59 Adaptive front lighting system (AFS)

Refer to: R123 00-S4

59.1 Effective date and Scope:

59.1.1 From 2011/1/1, new type of adaptive front lighting system (AFS) equipped on categories of M and N and from 2013/1/1, and all type of adaptive front lighting system (AFS) equipped on categories of M and N shall comply with this regulation and shall use the light source approved according the regulations of “Filament Lamps” and/or “LED light sources".

59.1.2 Paragraph 59.9. Test for stability of photometric performance, the test voltage shall comply with either 59.9.1.1 or 59.9.1.2 of this regulation.

59.1.2.1 Effective date from 2015/1/1, the new type of AFS used in category symbols M and N, the test voltage shall comply with 59.9.1.2 of this regulation.

59.1.3 The applicants applying for low volume safety type approval may be exempt from regulation of “Adaptive front lighting system (AFS)” except for large passenger vehicle and child-only vehicle.

59.1.4 Applying for vehicle-by-vehicle low volume safety type approval, the vehicle may be exempt from regulation of “Adaptive front lighting system (AFS)”.

59.2 Definitions

59.2.1 Adaptive front lighting system (or "system"): means a lighting device, providing beams with differing characteristics for automatic adaptation to varying conditions of use of the dipped-beam (passing beam) and, if it applies, the main-beam (driving-beam) with a minimum functional content as indicated in paragraph 59.4.7 such systems consist of the "system control", one or more "supply and operating device(s)", if any, and the "installation units" of the right and of the left side of the vehicle;

59.2.2 Class of a passing beam : means the designation of a passing beam, identified by particular provisions according to this Regulation.

59.2.3 Mode of a front-lighting function provided by a system means a beam within the provisions either for one of the passing beam classes or for the main beam, designed and specified by the manufacturer for adaptation to dedicated vehicle and ambient conditions;

59.2.4 Category 1 bending mode: means a bending mode with horizontal movement of the kink of the cut-off;

59.2.5 Category 2 bending mode: means a bending mode without horizontal movement of the kink of the cut-off;

59.2.6 Neutral state: means the state of the system when a defined mode of the class C passing beam ("basic passing beam") or of the main beam, if any, is produced, and no AFS control signal applies;

59.3 Adaptive front lighting system (AFS) shall according to suitable variants and range of principle：

59.3.1 Brand

59.3.2 The changeable characteristics of the optical system/ the component of optical performance

59.3.3 Functions、Mode and Class.

59.3.4 The materials constituting the lenses and coating.

59.3.5 The system belong to characteristic of signal.

59.4 Generally requirements:

59.4.1 Systems or part(s) thereof, shall be so made as to retain their prescribed photometric characteristics and to remain in good working order when in normal use, in spite of the vibrations to which they may be subjected.

59.4.2 Systems or part(s) thereof, shall be fitted with a device enabling them to be so adjusted on the vehicle as to comply with the rules applicable to them.

59.4.2.1 Such adjustment device(s) need not be fitted on systems or part(s) thereof, provided that their use is confined to vehicles on which the setting can be adjusted by other means or no such means are needed according to the applicant's system description.

59.4.3 If a light source is replaceable, its lamp holder shall conform to the dimensional characteristics given on the data sheet of IEC 60061. The design of the device shall be such that the filament lamp can be fixed in no other position but the correct one. If a light source is non-replaceable, it shall not be a part of a lighting unit that provides the passing beam in the neutral state.

59.4.4 On a system or part(s) of, designed to provide alternately the driving beam and the passing beam, any mechanical, electro-mechanical or other device incorporated in the lighting unit(s), for switching from one to the other beam shall be so constructed that:

59.4.4.1 the device is strong enough to withstand 50,000 operations without suffering damage despite the vibrations to which it may be subjected in normal use;

59.4.4.2 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 59.4.4.3 below;

59.4.4.3 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 1.5 lx in the zone III b and at least 4 lx in a point of "segment Emax".

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

59.4.5 The system shall be so made that, if a light source and/or a LED module has failed, a failure signal in order to comply with the relevant provisions of “The installation of lighting and light-signaling devices” shall be provided.

59.4.6 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.

59.4.7 Each system shall provide a class C passing beam according to paragraph 59.5.1.5 below 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 59.5.2 of this Regulation.

