adjustment cannot be performed repeatedly to the required position within the allowed tolerances, the instrumental method of paragraphs 92.8.4. and 92.8.5. shall be applied to test compliance with the required minimum quality of the "cut-off" line and to perform the beam vertical adjustment.

92.5.5.1.2 The front fog lamp shall meet the requirements as shown in Table 17 and Figure 11.

92.5.5.2 Photometric requirements

When so adjusted, the front fog lamp shall meet the photometric requirements in Table 17 (refer also to Figure 11):

Designated lines or zones	Vertical position*		Luminous intensity (in cd)	To comply
	above h + below h -	Horizontal position* left of v: - right of v: +		
Point 1, 2**	+60 deg.	+/-45 deg.	85 max	All points
Point 3, 4**	+40 deg.	+/-30 deg.		
Point 5, 6**	+30 deg.	+/-60 deg.		
Point 7, 10**	+20 deg.	+/-40 deg.		
Point 8, 9**	+20 deg.	+/-15 deg.		
Line 1**	+8 deg.	-26 deg. to +26 deg.	130 max	All line
Line 2**	+4 deg.	-26 deg. to +26 deg.	150 max	All line
Line 3	+2 deg.	-26 deg. to +26 deg.	245 max	All line
Line 4	+1 deg.	-26 deg. to +26 deg.	360 max	All line
Line 5	0 deg.	-10 deg. to +10 deg.	485 max	All line
Line 6 ***	-2.5 deg.	-10 deg. to +10 deg.	2700 min	All line
Line 7 ***	-6.0 deg.	-10 deg. to +10 deg.	< 50 per cent of max. on line 6	All line
Line 8L and R***	-1.5 deg. to -3.5 deg.	-22 deg. and +22 deg.	1,100 min	One or more points
Line 9L and R***	-1.5 deg. to -4.5 deg.	-35 deg. and +35 deg.	450 min	One or more points
Zone D***	-1.5 deg. to -3.5 deg.	-10 deg. to +10 deg.	12,000 max	Whole zone

Notes

* The co-ordinates are specified in degrees for an angular web with a vertical polar axis.

** See paragraph 92.5.5.2.4.

*** See paragraph 92.5.5.2.2.

Table 17: Type approval photometric requirements for front fog lamp

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92.5.5.2.1 The luminous intensity shall be measured either with white light or coloured light as prescribed by the applicant for use of the fog lamp in normal service. Variations in homogeneity detrimental to satisfactory visibility in the zone above the line 5 from 10 degrees left to 10 degrees right are not permitted.

92.5.5.2.2 At the request of the applicant, two front fog lamps constituting a matched pair (Front fog lamps of Class F3). may be tested separately. In this case the specified requirements for lines 6, 7, 8, 9 and the Zone D in the table 17. apply to half the sum of readings of the right-hand and left-hand side front fog lamp. However each of the two front fog lamps shall meet at least 50 per cent of the minimum value required for line 6. Additionally, each of the two front fog lamps that constitute the matched pair are only required to meet the requirements of line 6 and line 7 from 5 deg. inwards to 10 deg. outwards.

92.5.5.2.3 Inside the field between lines 1 to 5 in Figure 11, the beam pattern should be substantially uniform. Discontinuities in intensities detrimental to satisfactory visibility between the lines 6, 7, 8 and 9 are not permitted.

92.5.5.2.4 In the light-distribution as specified in Table 17, single narrow spots or stripes inside the area including the measuring points 1 to 10 and line 1 or inside the area of line 1 and line 2 with not more than 175 cd are allowed, if not extending beyond a conical angle of 2 deg. aperture or a width of 1 deg. If multiple spots or stripes are present they shall be separated by a minimum angle of 10 deg.

92.5.5.2.5 If the specified luminous intensity requirements are not met, a re-aim of the cut-off position within +/-0.5 deg. vertical and/or +/-2 deg. horizontal is allowed. In the reaimed position all photometric requirements shall be met.

92.5.5.3 Other photometric requirements

92.5.5.3.1 In the case of front fog lamps equipped with gas-discharge light sources with the ballast not integrated with the

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light source, the luminous intensity shall exceed 1,080 cd in the measuring point at 0 deg. horizontal and 2 deg. D vertical four seconds after activation of the fog lamp which has not been operated for 30 minutes or more.

92.5.5.3.2 To adapt to dense fog or similar conditions of reduced visibility, it is permitted to automatically vary the luminous intensities provided that:

- (a) An active electronic light source control gear is incorporated into the front fog lamp function system;
- (b) All intensities are varied proportionately

The system, when checked for compliance according to the provisions of paragraph 92.4.6.6., is considered acceptable if the luminous intensities remain within 60 per cent and 100 per cent of the values specified in Table 17.

92.5.5.3.2.1 The Technical Service responsible for type approval shall verify that the system provides automatic modifications, such that good road illumination is achieved and no discomfort is caused to the driver or to other road users.

92.5.5.3.2.2 Photometric measurements shall be performed according to the applicant's description.

92.6 Spherical coordinate measuring system and test point locations

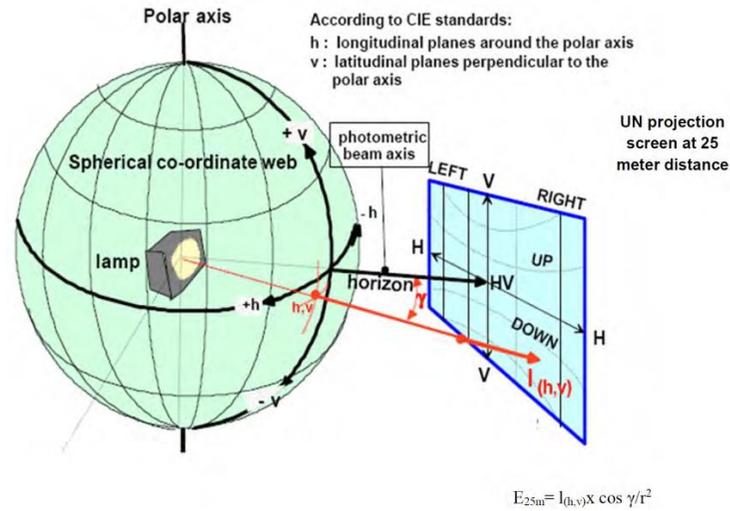


Figure 1: Spherical coordinate measuring system

92.6.1 Photometric measurement provisions

92.6.1.1 The RID or part(s) thereof shall be mounted on a goniometer with a fixed horizontal axis and moveable axis perpendicular to the fixed horizontal axis.

92.6.1.1.1 The luminous intensity values shall be determined by means of a photoreceptor contained within a square of 65 mm side and, except for cornering lamps, set up to a distance of at least 25 m forward of the centre of reference of each headlamp or lighting unit perpendicular to the measurement axis from the origin of the goniometer.

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The point HV is the centre-point of the coordinate system with a vertical polar axis. Line h is the horizontal through HV (see Figure 1).

92.6.1.1.2 The angular co-ordinates are specified in deg on a sphere with a vertical polar axis according to the gonio-photometer as defined in Figure 1.

92.6.1.1.3 During photometric measurements, stray reflections should be avoided by appropriate masking.

92.6.1.2 Any equivalent photometric method is acceptable, if the accordingly applicable correlation is observed.

92.6.1.3 An aiming screen shall be used and may be located at a shorter distance than that of the photoreceptor.

92.6.1.4 The RID or part(s) thereof shall be so aimed before starting the measurements that the position of the "cut-off" complies with the relevant requirements for the specific function in paragraph 92.5.

92.6.1.5 In case of AFS:

92.6.1.5.1 Any offset of the centre of reference of each lighting unit, with respect to the goniometer rotation axes, should be avoided. This applies especially to the vertical direction and to lighting units producing a "cut-off".

92.6.1.5.2 The photometric requirements for each single measuring point (angular position) of a lighting function or mode as specified in this Regulation apply to half of the sum of the respective measured values from all lighting units of the system applied for this function or mode, or, from all lighting units as indicated in the respective requirement.

92.6.1.5.2.1 However in those cases where a provision is specified for one side only, the division by the factor of 2 does not apply. These cases are: paragraphs 92.5.3.2.5.2., 92.5.3.2.7.1., 92.5.1.3.5., 92.5.1.3.6., 92.5.3.3.4.1., 92.5.3.5.1. of this Regulation, and note 4 of Table 7.

92.6.1.5.3 The lighting units of the system shall be measured individually; however, simultaneous measurements may be performed on two or more lighting units of an installation unit, being equipped with the same light source types with

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respect to their power supply (either power controlled or not), if they are sized and situated such, that their illuminating surfaces are completely contained in a rectangle of not more than 300 mm in horizontal extend and not more than 150 mm vertical extend, and, if a common centre of reference is specified by the manufacturer.

92.6.1.5.4 The system shall prior to the subsequent test procedures be set to the neutral state.

92.6.1.5.5 The system or part(s) thereof shall be so aimed before starting the measurements that the position of the "cut-off" complies with the requirements indicated in the Table 8. Parts of a system measured individually and having no "cut-off" shall be installed on the goniometer under the conditions (mounting position) specified by the applicant.

92.6.2 Test point locations:

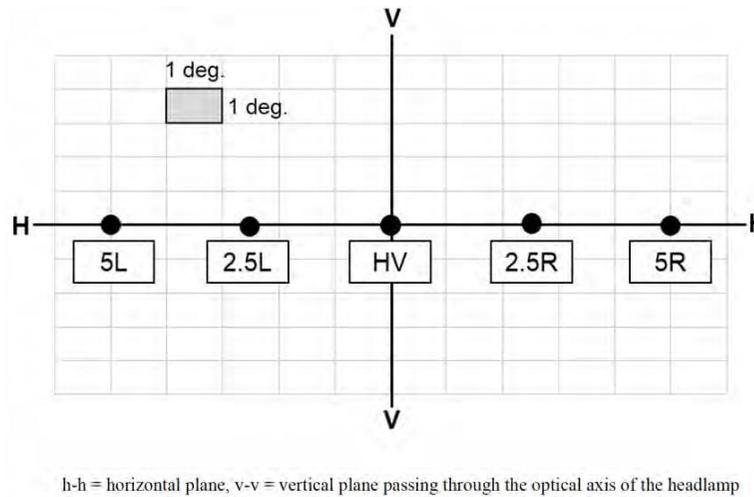


Figure 2: Driving beam test points

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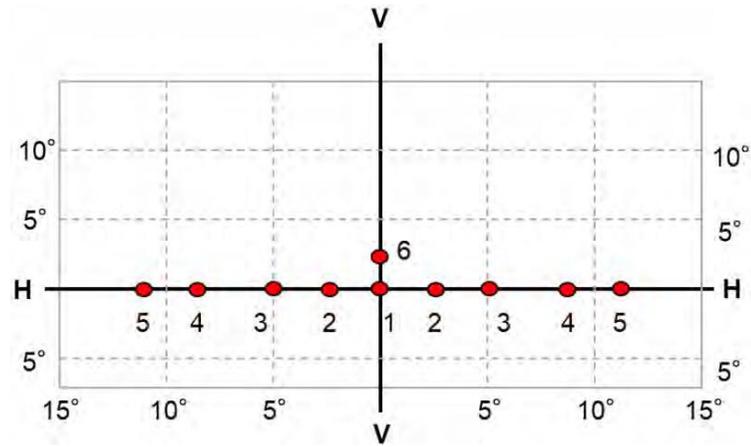


Figure 3: Primary driving beam - position of test points

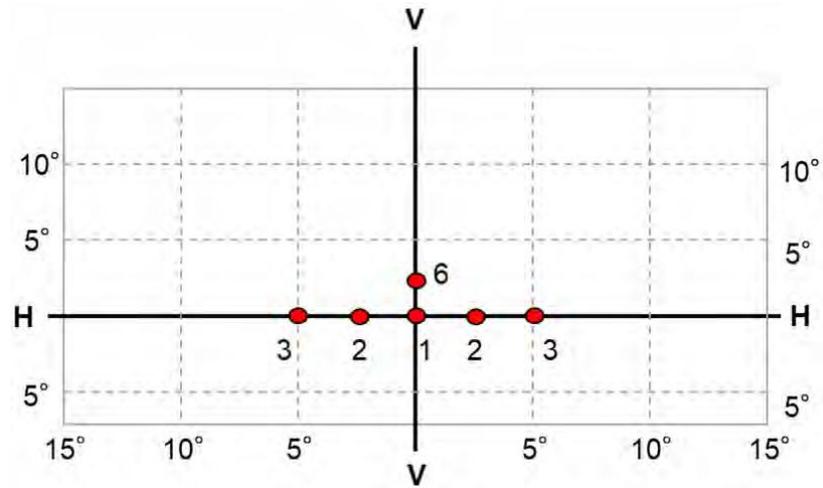
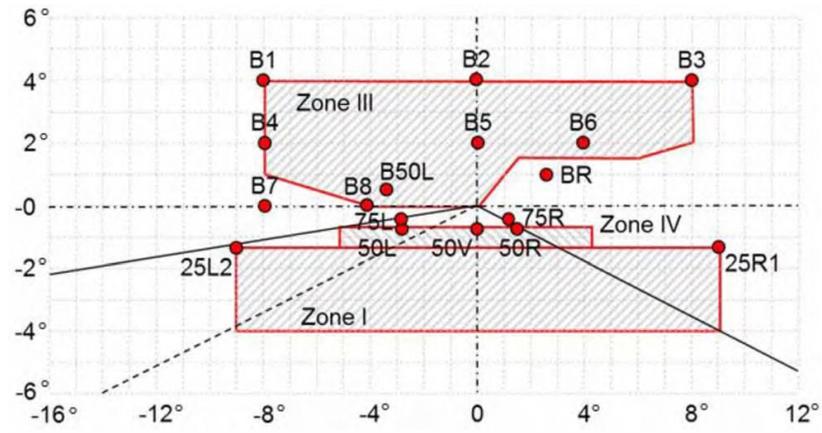


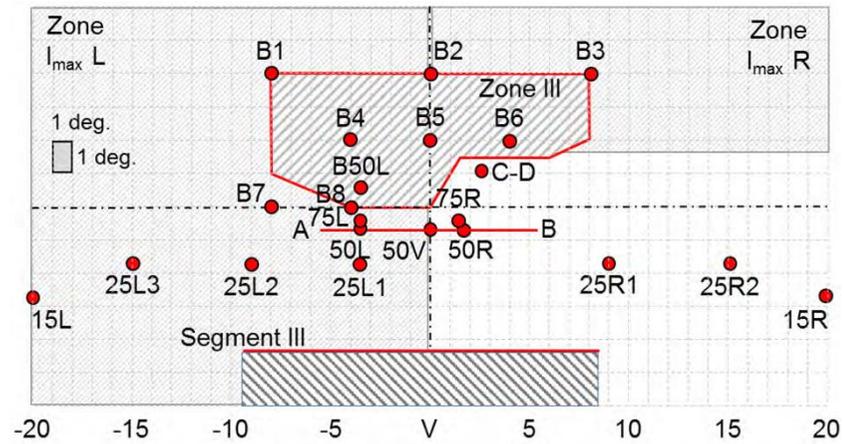
Figure 4: Secondary driving beam - position of test points

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The test point locations for left-hand traffic are mirrored about the VV line

Figure 5: Passing-beam for right-hand traffic



h-h = horizontal plane, v-v = vertical plane passing through the optical axis of the headlamp
 The test point locations for left-hand traffic are mirrored about the V-V line

Figure 6: Passing beam with gas discharge light sources for right-hand traffic

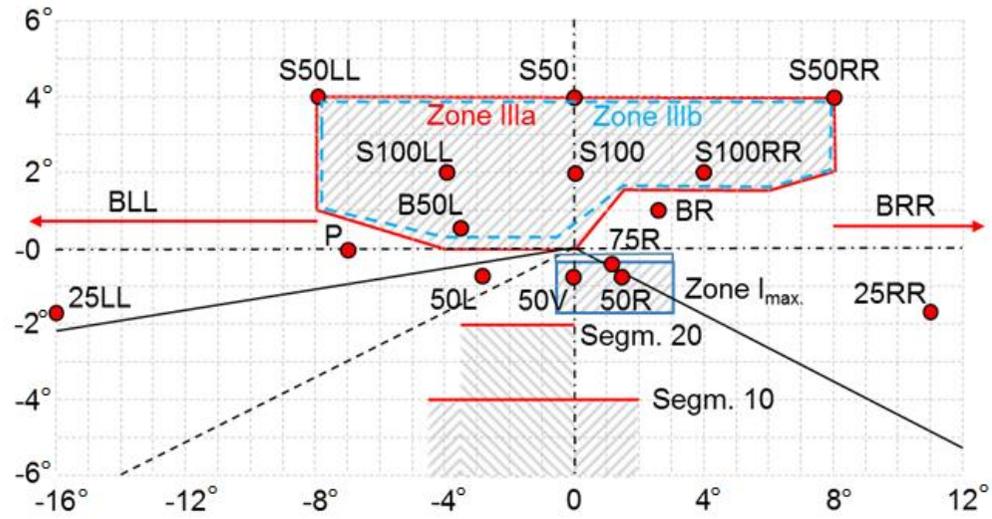


Figure 7: AFS Passing-beam

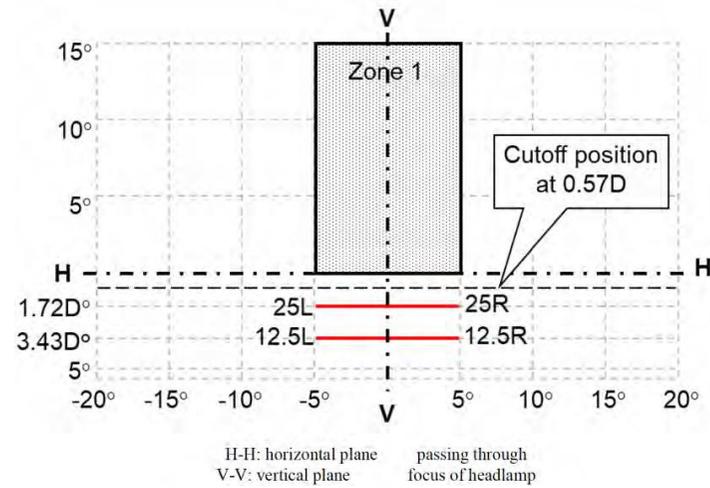


Figure 8: Passing beam test points and zones for Class AS headlamp(s)

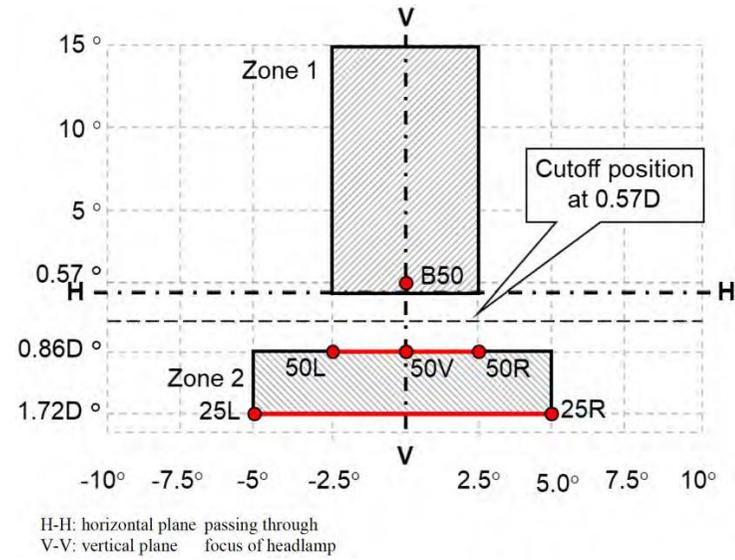


Figure 9: Passing beam test points and zones for Class BS headlamp(s)

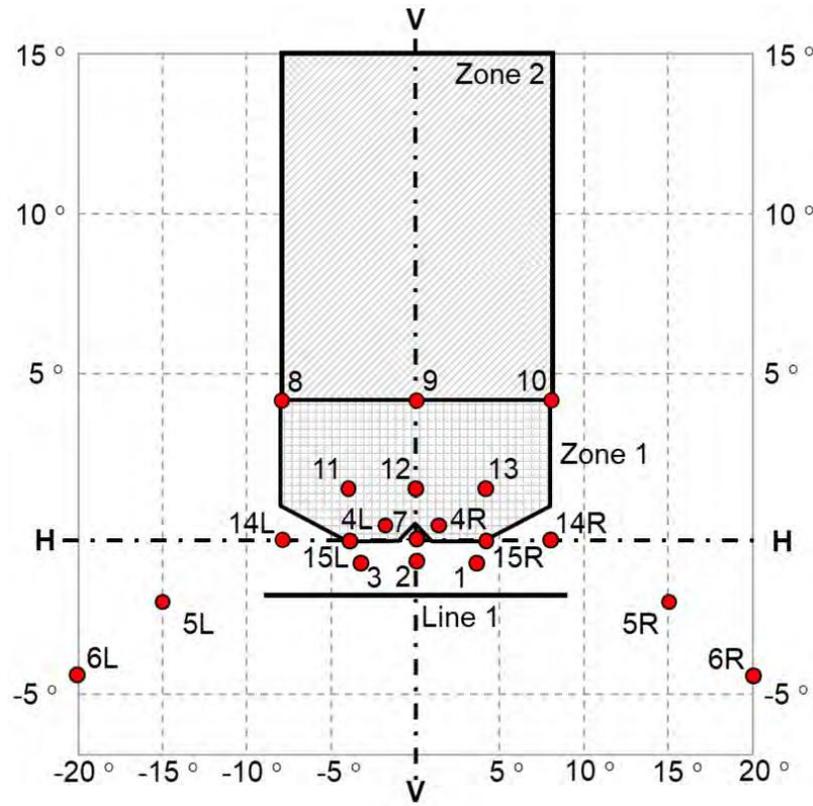


Figure 10: Passing beam - position of test points and zones for Classes CS, DS and ES headlamp(s)