59.4.8 The system shall provide automatic modifications, such, that good road illumination is achieved and no discomfort is caused, neither to the driver nor to other road users.

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

59.4.9.1 at neutral state .

59.4.9.2 at V-signal, W-signal, E-signal, T-signal .

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

59.4.10 The AFS, if equipped with LED modules, and the LED module(s) themselves shall comply with the relevant requirements specified in paragraph 59.11 of this Regulation. The compliance with the requirements shall be tested.

59.4.11 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 as indicated under the communication form conforming to the model which exceeds 2,000 lumen per side a reference shall be made in the communication form. The objective luminous flux of LED module(s) shall be measured as described in paragraph 59.11.5.

59.4.12 In the case of the basic passing beam in the neutral state being produced exclusively by LED modules, the total objective luminous flux of these LED modules shall be equal or greater than 1,000 lumen per side, when measured as described in paragraph 59.11.5.

59.5 Photometric test（Figure 1）

59.5.1 Provisions concerning passing beam

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

59.5.1.1 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 59.6 to this Regulation or,

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

59.5.1.2 The system or part(s) thereof shall be so aimed that the position of the cut-off complies with the requirements indicated in the Table 2 to this Regulation.

59.5.1.3 When so aimed, the system or part(s) thereof, 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; 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.

59.5.1.4 Where a system or any part(s) thereof so aimed do not meet the requirements as indicated in paragraph 59.5.1.3 above, its alignment may, according to the instructions of the manufacturer, be changed, within 0.5 deg to the right or left and vertically 0.2 deg up or down, with respect to the initial aiming.

59.5.1.5 When emitting a specified mode of the passing beam, the system shall meet the requirements in the respective section (C, V, E, W) of part A of Table 1 (photometric values) and in Table 2 (Emax and "cut-off" positions), as well as section 1, paragraph 59.6 ("cut-off" requirements).

59.5.1.6 A bending mode may be emitted, provided that:

59.5.1.6.1 the system meets the respective requirements of Table 1 (photometric values) and of Table 2 ("cut-off" provisions), when measured according to the procedure indicated paragraph 59.7, relevant to the category (either category 1 or category 2) of the bending mode, for which approval is sought;

59.5.1.6.2 Emax of the illumination does not lie outside of the rectangle extending from the uppermost vertical position specified in Table 2 for the respective passing beam class, to 2 deg below H-H and from 45 deg left to 45 deg right of the system reference axis;

59.5.1.6.3 when the T-signal corresponds to the vehicle's smallest turn radius to the left (or right), the sum of the illuminance values provided by all contributors of the right or the left side of the system shall be at least 3 lx at one or more points in the zone extending from H-H to 2 deg below H-H and from 10 to 45 deg left (or right) of the system reference axis;

59.5.1.6.4 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”;

59.5.1.6.5 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 59.5.1.5 above or a state with respect to the photometric conditions which yields values not exceeding 1.5 lx in the zone IIIb, and at least 4 lx in a point of "segment Emax";

59.5.1.6.5.1 however, this is not needed, if for positions, relative to the system reference axis up to 5 deg left, at 0.3 deg up from H-H, and greater than 5 deg left, at 0.57 deg up, a value of 1 lx is in no case exceeded.

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

59.5.1.8 The system shall be so made that:

59.5.1.8.1 any specified passing beam mode provides at least 3 lx at point 50V from each side of the system; the mode(s) of the Class V passing beam are exempted from this requirement;

59.5.1.8.2 four seconds after switching on the system, which has not been operated for 30 minutes or more, at least 5 lx must be reached at point 50V of the class C passing beam;

59.5.1.8.3 other modes:

59.5.1.8.3.1 when signal inputs according to paragraph 59.4.9.3 of this Regulation apply, the requirements of the paragraph 59.5.1 shall be fulfilled.

59.5.2 Provisions concerning driving beam: The system shall, prior to the subsequent test procedures, be set to the neutral state.

59.5.2.1 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;

59.5.2.1.1 any lighting unit(s) which is/are not independently adjustable, or, for which the aiming was done with respect to any measurements under paragraphs 59.5.1, shall be tested in its/ their unchanged position

59.5.2.2 When measured according to the provisions laid down in paragraph 59.7 the illumination shall meet the following requirements.

59.5.2.2.1 HV shall be situated within the isolux 80 per cent of maximum illumination of the driving beam.

59.5.2.2.1.1 This maximum value (EM) shall not be less than 48 lx. The maximum value shall in no circumstances exceed 240 lx. And IM = 0.625 EM

59.5.2.2.2 Starting from point HV, horizontally to the right and left, the illumination of the driving beam shall be not less than 24 lx up to 2.6 deg and not less than 6 lx up to 5.2 deg.

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

59.5.2.3.1 the system meets the requirements of the paragraphs 59.5.2.2.1.1 and 59.5.2.2.2.

59.5.2.4 The system shall be so made that:

59.5.2.4.1 the lighting unit(s) of the right side and of the left side provide each at least half of the minimum illumination value of the driving beam as specified by the paragraph 59.5.2.2.2 above:

59.5.2.4.2 four seconds after switching on the system, which has not been operated for 30 minutes or more, at least 42 lx must be reached at point HV of the driving beam;

59.5.2.4.3 When signal inputs according to paragraph 59.4.9.3 of this Regulation apply, the requirements of the paragraph 59.5.2 shall be fulfilled.

59.5.2.5 If the specified beam requirements are not met, a re-aiming of the beam position within 0.5 deg up or down and/or 1 deg 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 59.5.2 of this Regulation.

59.5.3 Other provisions

In the case of a system or part(s) thereof with adjustable lighting units the requirements of paragraphs 59.5.2 (passing beam), and 59.5.3 (driving beam) are applicable for each mounting position. (adjustment range). For verification the following procedure shall be used:

59.5.3.1 Each applied position is realized on the test goniometer with respect to a line joining the centre of reference and point HV on an aiming screen. The adjustable 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;

59.5.3.2 with the system or part(s) thereof initially fixed according to paragraph 59.5.3.1, the device or part(s) thereof must meet the relevant photometric requirements of paragraphs 59.5.2 and 59.5.3.;

59.5.3.3 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 system or part(s) thereof adjusting device. Having reaimed the 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:

59.5.3.3.1 passing beam: points HV and 75R, or 50R if applicable; driving beam: IM and point HV (percentage of IM);

59.5.3.4 if the applicant has indicated more than one mounting position, the procedure of paragraphs 59.5.3.1 to 59.5.3.3 shall be repeated for all other positions;

59.5.3.5 if the applicant has not asked for special mounting positions, the system or part(s) thereof shall be aimed for measurements of paragraphs 59.5.2 (passing beam) and 59.5.3 (driving beam) with the relevant adjusting device(s) of the system or part(s) thereof in its mean position. The additional test of paragraph 59.5.3.3 shall be made with the system or part(s) thereof, moved into its extreme positions (instead of +/- 2 deg) by means of the relevant adjusting device(s).

59.5.3.6 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.

59.5.3.7 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 6.

59.6 Passing beam “cut-off” and aiming provisions

59.6.1 The "cut-off", when projected on the aiming screen, shall be sufficiently sharp to permit aiming; it shall comply with the following requirements.

59.6.2 The "cut-off" shall provide a horizontal "flat part" towards the left, and a raised "shoulder part" to the right, 0.1 deg up or down within two thirds of said length, the line whose origin is at the intersection of line A and the V-V line to be constructed as a tangent to this edge, shall have an inclination versus the line H-H of at least 10 deg and not exceeding 60 deg (see Fig.2 below).

59.6.3 Visual aiming procedure

59.6.3.1 The system shall, prior to the subsequent test procedures, be set to the neutral state. The instructions below apply to the beams of those lighting units, which are specified by the applicant to be aimed.

59.6.3.2 The beam shall be vertically positioned so, that the "flat part" of its "cut-off" is situated at the nominal vertical position (line A) according to the respective requirements indicated in Table 2; this shall be deemed to be fulfilled, if the horizontal median line of

the "flat part" of the "cut-off" is situated at line A ;

59.6.3.3 The beam shall be horizontally positioned so, that its raised "shoulder" is situated to the right of the V-V line and touching it;

59.6.3.3.1 if a partial beam provides a horizontal "cut-off" only: no special requirements for horizontal adjustment apply if not specified by the applicant.