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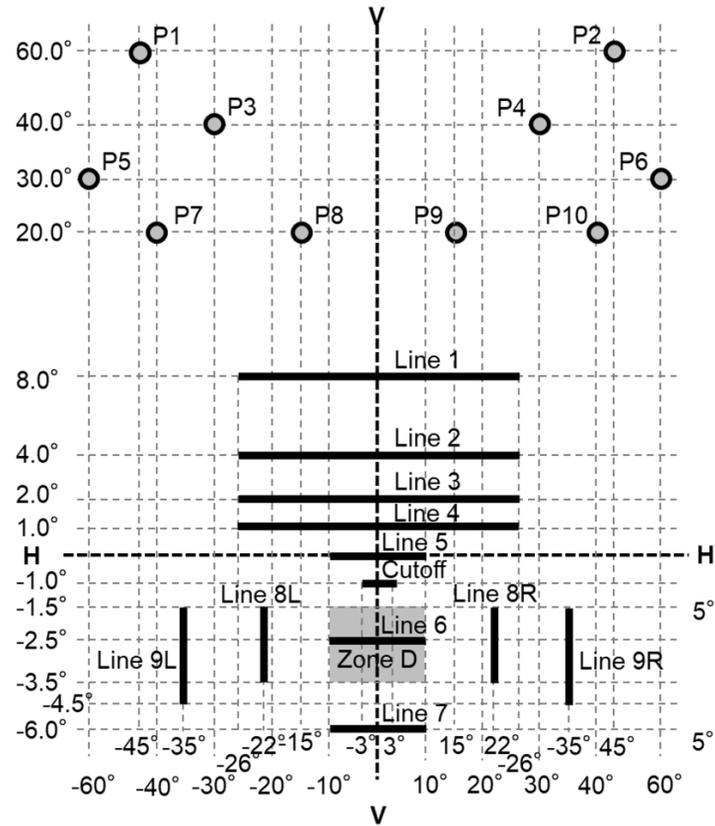


Figure 11: Light distribution of the Class F3 front fog lamp

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92.7 Aiming procedure, instrumental verification of the "cut-off" for asymmetric passing-beams

92.7.1 Visual aiming procedure

92.7.1.1 The luminous intensity distribution of a principal passing-beam headlamp or of at least one lighting unit for a class C passing beam of an AFS in its neutral state shall incorporate a "cut-off" (see Figure 12), which enables the headlamp to be adjusted correctly for the photometric measurements and for the aiming on the vehicle.

The "cut-off" shall provide:

- (a) A straight "horizontal part" towards the left.
- (b) A raised "elbow - shoulder" part towards the right.

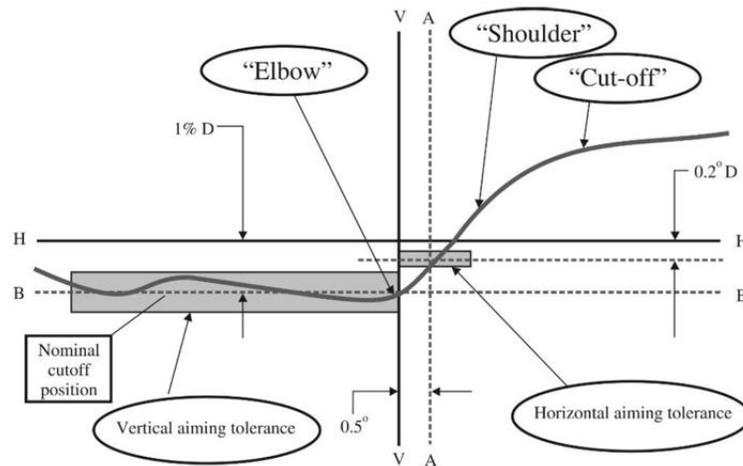
In each case the "elbow-shoulder" part shall have a sharp edge.

92.7.1.2 The headlamp or AFS shall be visually aimed by means of the "cut-off" (see Figure 12) as follows.

The aiming shall be carried out using a flat vertical screen set up at a distance of 10 m or 25 m forward of the headlamp or AFS and at right angles to the H-V axis as shown in paragraph 92.6.

The screen shall be sufficiently wide to allow examination and adjustment of the "cut-off" of the passingbeam over at least 5 deg. on either side of the V-V line.

92.7.1.2.1 For vertical adjustment: the horizontal part of the "cut-off" is moved upward from below line B and adjusted to its nominal position one per cent (0.57 degrees) below the H-H line.



Note: The scales are different for vertical and horizontal lines.

Figure 12: Visual aiming of the cut-off

92.7.1.2.2 For horizontal adjustment: the "elbow - shoulder" part of the "cut-off" shall be moved: For right hand traffic from right to left and shall be horizontally positioned after its movement so that:

- (a) Above the line 0.2 deg. D its "shoulder" shall not exceed the line A to the left;
- (b) The line 0.2 deg. D or below its "shoulder" should cross the line A; and
- (c) The kink of the "elbow" is basically located within +/-0.5 degrees to the left or right of the V-V line;

92.7.1.2.3 Where a headlamp or AFS so aimed does not meet the requirements set out in paragraphs 92.5.2. to 92.5.4

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respectively, its alignment may be changed, provided that the axis of the beam is not displaced:

Horizontally from line A by more than: 0.5 deg. to the left or 0.75 deg. to the right. Vertically not more than 0.25 deg. up or down from line B.

92.7.1.2.4 If, however, vertical adjustment cannot be performed repeatedly to the required position within the tolerances described in paragraph 92.7.1.2.3., the instrumental method of paragraph 92.7.2. shall be applied to test compliance with the required minimum quality of the "cut-off" and to perform the vertical and horizontal adjustment of the beam.

92.7.1.2.5 When so aimed, a headlamp, if its approval is sought solely for provision of a passing-beam, need comply only with the requirements set out in paragraphs 92.5.2. to 92.5.4. of this Regulation; if it is intended to provide both a passing-beam and a driving-beam, it shall comply with the requirements set out in paragraphs 92.5.1. to 92.5.4.

92.7.2 Instrumental verification of the "cut-off" line for asymmetric passing-beams

92.7.2.1 General

In the case where paragraph 92.1.2.4. applies, the quality of the "cut-off" line shall be tested according to the requirements set out in paragraph 92.7.2.2. and the instrumental vertical and horizontal adjustment of the beam shall be performed according to the requirements set out in paragraph 92.7.2.3. Before carrying out the measurement of the quality of "cut-off", and the instrumental aiming procedure, a visual pre-aim in accordance with paragraphs 92.7.1.2.1. and 92.7.1.2.2. is required.

92.7.2.2 Measurement of the quality of the "cut-off"

To determine the minimum sharpness, measurements shall be performed by vertically scanning through the horizontal part of the "cut-off" in angular steps of 0.05 deg. at either a measurement distance of:

- (a) 10 m with a detector having a diameter of approximately 10 mm; or

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(b) 25 m with a detector having a diameter of approximately 30 mm.

To determine the maximum sharpness, measurements shall be performed by vertically scanning through the horizontal part of the "cut-off" in angular steps of 0.05 deg. exclusively at a measurement distance of 25 m and with a detector having a diameter of approximately 30 mm.

The "cut-off" quality shall be considered acceptable if the requirements of paragraphs 92.7.2.2.1. to 92.7.2.2.3. comply with at least one set of measurements.

92.7.2.2.1 Not more than one "cut-off" shall be visible.

92.7.2.2.2 Sharpness of "cut-off"

The sharpness factor G is determined by scanning vertically through the horizontal part of the "cut-off" at 2.5 deg. from the V-V where:

$$G = (\log E_{\text{beta}} - \log E_{(\text{beta} + 0.1 \text{ deg.})})$$

The value of G shall not be less than 0.13 (minimum sharpness) and not greater than 0.40 (maximum sharpness).

92.7.2.2.3 Linearity

The part of the horizontal "cut-off" that serves for vertical adjustment shall be horizontal between 1.5 deg. and 3.5 deg. from the V-V line (see Figure 13).

The inflection points of the "cut-off" gradient at the vertical lines at 1.5 deg., 2.5 deg. and 3.5 deg. shall be determined by the equation:

The maximum vertical distance between the inflection points determined shall not exceed 0.2 deg.

$$(d^2 (\log E) / d \beta^2 = 0)$$

92.7.2.3 Vertical and horizontal adjustment

If the "cut-off" complies with the quality requirements of paragraph 92.7.2.2. the beam adjustment may be performed instrumentally.

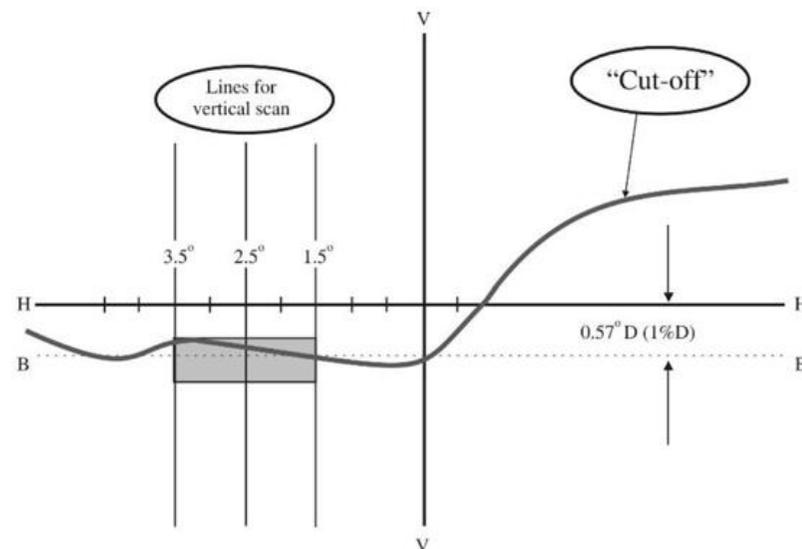


Figure 13: Measurement of "cut-off" quality

92.7.2.3.1 Vertical adjustment

Moving upward from below the line B (see Figure A5-III), a vertical scan is carried out through the horizontal part of the

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"cut-off" at 2.5 deg. from V-V.

(where $(d^2(\log E) / d\beta^2 = 0)$) is determined and positioned on the line B situated one per cent below H-H.

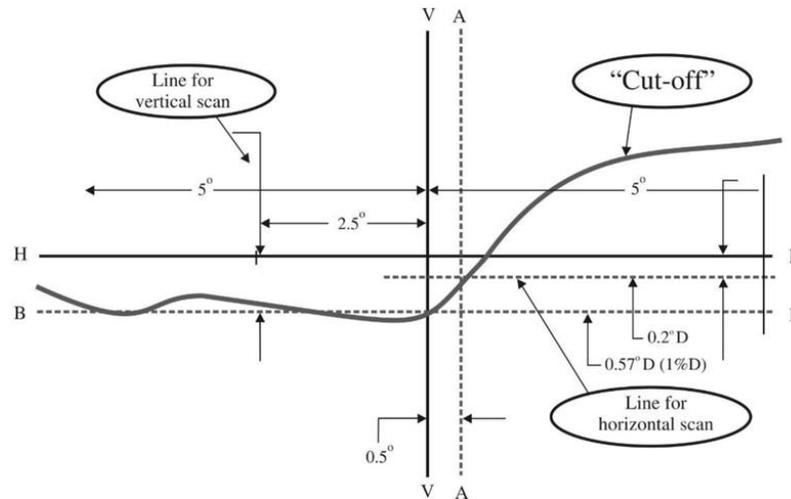
92.7.2.3.2 Horizontal adjustment

The applicant shall specify one of the following horizontal aim methods:

(a) The "0.2 D line" method (see Figure 14).

A single horizontal line at 0.2 deg. D shall be scanned from 5 deg. left to 5 deg. right after the lamp has been aimed vertically. The maximum gradient "G" determined using the formula $G = (\log E_{\beta} - \log E_{(\beta + 0.1 \text{ deg.})})$ where beta is the horizontal position in degrees, shall not be less than 0.08.

The inflection point found on the 0.2 D line shall be positioned on the line A.



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Note: The scales are different for vertical and horizontal lines.