59.6.3.4 Any "cut-off" of a lighting unit not designed to be separately aimed, according to the applicants specification, must comply with the relevant requirements.

59.6.3.5 Lighting units when aimed using a method specified by the applicant in accordance with the provisions of the paragraphs 59.5.2 and 59.6.2.1.1 of this Regulation: the shape and position of the "cut-off", if any, shall comply with the respective requirements of Table 2.

59.6.3.6 For each further mode of passing beam. the shape and position of the "cut-off", if any, shall comply automatically with the respective requirements of Table 2.

59.6.3.7 A separate initial aiming and/or adjustment process according to the applicant's specification, based on the provisions of paragraphs 59.6.3.1. through 59.6.3.6 above, may apply to lighting units intended to be installed separately.

59.7 Photometric measurement provisions

59.7.1 The illuminance values shall be determined by means of a photoreceptor contained within a square of 65 mm side and set up to a distance of at least 25 m forward of the centre of reference of each lighting unit perpendicular to the measurement axis from the origin of the goniometer;

59.7.2 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;

59.7.2.1 However in those cases where a provision is specified for one side only, the division by the factor of 2 does not apply.

59.7.3 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 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.

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

59.7.5 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 2. Parts of a system measured individually and having no "cutoff" shall be installed on the goniometer under the conditions (mounting position) specified by the applicant.

59.7.6 Measurement conditions with respect to light sources

59.7.6.1 In the case of replaceable filament lamps operated directly under vehicle voltage system conditions:

59.7.6.1.1 The system or parts thereof shall be checked by means of an uncoloured standard filament lamp(s) designed for a rated voltage of 12 V. During checking of the system or part of, the voltage at the terminals of the filament lamp(s) shall be regulated so as to obtain the reference luminous flux, at least one standard filament lamp, which may be submitted with the system.

59.7.6.2 In the case of a replaceable gas-discharge light source:

59.7.6.2.1 At least one standard light source, which has been aged during at least 15 cycles, the luminous flux of this gas-discharge light source may differ from the objective luminous flux. They shall be multiplied by a factor of 0.7 prior to the check for compliance.

59.7.6.3 In the case of a non-replaceable light source operating directly under vehicle voltage system conditions:

59.7.6.3.1 All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.75 V, 13.5 V or 28.0 V, or at a voltage as specified by the applicant with respect to any other vehicle voltage system. The measured photometric values shall be multiplied by a factor of 0.7 prior to the check for compliance.

59.7.6.4 In the case of a light source, replaceable or non-replaceable, which is operated independently from vehicle supply voltage and fully controlled by the system, or in the case of a light source supplied by a special power supply. The test laboratory may require from the manufacturer this special power supply needed to supply the light sources. The measured photometric values shall be multiplied by a factor of 0.7 prior to the check for compliance, except if this correction factor is already applied according to the provisions of paragraph 59.7.6.2 above.

59.7.6.5 LED module(s) shall be measured at 6.75V, 13.5V or 28.0V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant. The measured photometric values shall be multiplied by a factor of 0.7 prior to the check for compliance.

59.7.7 Measurement conditions with respect to bending modes

59.7.7.1 In the case of a system or part(s) thereof, which provide a bending mode, the requirements of paragraphs 59.5.1 (passing beam), and/or 59.5.2 (driving beam) apply for all states, corresponding to the turn radius of the vehicle.

59.7.7.1.1 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.

59.7.7.1.1.1 Compliance with the requirements of paragraphs 59.5.1.6.2, 59.5.1.6.3 and 59.5.1.6.5.1 of this Regulation shall be checked for both category 1 and category 2 bending modes without additional horizontal re-aim.

59.7.7.1.1.2 Compliance with the requirements of paragraphs 59.5.1.6.1 and 59.5.2 of this Regulation, 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.

59.7.7.2 When testing a category 1 or category 2 bending mode, for a turn radius of the vehicle other than specified in paragraph 59.7.1.1.1 above: it shall be observed whether the light distribution is substantially uniform and no undue glare occurs. If this can not be confirmed the compliance with the requirement laid down in Table 1.