Figure 14: Instrumental vertical and horizontal adjustment - horizontal line scan method

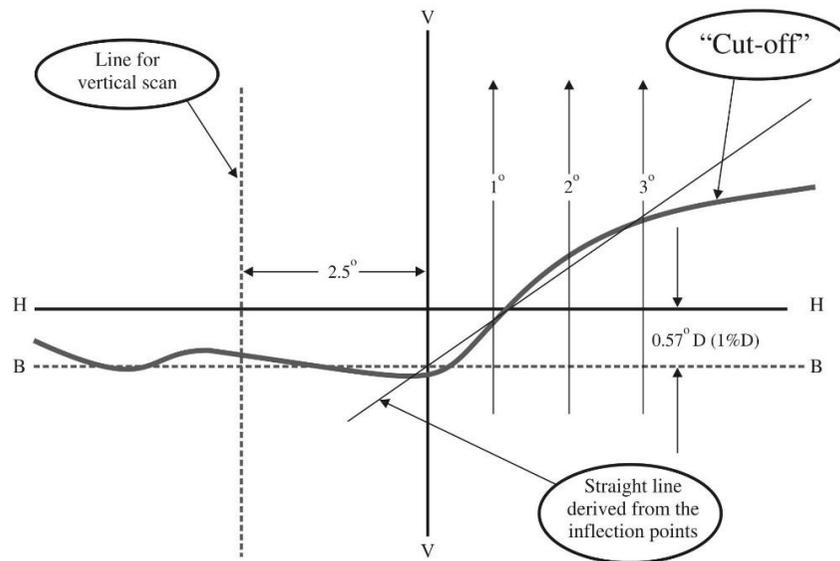
(b) The "3 line" method (see Figure 15)

Three vertical lines shall be scanned from 2 deg. D to 2 deg. U at 1 deg. R, 2 deg. R, and 3 deg. R after the lamp has been aimed vertically. The respective maximum gradients "G" determined using the formula:

$$G = (\log E_{\text{beta}} - \log E_{(\text{beta} + 0.1 \text{ deg.})})$$

where beta is the vertical position in degrees, shall not be less than 0.08.

The inflection points found on the three lines shall be used to derive a straight line. The intersection of this line and the line B found while performing vertical aim shall be placed on the V line.



Note: The scales are different for vertical and horizontal lines

Figure 15: Instrumental vertical and horizontal adjustment - Three line scan method

92.8 Definition and sharpness of the horizontal "cut-off" line and aiming procedure by means of this "cutoff" line for symmetrical passing beam headlamps and front fog lamps

92.8.1 General

92.8.1.1 The luminous intensity distribution of the symmetrical passing-beam headlamps and front fog lamp shall incorporate a

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"cut-off" line which enables the lamp to be adjusted correctly for the photometric measurements and for the aiming on the vehicle. The characteristics of the "cut-off" line shall comply with the requirements set out in paragraphs 92.2. to 92.4.

92.8.2 Shape of the "cut-off" line

92.8.2.1 For visual adjustment of the lamp the "cut-off" line shall provide:

92.8.2.1.1 A horizontal line for vertical adjustment of the symmetrical passing-beam headlamp extending to either side of the V-V line (see Figure 16) as specified in paragraph 92.5.4.1.1.

92.8.2.1.2 A horizontal line for vertical adjustment of the front fog lamp extending to 4 deg. either side of the V-V line (see Figure 17).

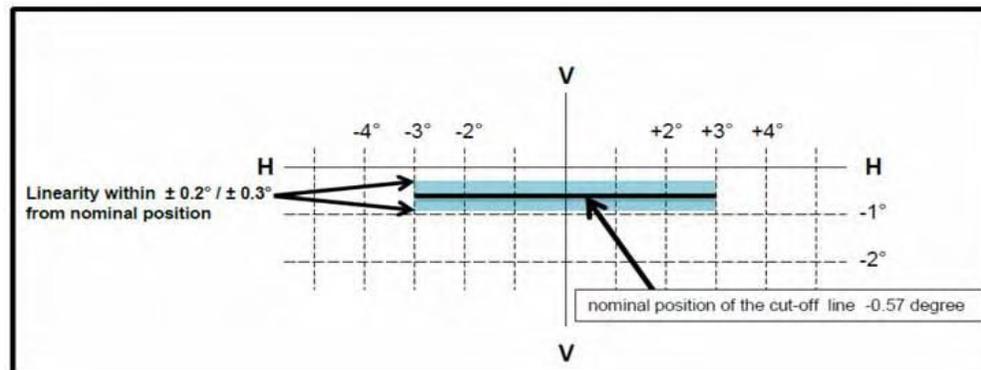


Figure 16: Shape and position of the "cut-off" line of symmetrical passing-beam headlamp

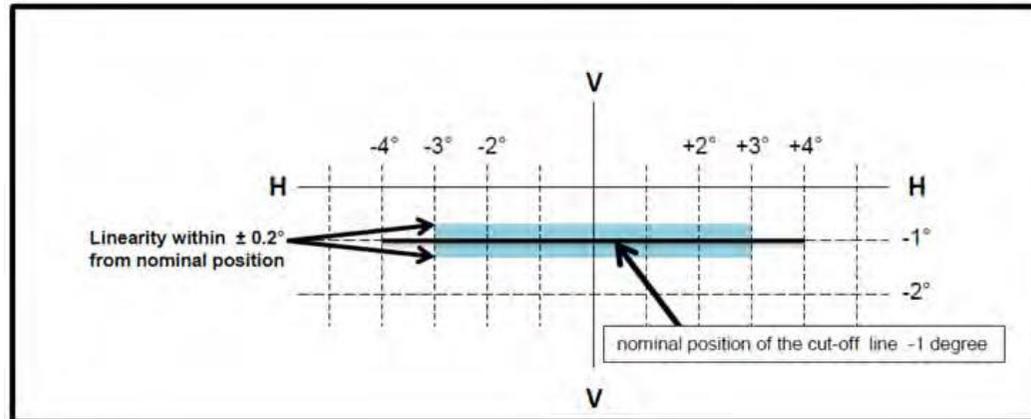


Figure 17: Shape and position of the "cut-off" line of the front fog lamp

92.8.3 Adjustment of the symmetrical passing-beam headlamp and front fog lamp

92.8.3.1 Horizontal adjustment: the cut-off line shall be so positioned that the projected beam pattern appears approximately symmetrical to the V-V line.

When the front fog lamp is designed for use in pairs or has otherwise an asymmetric beam pattern, it shall be horizontally aligned according to the specification of the applicant, or otherwise in such a way that the cut-off line appears symmetrical to the V-V line.

92.8.3.2 Vertical adjustment: after horizontal adjustment of the lamp according to paragraph 92.8.3.1., the vertical adjustment shall be performed in such a way that the beam with its "cut-off" line is moved upwards from the lower position until the "cut-off" line is situated at nominal vertical position. For nominal vertical adjustment the "cut-off" line is positioned on the V-V

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line.

- (a) At 0.57 degree (1 per cent) below the h-h line for symmetrical headlamps of the Classes AS, BS, CS, DS and ES;
- (b) At 1 degree below the h-h line for front fog lamps.

If the horizontal part is not straight but slightly curved or inclined, the "cut-off" line shall not exceed the vertical range formed by two horizontal lines which are situated from 3 deg. left to 3 deg. right of the V-V line at:

- (a) 0.2 deg. for Class BS headlamps and front fog lamps;
- (b) 0.3 deg. for Classes AS, CS, DS and ES headlamps;

Above and below the nominal position of the "cut-off" (see Figures 16 and 17 respectively).

92.8.3.3 If the vertical positions of three attempts to adjust the cut-off differ by more than:

- (a) 0.2 deg. for Class BS headlamps and front fog lamps;
- (b) 0.3 deg. for Classes AS, CS, DS and ES headlamps;

The horizontal part of the "cut-off" line is assumed not to provide sufficient linearity or sharpness for performing visual adjustment. In this case the quality of "cut-off" shall be tested instrumentally for compliance with requirements as follows.

92.8.4 Measurement of the quality of "cut-off"

92.8.4.1 Measurements shall be performed by vertically scanning through the horizontal part of the "cut-off" line in angular steps not exceeding 0.05 deg. :

- (a) At either a measurement distance of 10 m and a detector with a diameter of approximately 10 mm; or
- (b) At a measurement distance of 25 m and a detector with a diameter of approximately 30 mm.

The measurement of the "cut-off" quality shall be considered acceptable if the requirements of the paragraph 92.4.1.1. to 92.4.1.3. comply with at least one measurement at 10 m or 25 m.

The scanning is performed from its lower position upwards through the "cut-off" line along the vertical lines at:

- (a) - 3 deg. to -1.5 deg. and +1.5 deg. to +3 deg. from the V-V line for headlamps.
- (b) - 2.5 deg. and + 2.5 deg. from the V-V line for front fog lamps.

When so measured, the quality of the "cut-off" line shall meet the following requirements:

92.8.4.1.1 Not more than one "cut-off" line shall be visible.

92.8.4.1.2 Sharpness of "cut-off": if scanned vertically through the horizontal part of the "cut-off" line along the +/-2.5 -lines, the maximum value measured for:

$$G = (\log E_{\text{beta}} - \log E_{(\text{beta} + 0.1 \text{ deg.})})$$

is called the sharpness factor G of the "cut-off" line. The value of G shall not be less than:

- (a) 0.13 for Class BS headlamps;
- (b) 0.08 for Classes AS, CS, DS, ES headlamps and front fog lamps.

92.8.4.1.3 Linearity: the part of the "cut-off" line which serves for vertical adjustment shall be horizontal from 3 deg. L to 3 deg. R of the V-V line.

This requirement is deemed to be met if the vertical positions of the inflection points according to paragraph 92.8.3.2. above at 3 deg. left and right of the V-V line do not differ by more than:

- (a) 0.2 deg. for Class BS headlamps and front fog lamps.
- (b) 0.3 deg. for Classes AS, CS, DS and ES headlamps.

from the nominal position at the V-V line.

92.8.5 Instrumental vertical adjustment

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If the "cut-off" line complies with the above quality requirements, the vertical beam adjustment can be performed instrumentally. For this purpose the inflection point where $d^2(\log E) / dv^2 = 0$ is positioned on the V-V line in its nominal position below the h-hline. The movement for measuring and adjusting the "cut-off" line shall be upwards from below the nominal position..

92.9 Tests for stability of photometric performance of Road Illumination Devices in operation

92.9.1 Tests on complete Road Illumination Devices (RID)

Once the photometric values have been measured according to this Regulation:

- (a) In the case of a headlamp with an asymmetrical passing-beam pattern: at the point for I_{max} for driving-beam and in points 25L, 50 R, B 50 L for passing-beam
- (b) In the case of a headlamp with a symmetrical beam pattern:
 - (i) Class B passing-beam
 - Passing-beam : In points 0.50U/1.5L and 0.50U/1.5R, 50R, 50L
 - Driving beam : At the point for I_M
 - (ii) Classes C, D and E
 - Passing-beam : In points 0.86D-3.5R, 0.86D-3.5L, 0.50U-1.5L and 0.50U-1.5R
 - Driving beam : At the point for I_M
- (c) In the case of a front fog lamps:
 - At the point of maximum illumination in zone D (I_{max}) and in the point HV.
- (d) In the case of an AFS:
 - Passing-beam : In points 25L, 50V, B50L
 - Driving beam : At the point for I_M

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A complete sample shall be tested for stability of photometric performance in operation.

92.9.1.1 In the case of headlamps or front fog lamps:

"Complete sample" shall be understood to mean the complete lamp itself including ballast(s) and those surrounding body parts, light sources or LED module(s) which could influence its thermal dissipation.

92.9.1.2 In the case of an AFS:

(a)"Complete sample" shall be understood to mean the complete right and left side of a system itself including electronic light source control-gear(s) and/or supply and operating device(s) and those surrounding body parts and lamps which could influence its thermal dissipation.

(b)"Test sample" in the following text means correspondingly either the "complete sample" or the installation unit under test.

(c)The expression "light source" shall be understood to comprise also any single filament of a filament light source, LED light source, LED modules or light emitting parts of a LED light source or LED module.

92.9.1.3 The tests shall be carried out:

(a)In a dry and still atmosphere at an ambient temperature of 23 deg. C +/- 5 deg. C, the test sample being mounted on a base representing the correct installation on the vehicle.

(b)In case of replaceable light sources: using mass production filament light sources, which have been aged for at least one hour, or mass production gas-discharge light sources, which have been aged for at least 15 hours or mass production LED light source and LED modules which have been aged for at least 48 hours and cooled down to ambient temperature before starting the tests as specified in this Regulation. The LED modules supplied by the applicant shall be used.

(c)In the case of an AFS providing an adaptation of the driving-beam, the driving beam shall be in the maximum condition if activated.

92.9.1.4 The measuring equipment shall be equivalent to that used during type approval tests. The AFS or part(s) thereof shall, prior to the subsequent tests, be set to the neutral state.

The test sample shall be operated without being dismantled from or readjusted in relation to its test fixture. The light source used shall be a light source of the category specified for that headlamp.

92.9.2 Test for stability of photometric performance

92.9.2.1 Clean device

The device shall be operated for 12 hours as described in paragraph 92.2.1.1. and checked as prescribed in paragraph 92.2.1.2.

92.9.2.1.1 Test procedure

92.9.2.1.1.1 The device shall be operated for a period according to the specified time, so that:

- (a) In the case where a device is designed to provide only one lighting function (driving beam or passing beam or front fog lamp) and not more than one class in case of passing beam, the corresponding light source(s) is/are lit for the time, specified in paragraph 92.9.2.1.
- (b) In the case where a device is designed to provide a passing-beam and one or more driving-beams or in the case of a headlamp with a passing-beam and a front fog lamp:
 - (i) The device shall be subjected to the following cycle until the time specified is reached as follows:
 - 15 minutes, principal passing-beam lit
 - 5 minutes, all functions lit
 - (ii) If the applicant declares that the headlamp is to be used with only the passing beam lit or only the driving beam(s) lit at a time, the test shall be carried out in accordance with this condition, activating successively the

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passing beam half of the time and the driving beam(s) for half the time specified (i.e. 6 hours).

(iii) In the case of a passing beam and a driving beam provided by the same gasdischarge light source, the cycle will be:

- 15 minutes, passing beam lit
- 5 minutes, all driving beam contributors lit.

(c) In case of an AFS,

(i) Where a test sample provides more than one function or class of passing beam according to this Regulation: if the applicant declares that each specified function or class of passing beam of the test sample has its own light source(s), being exclusively lit at a time, the test shall be carried out in accordance with this condition, activating the most power consuming mode of each specified function or class of passing beam successively for 12 hours.

(ii) In all other cases, the test sample shall be subjected to the following cycle test for each, the mode(s) of class C passing beam, the class V passing beam, the class E passing beam and the class W passing beam, whatever is provided or partly provided by the test sample, for the same (equally divided) part of the time specified in paragraph 92.9.2.1.:

- 15 minutes, first, e.g. class C passing beam mode lit with its most power-consuming mode for straight road conditions;
 - 5 minutes, same passing beam mode lit as before and, additionally, all light sources of the test sample, which are possible to be lit at the same time, according to the applicant's declaration;
- after having reached the said (equally divided) part of the time specified in paragraph 92.2.1., the above test cycle shall be performed with the second, third and fourth class of passing beam, if applicable, in the above

order.

(d) In the case of a headlamp with a front fog lamp and one or more driving-beams:

(i) The headlamp shall be subjected to the following cycle until the time specified is reached:

- 15 minutes, front fog lamp lit;

- 5 minutes, all functions lit.

(ii) If the applicant declares that the headlamp is to be used with only the front fog lamp lit or only the driving-beam(s) lit at a time, the test shall be carried out in accordance with this condition, activating successively the front fog lamp half of the time and the driving-beam(s) (simultaneously) for half the time specified in paragraph 92.9.2.1.

(e) In the case where a test sample includes other grouped lighting function(s), all the individual functions shall be lit simultaneously for the time specified in (a) or (b) above for individual lighting functions, according to the manufacturer's specifications.

(f) In the case of a headlamp with a passing-beam, one or more driving-beams and a front fog lamp:

(i) The headlamp shall be subjected to the following cycle until the time specified is reached:

- 15 minutes, principal passing-beam lit;

- 5 minutes, all functions lit.

(ii) If the applicant declares that the headlamp is to be used with only the passing-beam lit or only the driving-beam(s) lit at a time, the test shall be carried out in accordance with this condition, activating successively the principal passing-beam half of the time and the driving-beam(s) for half the time specified in paragraph 92.9.2.1., while the front fog lamp is subjected to a cycle of 15 minutes off and 5 minutes lit for half of the time and during the

operation of the driving-beam.

(iii) If the applicant declares that the headlamp is to be used with only the passingbeam lit or only the front fog lamp lit at a time, the test shall be carried out in accordance with this condition, activating successively the principal passingbeam half of the time and the front fog lamp for half of the time specified in paragraph 92.9.2.1., while the driving-beam(s) is(are) subjected to a cycle of 15 minutes off and 5 minutes lit for half of the time and during the operation of the principal passing-beam.

(iv) If the applicant declares that the headlamp is to be used with only the passingbeam lit or only the driving-beam(s) lit or only the front fog lamp lit at a time, the test shall be carried out in accordance with this condition, activating successively the principal passing-beam one third of the time, the drivingbeam(s) one third of the time and the front fog lamp for one third of the time specified in paragraph 92.9.2.1

(g) In the case of a passing-beam designed to provide bend lighting with the addition of light source(s) or LED module(s), it/they shall be switched on for one minute, and switched off for nine minutes during the activation of the passing-beam only.

If the headlamp has several additional light sources used to produce bend lighting, the test shall be carried out with the combination of light source(s) that represents the most severe operating condition.

(h) In the case that the driving beam uses several light sources and if the applicant declares that a part of the driving beam (one of these additional light sources) will be used exclusively for short time signals (flash to pass), the test shall be carried out without this part of the driving beam.

92.9.2.1.1.2 Test voltage

The voltage shall be applied to the terminals of the test sample as follows:

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- (a) In case of replaceable filament light source(s) operated directly under vehicle voltage system conditions: The test shall be performed at 6.3 V, 13.2 V or 28.0 V as applicable except if the applicant specifies that the test sample may be used at a different voltage. In this case, the test shall be carried out with the filament light source operated at the highest voltage that can be used.
- (b) In case of replaceable gas discharge light source(s): The test voltage for the electronic light source control-gear or the light source In*/ case the ballast is integrated with the light source is 13.2 +/- 0.1 volts for 12 V vehicle voltage system, or otherwise specified in the application for approval.
- (c) In the case of non-replaceable light source operated directly under vehicle voltage system conditions: All measurements on lighting units equipped with non-replaceable light sources (filament light sources and/ or others) shall be made at 6.3 V, 13.2 V or 28.0 V or at other voltages according to the vehicle voltage system as specified by the applicant respectively.
- (d) In the case of light sources, replaceable or non-replaceable, being operated independently from vehicle supply voltage and fully controlled by the system, or, in the case of light sources supplied by a supply and operating device, the test voltages as specified above shall be applied to the input terminals of that device. The test laboratory may require from the manufacturer the supply and operating device or a special power supply needed to supply the light source(s).
- (e) LED light source(s) and LED module(s) shall be measured at 6.75 V, 13.2 V or 28.0 V respectively, if not otherwise specified within the pertinent Regulation. LED light source(s) and LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.
- (f) Where signalling lamps are grouped, combined or reciprocally incorporated into the test sample and operating at

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voltages other than the nominal rated voltages of 6 V, 12 V or 24 V respectively, the voltage shall be adjusted as declared by the manufacturer for the correct photometric functioning of that lamp.

- (g) For a gas-discharge light source, the test voltage for the ballast or for the light source in case the ballast is integrated with the light source is 13.2 +/- 0.1 volts for 12 V network system, or otherwise specified in the application for approval.

92.9.2.1.2 Test results

92.9.2.1.2.1 Visual inspection : No distortion, deformation, cracking or change in color of either the headlamp lens or the external lens, if any, shall be noticeable.

92.9.2.1.2.2 Photometric test

To comply with the requirements, the photometric values shall be verified in the following points:

92.9.2.1.2.2.1 In the case of a headlamp with an asymmetrical beam pattern:

- (a) Passing-beam, except for AFS system:- 50 R - B 50 L - 25L
- (b) Passing-beam, for AFS system:

Class C passing beam and each specified other passing beam class: 50V, B50L, and 25RR, if applicable

- (c) Driving-beam: Point I_M

Another aiming may be carried out to allow for any deformation of the headlamp base due to heat (the change of the position of the cut-off line is covered

Except for point B 50 L, a 10 per cent discrepancy between the photometric characteristics and the values measured prior to the test is permissible including the tolerances of the photometric procedure.

The value measured at point B 50 L shall not exceed the photometric value measured prior to the test by more than 170 cd.

92.9.2.1.2.2.2 In the case of a head lamp with a symmetrical beam pattern:

(a) Class B headlamp:

- Passing beam: 50R - 50L - 0.50U/1.5L and 0.50U/1.5R

- Driving beam: Point of I_M

(b) For Classes C, D and E headlamp:

- Passing beam: 0.86D/3.5R - 0.86D/3.5L - 0.50U/1.5L and 1.5R.

-Driving beam: Point of I_M

Another aiming may be carried out to allow for any deformation of the headlamp base due to heat (the change of the position of the cut-off line is covered in paragraph 92.9.2.3).

Except for points 0.50U/1.5L and 0.50U/1.5R, a 10 per cent discrepancy between the photometric characteristics and the values measured prior to the test is permissible including the tolerances of the photometric procedure. The value measured at points 0.50U/1.5L and 0.50U/1.5R shall not exceed the photometric value measured prior to the test by more than 255cd.

92.9.2.1.2.2.3 In the case of front fog lamps on line 5 at point $h = 0$ and the point of I_{max} in zone D.

Another aiming may be carried out to allow for any deformation of the front fog lamp base due to heat (the change of the position of the cut-off line is covered in paragraph 92.9.2.3).

A 10 per cent discrepancy between the photometric characteristics and the values measured prior to the test is permissible including the tolerances of the photometric procedure.

92.9.2.2 Dirty headlamp

After being tested as specified in paragraph 92.9.2.1., the headlamp shall be operated for one hour as described in paragraph 92.9.2.1.1. for each function or class of passing beam after being prepared as prescribed in paragraph 92.9.2.2.1., and checked as prescribed in paragraph 92.9.2.1.2.

92.9.2.2.1 Preparation of the headlamp

92.9.2.2.1.1 Test mixture:

92.9.2.2.1.1.1 For devices with the outer lens made of glass:

The mixture of water and a polluting agent to be applied to the device shall be composed of:

- (a) 9 parts by weight of silica sand with a particle size of 0-100 micrometres;
- (b) 1 part by weight of vegetal carbon dust produced from beech wood with a particle size of 0-100 micrometres;
- (c) 0.2 parts by weight of NaCMC; and
- (d) 5 parts by weight of sodium chloride (pure at 99 per cent);
- (e) an appropriate quantity of distilled water, with a conductivity of < 1 mS/m. The mixture shall not be more than 14 days old.

92.9.2.2.1.1.2 For devices with outer lens made of plastic material:

The mixture of water and polluting agent to be applied to the device shall be composed of:

- (a) 9 parts by weight of silica sand with a particle size of 0-100 micrometres;
- (b) 1 part by weight of vegetal carbon dust produced from beech wood with a particle size of 0-100 micrometres;

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- (c) 0.2 parts by weight of NaCMC; and
- (d) 5 parts by weight of sodium chloride (pure at 99 per cent);
- (e) 13 parts by weight of distilled water with a conductivity of < 1 mS/m; and
- (f) 2 +/- 1 drops by weight of surfactant. The mixture shall not be more than 14 days old.

92.9.2.2.1.2 Application of the test mixture to the headlamp

The test mixture shall be uniformly applied to the entire light-emitting surface of the headlamp and then left to dry. This procedure shall be repeated until the illumination value has dropped to 15-20 per cent of the values measured for each following point under the conditions described below:

- (a) In the case of a headlamp with an asymmetrical beam pattern:
 - (i) Point of I_{max} in passing-beam/driving-beam and in driving-beam only;
 - (ii) 50 R and 50 V for a headlamp producing only a passing-beam,
 - (iii) 50V for a class C passing beam of AFS system, and each specified passing beam mode.
- (b) In the case of a headlamp with a symmetrical beam pattern:
 - (i) For Class B headlamp:
 - Passing beam / driving beam and driving beam only: Point of I_{max}
 - Passing beam only: B 50 and 50 V
 - (ii) For Class C, D and E headlamp:
 - Passing beam/driving beam and driving beam only: Point of I_{max}
 - Passing beam only: 0.50U/1.5L and 1.5R and 0.86D/V
- (c) In the case of a front fog lamps:

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- point of I_{max} in zone D.

92.9.3 Test for change in vertical position of the cut-off line under the influence of heat

This test consists of verifying that the vertical drift of the cut-off line under the influence of heat does not exceed a specified value for an operating headlamp producing a passing-beam, for front fog lamps, or in the case of an AFS for a system or part(s) of emitting a class C (basic) passing-beam, or each specified passing-beam mode.

The device tested in accordance with paragraph 92.2., shall be subjected to the test described in paragraph 92.3.1., without being removed from or readjusted in relation to its test fixture.

If the AFS consists of more than one lighting unit or more than one assembly of lighting units which provide a cut-off, each of these is understood to be a test sample for the purpose of this test and must be tested separately.

If the AFS has a moving optical part, only the position closest to the average vertical angular stroke and/or the initial position according to the neutral state is chosen for this test. The test is confined to signal input conditions corresponding to a straight road, only.

92.9.3.1 Test procedure

92.9.3.1.1 For the purpose of this test, the voltage shall be adjusted as specified in paragraph 92.2.1.1.2.; The test shall be carried out in a dry and still atmosphere at an ambient temperature of 23 deg. C +/- 5 deg. C.

The device shall be operated without being dismantled from or readjusted in relation to its test fixture. (For the purpose of this test, the voltage shall be adjusted as specified in paragraph 92.2.1.1.2.):

(a) Using a mass production filament light source as submitted with the device, which has been aged for at least 1 hour;

(b) Using mass production LED light source(s) and/or the LED module(s) as submitted with the device, which has

been aged for at least 48 hours;

(c) Using a mass production gas-discharge light source which has been aged for at least 15 hours.

92.9.3.1.2 In the case of a device with an asymmetrical beam pattern: the position of the "cut-off" line in its horizontal part (between V-V and the vertical lines passing through point B 50 L for right-hand traffic or B 50 R for left-hand traffic) shall be verified 3 minutes (r3) and 60 minutes (r60) respectively after operation.

92.9.3.1.3 In the case of a headlamp with a symmetrical beam pattern: the position of the "cut-off" line in its horizontal part (between V-V and the vertical lines passing through point 50 L and 50 R for Class BS headlamp, 3.5 L and 3.5 R for Class CS, DS and ES headlamp) shall be verified 3 minutes (r3) and 60 minutes (r60) respectively after operation.

92.9.3.1.4 In the case of a front fog lamps: the position of the "cut-off" line between a point situated 3.0 degrees left and a point situated 3.0 degrees right of the cut-off line V-V shall be verified 3 minutes (r3) and 60 minutes (r60) respectively after operation.

The measurement of the variation in the cut-off line position as described above shall be carried out by any method giving acceptable accuracy and reproducible results.

92.9.3.2 Test results

92.9.3.2.1 The result, expressed in milliradians (mrad), shall be considered as acceptable when:

(a) In case of headlamps or AFS, the absolute value $\Delta r1 = |r3 - r60|$ recorded on the device is not more than 1.0 mrad ($\Delta r1 \leq 1.0$ mrad) upward and not more than 2.0 mrad ($\Delta r1 \leq 2.0$ mrad) downwards.

(b) In case of front fog lamps, the absolute value $\Delta r1 = |r3 - r60|$ recorded on this device is not more than 2.0 mrad ($\Delta r1 \leq 2.0$ mrad).

92.9.3.2.2 However, if value of headlamp or AFS (upward) is more than 1.0 mrad but not more than 1.5 mrad, the value of

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已註解 [b1]:

front fog lamp (upward) is more than 2.0 mrad but not more than 3.0 mrad, the value of headlamp or AFS or front fog lamp (downward) is more than 2.0 mrad but not more than 3.0 mrad, then a further sample of a headlamp mounted on a test fixture representative of the correct installation on the vehicle shall be tested as described in paragraph 91.9.3.1 after being subjected three consecutive times to the cycle as described below, in order to stabilize the position of mechanical parts:

Operation of the lamp for one hour (the voltage shall be adjusted as specified in paragraph 92.9.2.1.1.2), one hour period with the lamp switched off.

After these three cycles, the device shall be considered as acceptable if the absolute values Δr measured according to paragraph 92.9.3.2. on this further sample meet the requirements in paragraph 92.9.3.2.1.

92.10 Requirements for road illumination devices incorporating lenses of plastic material - testing of lens or material samples

92.10.1 General administrative requirements:

92.10.1.1 A test report shall be prepared on the base of this paragraph, covering the test and test results as described below for the tests 92.10.3.1 to 92.10.3.5, which will be added to the test report and the documentation to a specific device for approval.

The road illumination device used for this test shall be noted in the test report.

92.10.1.2 Test report:

92.10.1.2.1 For the test of plastic material of which the lenses are made: Fourteen lenses;

92.10.1.2.1.1 Ten of these lenses may be replaced by ten samples of material at least 60 x 80 mm in size, having a flat or convex outer surface and a substantially flat area (radius of curvature not less than 300 mm) in the middle

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measuring at least 15 x 15 mm;

92.10.1.2.1.2 Every such lens or sample of material shall be produced by the method to be used in mass production;

92.10.1.2.2 An optical assembly, if applicable, to which the lenses can be fitted in accordance with the manufacturer's instructions.

92.10.1.2.3 For testing the ultraviolet (UV)-resistance of light transmitting components made of plastic material against UV radiation of LED modules inside the headlamp: One sample of each of the relevant material as being used in the road illumination device or one road illumination device sample containing these. Each material sample shall have the same appearance and surface treatment, if any, as intended for use in the headlamp to be approved;

The UV-resistance testing of internal materials to light source radiation is not necessary if no LED modules other than low-UV-types as specified in paragraph 92.11 are being applied or if provisions are taken, to shield the relevant device components from UV radiation, e.g. by glass filters.

92.10.2 General requirements

92.10.2.1 The samples supplied pursuant to paragraph 92.10.1.2. shall satisfy the requirements indicated in paragraphs 92.10.3.1. to 92.10.3.6.

92.10.2.2 The two samples of complete road illumination devices supplied pursuant to paragraph 92.10.3.1.3.4. of this Regulation and incorporating lenses of plastic material shall, with regard to the lens material, satisfy the requirements indicated in paragraph 92.10.3.7.

92.10.2.3 The samples (lenses of plastic material or samples of material) shall be subjected, with the optical assembly to which they are intended to be fitted (where applicable), to approval tests in the chronological order indicated in Table 18.

92.10.2.4 However, if the lamp manufacturer can prove that the product has already passed the tests prescribed in paragraphs

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92.10.3.1. to 92.10.3.5., or the equivalent tests pursuant to another regulation, those tests need not be repeated; only the tests prescribed in Table 19 shall be mandatory.

92.10.2.5 Chronological order of material tests

A. Tests on plastic materials (lenses or samples of material supplied pursuant to paragraph 92.10.1.2.).

Samples Tests	Lenses or samples of material										Lenses			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Limited photometry											X	X	X	
Temperature change											X	X	X	
Limited photometry											X	X	X	
Transmission measurement	X	X	X	X	X	X	X	X	X					
Diffusion measurement	X	X	X				X	X	X					
Atmospheric agents	X	X	X											
Transmission measurement	X	X	X											
Chemical agents	X	X	X											
Diffusion measurements	X	X	X											
Detergents				X	X	X								
Hydrocarbons				X	X	X								
Transmission measurement				X	X	X								
Deterioration							X	X	X					
Transmission measurement							X	X	X					
Diffusion measurement							X	X	X					
Adherence														X
Resistance to light source radiations*										X				

* This test concerns front fog lamps equipped with gas-discharge light sources, headlamps and AFS.

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Table 18: Chronological order of material tests

Tests	Complete devices, systems or parts thereof	
	Sample No.	
	1	2
Deterioration	X	
Photometry	X	
Adherence		X

Table 19: Tests on complete devices, systems or parts thereof

92.10.2.6 Method of measurement of the diffusion and transmission of light

92.10.2.6.1 Equipment (see figure 18)

The beam of a collimator K with a half divergence $\beta/2 = 17.4 \times 10^4$ rd is limited by a diaphragm Dtau with an opening of 6 mm against which the sample stand is placed.

A convergent achromatic lens L_2 , corrected for spherical aberrations links the diaphragm Dtau with the receiver R; the diameter of the lens L_2 shall be such that it does not diaphragm the light diffused by the sample in a cone with a half top angle of $\beta/2 = 14$ deg.

An annular diaphragm DD, with angles $\alpha_o/2 = 1$ deg. and $\alpha_{max}/2 = 12$ deg. Is placed in an image focal plane of the lens L_2 .

The non-transparent central part of the diaphragm is necessary in order to eliminate the light arriving directly from the light source. It shall be possible to remove the central part of the diaphragm from the light beam in such a manner that

it returns exactly to its original position.

The distance L_2 D_{tau} and the focal length F_2 of the lens L_2 shall be so chosen that the image of D_{tau} completely covers the receiver R.

When the initial incident flux is referred to 1,000 units, the absolute precision of each reading shall be better than 1 unit.

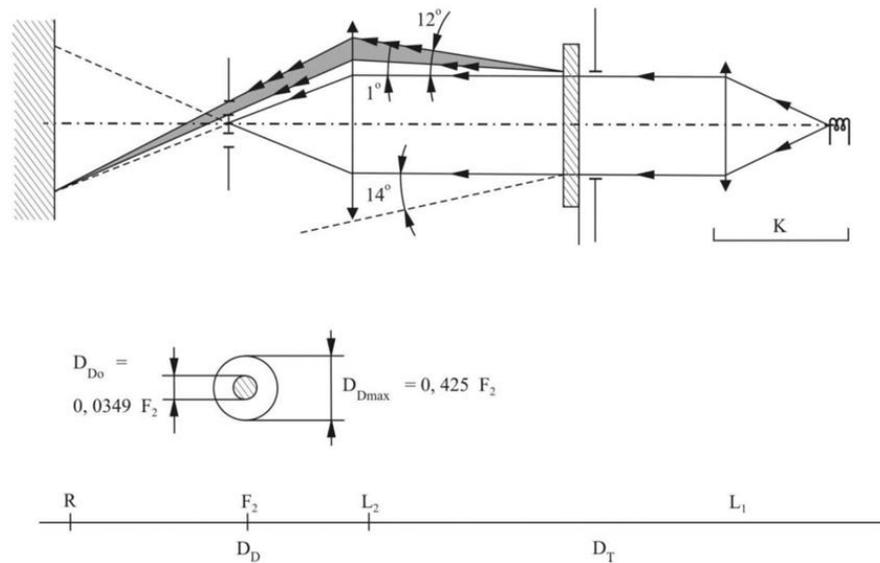


Figure 18: Optical set up for measurement of variations in diffusion and transmission

92.10.2.6.2 Measurements

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The following readings shall be taken:

Reading	With sample	With central part of D_D	Quantity represented
T ₁	No	No	Incident flux in initial reading
T ₂	Yes (before test)	No	Flux transmitted by the new material in a field of 24 deg.
T ₃	Yes (after test)	No	Flux transmitted by the tested material in a field of 24 deg.
T ₄	Yes (before test)	Yes	Flux diffused by the new material
T ₅	Yes (after test)	Yes	Flux diffused by the tested material

Table 20: Readings

92.10.2.7 Spray testing method

92.10.2.7.1 Test equipment

92.10.2.7.1.1 Spray gun

The spray gun used shall be equipped with a nozzle 1.3 mm in diameter allowing a liquid flow rate of 0.24 +/- 0.02 l/minute at an operating pressure of 6.0 bars -0/+0.5 bar.

Under these operation conditions the fan pattern obtained shall be 170 mm/ 50 mm in diameter on the surface exposed to deterioration, at a distance of 380 mm/ 10 mm from the nozzle.

92.10.2.7.1.2 Test mixture

The test mixture shall be composed of:

- (i) Silica sand of hardness 7 on the Mohr scale, with a grain size between 0 and 0.2 mm and an almost normal distribution, with an angular factor of 1.8 to 2;
- (ii) Water of hardness not exceeding 205 g/m³ for a mixture comprising 25 g of sand per litre of water.

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92.10.2.7.2 Test

The outer surface of the lamp lenses shall be subjected once or more than once to the action of the sand jet produced as described above. The jet shall be sprayed almost perpendicular to the surface to be tested.

The deterioration shall be checked by means of one or more samples of glass placed as a reference near the lenses to be tested. The mixture shall be sprayed until the variation in the diffusion of light on the sample or samples measured by the method described in paragraph 92.10.2.6, is such that:

$$\Delta d = \frac{T_5 - T_4}{T_2} = 0.0250 \pm 0.0025$$

Several reference samples may be used to check that the whole surface to be tested has deteriorated homogeneously.

92.10.2.8 Adhesive tape adherence test

92.10.2.8.1 Purpose

This method allows to determine under standard conditions the linear force of adhesion of an adhesive tape to a glass plate.

92.10.2.8.2 Principle

Measurement of the force necessary to unstick an adhesive tape from a glass plate at an angle of 90 deg.

92.10.2.8.3 Specified atmospheric conditions

The ambient conditions shall be at 23 deg. C +/- 5 deg. C and 65 +/- 15 per cent RH.

92.10.2.8.4 Test pieces

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Before the test, the sample roll of adhesive tape shall be conditioned for 24 hours in the specified atmosphere (see para. 3. above). Five test pieces each 400 mm long shall be tested from each roll. These test pieces shall be taken from the roll after the first three turns were discarded.

92.10.2.8.5 Procedure

The test shall be under the ambient conditions specified in paragraph 92.10.2.8.3.

Take the five test pieces while unrolling the tape radially at a speed of approximately 300 mm/s, then apply them within 15 seconds in the following manner:

Apply the tape to the glass plate progressively with a slight length-wise rubbing movement of the finger, without excessive pressure, in such a manner as to leave no air bubble between the tape and the glass plate.

Leave the assembly in the specified atmospheric conditions for 10 minutes. Unstick about 25 mm of the test piece from the plate in a plane perpendicular to the axis of the test piece.

Fix the plate and fold back the free end of the tape at 90 deg. Apply force in such a manner that the separation line between the tape and the plate is perpendicular to this force and perpendicular to the plate.

Pull to unstick at a speed of 300 mm/s +/- 30 mm/s and record the force required.

92.10.2.8.6 Results

The five values obtained shall be arranged in order and the median value taken as a result of the measurement. This value shall be expressed in Newtons per centimetre of width of the tape.

92.10.3 Specific Test Requirements

92.10.3.1 Resistance to temperature changes

92.10.3.1.1 Three new samples (lenses) shall be subjected to five cycles of temperature and humidity (RH = relative humidity)

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change in accordance with the following programme:

Before this test, the samples shall be kept at 23 deg. C +/- 5 deg. C and 60-75 per cent RH for at least four hours.

- (a) 3 hours at 40 deg. C +/- 2 deg. C and 85-95 per cent RH;
- (b) 1 hour at 23 deg. C +/- 5 deg. C and 60-75 per cent RH;
- (c) 15 hours at -30 deg. C +/- 2 deg. C;
- (d) 1 hour at 23 deg. C +/- 5 deg. C and 60-75 per cent RH;
- (e) 3 hours at 80 deg. C +/- 2 deg. C;
- (f) 1 hour at 23 deg. C +/- 5 deg. C and 60-75 per cent RH;

Note: The periods of one hour at 23 deg. C +/- 5 deg. C shall include the periods of transition from one temperature to another which are needed in order to avoid thermal shock effects.

92.10.3.1.2 Photometric measurements

92.10.3.1.2.1 Photometric measurements shall be carried out on the samples before and after the test.

92.10.3.1.2.2 These measurements shall be made using a standard (etalon) light source and/or LED module(s), or if applicable with a standard gas-discharge light source, as present in the road illumination device, at the following points:

- (a) In the case of classes A, B and D:
 - B 50 L and 50 R for the passing-beam
- (b) In the case of AFS:
 - B50L and 50V for the Class C passing-beam lighting;
 - I_{max} for the driving-beam of a system

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(c) In the case of classes BS, CS, DS and ES:

- B 50, 50L and 50R for Class BS headlamp, 0.86D/3.5R, 0.86D/3.5L, 0.50U/1.5L and 1.5R for Class CS, DS and ES headlamps for the passing beam or a passing/ driving lamp;
- I_{max} for the driving beam of a driving lamp or a passing/driving lamp;

(d) In the case of front fog lamps:

- intersection VV line with line 6 and
- intersection VV line with line 4.

92.10.3.1.2.3 Results

The variation between the photometric values measured on each sample before and after the test shall not exceed 10 per cent including the tolerances of the photometric procedure.

92.10.3.2 Resistance to atmospheric and chemical agents

92.10.3.2.1 Resistance to atmospheric agents

Three new samples (lenses or samples of material) shall be exposed to radiation from a source having a spectral energy distribution similar to that of a black body at a temperature between 5,500 K and 6,000 K. Appropriate filters shall be placed between the source and the samples so as to reduce as far as possible radiations with wave lengths smaller than 295 nm and greater than 2,500 nm.

The samples shall be exposed to an energetic illumination of 1,200 W/m² +/- 200 W/m² for a period such that the luminous energy that they receive is equal to 4,500 MJ/m² +/- 200 MJ/m². Within the enclosure, the temperature measured on the black panel placed on a level with the samples shall be 50 deg. C +/- 5 deg. C. In order to ensure a regular exposure, the samples shall revolve around the source of radiation at a speed between 1 and 5 1/min. The

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samples shall be sprayed with distilled water of conductivity lower than 1 mS/m at a temperature of 23 deg. C +/- 5 deg. C, in accordance with the following cycle: spraying: 5 minutes; drying: 25 minutes.

92.10.3.2.2 Resistance to chemical agents

After the test described in paragraph 92.10.3.2.1. and the measurement described in paragraph 92.10.3.2.3.1. have been carried out, the outer face of the said three samples shall be treated as described in paragraph 92.10.3.2.2.2. with the mixture defined in paragraph 92.10.3.2.2.1.

92.10.3.2.2.1 Test mixture

The test mixture shall be composed of 61.5 per cent n-heptane, 12.5 per cent toluene, 7.5 per cent ethyl tetrachloride, 12.5 per cent trichloroethylene and 6 per cent xylene (volume per cent).

92.10.3.2.2.2 Application of the test mixture

Soak a piece of cotton cloth (as per ISO 105) until saturation with the mixture defined in paragraph 92.3.2.2.1. and, within 10 seconds, apply it for 10 minutes to the outer face of the sample at a pressure of 50 N/cm², corresponding to an effort of 100 N applied on a test surface of 14 x 14 mm.

During this 10-minute period, the cloth pad shall be soaked again with the mixture so that the composition of the liquid applied is continuously identical with that of the test mixture prescribed.

During the period of application, it is permissible to compensate the pressure applied to the sample in order to prevent it from causing cracks.

92.10.3.2.2.3 Cleaning

At the end of the application of the test mixture, the samples shall be dried in the open air and then washed with the solution described in paragraph 92.10.3.4.1. (Resistance to detergents) at 23 deg. C +/- 5 deg. C.

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Afterwards the samples shall be carefully rinsed with distilled water containing not more than 0.2 per cent impurities at 23 deg. C +/- 5 deg. C and then wiped off with a soft cloth.

92.10.3.2.3 Results

92.10.3.2.3.1 After the test of resistance to atmospheric agents, the outer face of the samples shall be free from cracks, scratches, chipping and deformation, and the mean variation in transmission

$$\Delta t = \frac{T_2 - T_3}{T_2}$$

, measured on the three samples shall not exceed 0.020 ($\Delta t_m < 0.020$).

92.10.3.2.3.2 After the test of resistance to chemical agents, the samples shall not bear any traces of chemical staining likely to cause a variation of flux diffusion, whose mean variation

$$\Delta d = \frac{T_5 - T_4}{T_2}$$

, measured on the three samples shall not exceed 0.020 ($\Delta d_m < 0.020$).

92.10.3.3 Resistance to light source radiations

If necessary the following test shall be done:

Flat samples of each light transmitting plastic component of the road illumination device are exposed to the light of the light source(s). The parameters such as angles and distances of these samples shall be the same as in the road illumination device. These samples shall have the same colour and surface treatment, if any, as the parts of the road illumination device.

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After 1,500 hours of continuous operation, the colorimetric requirements of the transmitted light must be met with a new light source, and the surfaces of the samples shall be free of cracks, scratches, scalings or deformation.

The UV-resistance testing of internal materials to light source radiation is not necessary if light sources according to UN Regulation No. 37 and/or low-UV-type gas discharge light sources and/or low-UV-type LED modules are being applied or if provisions are taken, to shield the relevant system components from UV radiation, e.g. by glass filters.

92.10.3.4 Resistance to detergents and hydrocarbons

92.10.3.4.1 Resistance to detergents

The outer face of three samples (lenses or samples of material) shall be heated to 50 deg. C +/- 5 deg. C and then immersed for five minutes in a mixture maintained at 23 deg. C +/- 5 deg. C and composed of 99 parts distilled water containing not more than 0.02 per cent impurities and one part alkylaryl sulphonate. At the end of the test, the samples shall be dried at 50 deg. C +/- 5 deg. C. The surface of the samples shall be cleaned with a moist cloth.

92.10.3.4.2 Resistance to hydrocarbons

The outer face of these three samples shall then be lightly rubbed for one minute with a cotton cloth soaked in a mixture composed of 70 per cent n-heptane and 30 per cent toluene (volume per cent), and shall then be dried in the open air.

92.10.3.4.3 Results

After the above two tests have been performed successively, the mean value of the variation in transmission

$$\Delta t = \frac{T_2 - T_3}{T_2}$$

, measured on the three samples according to the procedure described in Appendix 2 shall not exceed 0.010 ($\Delta t_m < 0.010$).

92.10.3.5 Resistance to mechanical deterioration

92.10.3.5.1 Mechanical deterioration method

The outer face of the three new samples (lenses) shall be subjected to the uniform mechanical deterioration test by the method described in paragraph 92.10.5.

92.10.3.5.2 Results

After this test, the variations:

in transmission:

$$\Delta t = \frac{T_2 - T_3}{T_2}$$

,and in diffusion

$$\Delta d = \frac{T_5 - T_4}{T_2}$$

,

The mean value of the three samples shall be such that:

$\Delta t_m \leq 0.100$;

$\Delta d_m \leq 0.050$.

92.10.3.6 Test of adherence of coatings, if any

92.10.3.6.1 Preparation of the sample

A surface of 20 mm x 20 mm in area of the coating of a lens shall be cut with a razor blade or a needle into a grid of squares approximately 2 mm x 2 mm. The pressure on the blade or needle shall be sufficient to cut at least the coating.

92.10.3.6.2 Description of the test

Use an adhesive tape with a force adhesion of 2 N/(cm of width) +/-20 per cent measured under the standardized conditions specified in paragraph 92.10.2.8 This adhesive tape, which shall be at least 25 mm wide, shall be pressed for at least five minutes to the surface prepared as prescribed in paragraph 92.10.3.6.1.

Then the end of the adhesive tape shall be loaded in such a way that the force of adhesion to the surface considered is balanced by a force perpendicular to that surface. At this stage, the tape shall be torn off at a constant speed of 1.5 m/s +/- 0.2 m/s

92.10.3.6.3 Results

There shall be no appreciable impairment of the gridded area. Impairments at the intersections between squares or at the edges of the cuts shall be permitted, provided that the impaired area does not exceed 15 per cent of the gridded surface.

92.10.3.7 Tests of the complete road illumination device incorporating a lens of plastic material.

92.10.3.7.1 Resistance to mechanical deterioration of the lens surface

92.10.3.7.1.1 Tests

The lens of sample No. 1 shall be subjected to the test described in paragraph 92.3.5.1. above.

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92.10.3.7.1.2 Results

92.10.3.7.1.2.1 In case of classes A, B and D and AFS, after the test the results of photometric measurements carried out on the headlamp in accordance with this Regulation shall not exceed:

- (a) By more than 30 per cent the maximum values prescribed at points B 50 L and HV and by more than 10 per cent below the minimum values prescribed at point 75 R (in the case of headlamps intended for left-hand traffic, the points to be considered are B 50 R, HV and 75 L)

or

- (b) By more than 10 per cent below the minimum values prescribed for HV in the case of a headlamp producing driving beam only.

92.10.3.7.1.2.2 In the case of Classes BS, CS, DS and ES, after the test, the results of photometric measurements carried out on the headlamp in accordance with this Regulation shall not exceed:

- (a) By more than 30 per cent the maximum values prescribed at point HV and not be more than 10 per cent below the minimum values prescribed at point 50 L and 50 R for Class BS headlamp, 0.86D/3.5R, 0.86D/3.5L for Classes CS, DS and ES headlamp

or

- (b) By more than 10 per cent below the minimum values prescribed for HV in the case of a headlamp producing driving beam only.

92.10.3.7.1.2.3 In the case of fog lamps, after the test, the results of photometric measurements prescribed for lines 2 and 5 shall not exceed the maximum values prescribed by more than 30 per cent.

92.10.3.7.2 Test of adherence of coatings, if any

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The lens of sample No. 2 shall be subjected to the test described in paragraph 92.10.3.6.

92.11 Requirements for LED modules and Road Illumination Devices (except cornering lamps) including LED modules and/or LED light sources

92.11.1 General requirements for LED modules

92.11.1.1 Each LED module sample submitted shall conform to the relevant requirements of this Regulation when tested with the supplied electronic light source control-gear(s), if any.

92.11.1.2 LED module(s) shall be so designed as to be and to remain in good working order when in normal use. They shall moreover exhibit no fault in design or manufacture. A LED module shall be considered to have failed if any one of its LEDs has failed.

92.11.1.3 LED module(s) shall be tamperproof.

92.11.1.4 The design of removable LED module(s) shall be such that:

92.11.1.4.1 When the LED module is removed and replaced by another module provided by the applicant and bearing the same light source module identification code, the photometric requirements of the headlamp or AFS system shall be met;

92.11.1.4.2 LED modules with different light source module identification codes within the same lamp housing shall not be interchangeable.

92.11.2 Manufacture of LED modules

92.11.2.1 The LED(s) on the LED module shall be equipped with suitable fixation elements.

92.11.2.2 The fixation elements shall be strong and firmly secured to the LED(s) and the LED module.

92.11.3 Test conditions

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92.11.3.1 All samples shall be tested as specified in paragraph 92.4. The kind of light sources on a LED module shall be light-emitting diodes (LED) . Other kinds of light sources are not permitted.

92.11.3.2 Operating conditions

92.11.3.2.1 LED module operating conditions

All samples shall be tested under the conditions as specified in paragraph 92.4.6.4. If not specified differently in this paragraph, LED modules shall be tested inside the device as submitted by the manufacturer.

92.11.3.2.2 LED light source operating conditions

All samples shall be tested under the conditions as specified in paragraph 92.4.6.3.

92.11.3.2.3 Ambient temperature

For the measurement of electrical and photometric characteristics, the device shall be operated in a dry and still atmosphere at an ambient temperature of 23 deg. C +/- 5 deg. C.

92.11.3.3 Ageing

Upon the request of the applicant the LED module shall be operated for 15 h and cooled down to ambient temperature before starting the tests as specified in this Regulation.

92.11.4 Specific requirements and tests

92.11.4.1 Colour rendering : Red content

In addition to provisions as described in paragraph 92.4.14. of this Regulation.

The minimum red content of the light of a LED module or a device incorporating LED module(s) tested (at 50 V for headlamps and AFS) shall be such that:

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

where:

$E_e(\lambda)$ (unit: W) is the spectral distribution of the irradiance;

$V(\lambda)$ (unit: 1) is the spectral luminous efficiency;

λ (unit: nm) is the wavelength.

This value shall be calculated using intervals of one nanometre.

92.11.4.2 4.2. UV-radiation

The UV-radiation of a low-UV-type LED module shall be such that:

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

where:

$S(\lambda)$ (unit: 1) is the spectral weighting function; $k_m = 683 \text{ lm/W}$ is the maximum value of the luminous efficacy of radiation.

This value shall be calculated using intervals of one nanometre. The UV-radiation shall be weighted according to the values as indicated Table 21:

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λ	$S(\lambda)$	λ	$S(\lambda)$	λ	$S(\lambda)$
250	0.430	305	0.060	355	0.000 16
255	0.520	310	0.015	360	0.000 13
260	0.650	315	0.003	365	0.000 11
265	0.810	320	0.001	370	0.000 09
270	1.000	32	0.000 50	375	0.000 077
275	0.960	330	0.000 41	380	0.000 064
280	0.880	335	0.000 34	385	0.000 053
285	0.770	340	0.000 28	390	0.000 044
290	0.640	345	0.000 24	395	0.000 036
295	0.540	350	0.000 20	400	0.000 030
300	0.300				

Table 21: Table UV Values according to "IRPA/INIRC Guidelines on limits of exposure to ultraviolet radiation". Wavelengths (in nanometres) chosen are representative; other values should be interpolated.

92.11.4.3 Temperature stability for device including LED light source(s) and/or LED module(s)

92.11.4.3.1 Luminous intensity

92.11.4.3.1.1 A photometric measurement of the device shall be made after 1 minute of operation for the specific function at the test point specified below. For these measurements, the aim can be approximate but must be maintained for before and after ratio measurements.

Test points to be measured:

Passing-beam:

25R in case of headlamps of classes A, B and D

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50V in case of headlamps of classes AS, BS, CS, DS, ES

25RR in case of AFS

Driving-beam: H - V

Front fog lamps: horizontal 0 deg. vertical 2.5 deg. D

92.11.4.3.1.2 The lamp shall continue operation until photometric stability has occurred. The moment at which the photometry is stable is defined as the point in time at which the variation of the photometric value is less than 3 per cent within any 15 minutes period. After stability has occurred, aim for complete photometry shall be performed in accordance with the requirements of the specific device. Photometer the lamp at all test points required for the specific device.

92.11.4.3.1.3 Calculate the ratio between the photometric test point value determined in paragraph 92.4.3.1.1. and the point value determined in paragraph 92.4.3.1.2.

92.11.4.3.1.4 Once stability of photometry has been achieved, apply the ratio calculated above to each of the remainder of the test points to create a new photometric table that describes the complete photometry based on one minute of operation.

92.11.4.3.1.5 The luminous intensity values, measured after one minute and after photometric stability has occurred, shall comply with the minimum and maximum requirements.

92.11.4.3.2 Colour

The colour of the light emitted measured after one minute and measured after photometric stability has been obtained, as described in paragraph 92.4.3.1.2., shall both be within the required colour boundaries.

92.11.5 The measurement of the objective luminous flux of LED module(s) producing the principal passing-beam shall be carried out as
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follows:

92.11.5.1 The LED module(s) shall be in the configuration as described in the technical specification. Optical elements (secondary optics) shall be removed by the Technical Service at the request of the applicant by the use of tools. This procedure and the conditions during the measurements as described below shall be described in the test report.

92.11.5.2 One module of each type shall be submitted by the applicant with the light source control gear, if applicable, and sufficient instructions.

Suitable thermal management (e.g. heat sink) may be provided, to simulate similar thermal conditions as in the corresponding headlamp or AFS application.

Before the test each LED module shall be aged at least for seventy-two hours under the same conditions as in the corresponding headlamp application.

In the case of use of an integrating sphere, the sphere shall have a minimum diameter of one meter, and at least ten times the maximum dimension of the LED module, whichever is the largest. The flux measurements can also be performed by integration using a goniophotometer. The prescriptions in CIE - Publication 84 - 1989, regarding the room temperature, positioning, etc., shall be taken into consideration.

The LED module shall be burned in for approximately one hour in the closed sphere or goniophotometer.

The flux shall be measured after stability has occurred, as explained in paragraph 92.4.3.1.2.