59.8 The colour of the light emitted shall be white defined in “The installation of lighting and light-signaling devices” of “Directions”.

59.9 Test for stability of photometric performance of systems in operation

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

(b) In case of replaceable light sources: using a mass production filament light source, which has been aged for at least one hour, or a mass production gas discharge light source, which has been aged for at least 15 hours, or a mass production LED module which has 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.

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

The test sample shall be operated on passing beam without being dismounted 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.

59.9.1 Test voltage: according to 59.1.2 and 59.1.2.1 requirements shall comply with either 59.9.1.1 or 59.9.1.2 provisions are as follows:

59.9.1.1 In case of replaceable filament light source(s) operated directly under vehicle voltage system conditions: The voltage shall be adjusted so as to supply 90 per cent of the maximum wattage for the filament light source(s) used. The applied wattage shall in all cases comply with the corresponding value of a filament light source of 12 V rated voltage, 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 whose wattage is the highest that can be used.

59.9.1.1.1 In case of replaceable gas discharge light source(s): The test voltage for the electronic light source control-gear is 13.5 +/- 0.1 volts for 12 V vehicle voltage system, or otherwise specified in the application for approval.

59.9.1.1.2 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 6.75 V, 13.5 V or 28.0 V or at other voltages according to the vehicle voltage system as specified by the applicant respectively.

59.9.1.1.3 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.

59.9.1.1.4 LED module(s) shall be measured at 6.75 V, 13.5 V or 28.0 V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.

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).

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

59.9.1.2.1 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.

59.9.1.2.2 In case of replaceable gas discharge light source(s): The test voltage for the electronic light source control-gear is 13.2 + 0.1 volts for 12 V vehicle voltage system, or otherwise specified in the application for approval.

59.9.1.2.3 In the case of non-replaceable light source operated directly under vehicle voltage system conditions: All measurements on lighting units equipped with nonreplaceable light sources (filament light sources and/or others) shall be made at 6.3V, 13.2V or 28.0 V or at other voltages according to the vehicle voltage system as specified by the applicant respectively.

59.9.1.2.4 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).

59.9.1.2.5 LED module(s) shall be measured at 6.3V, 13.2V or 28 V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.

59.9.1.2.6 Where signalling lamps are grouped, combined or reciprocally incorporated into the test sample and operating at 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.

59.9.1.3 Clean test sample

59.9.1.3.1 Test procedure

59.9.1.3.1.1 In the case where a test sample is designed to provide only one lighting function (driving beam or passing beam) and not more than one class in case of passing beam, the corresponding light source(s) is/are lit for the time , each test sample shall be operated for 12 hours.

59.9.1.3.1.2 In the case where a test sample provides more than one function or class of passing beam:

59.9.1.3.1.2.1 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.

59.9.1.3.1.2.2 Specification for when headlamps and signaling lamps are composed of grouped or reciprocally

incorporated and headlamp flashing is used,:

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 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 3/ of the test sample, which are possible to be lit at the same time, according to the applicants declaration;

59.9.1.3.1.2.2.1 When headlamps is grouped or reciprocally incorporated with signalling lamps, the latter shall be lit for the duration of the test. In the case of a direction indicator lamp, it shall be lit in flashing operation mode with an on/off time ratio of approximately one to one.

59.9.1.3.1.2.2.2 Should additional light sources be simultaneously lit when headlamp flashing is used, this shall not be considered as being normal use of the light sources simultaneously.

59.9.1.3.1.3 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 59.9.1.3.1.1 or 59.9.1.3.1.2 above for individual lighting functions, according to the manufacturer's specifications.

59.9.1.3.1.4 In the case of a test sample designed to provide a passing beam bending mode with an additional light source being energized, said light source shall simultaneously be switched on for 1 minute, and switched off for 9 minutes during the activation of the passing beam only.

59.9.1.4 Test results

59.9.1.4.1 Visual inspection: Once the test sample has been stabilized to the ambient temperature, the test sample lens and the external lens. It shall then be inspected visually; no distortion, deformation, cracking or change in colour of either the test sample lens or the external lens.

59.9.1.4.2 Test results: Another aiming may be carried out to allow for any deformation of the test sample base due to heat 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.

59.9.1.4.2.1 Class C passing beam, and each specified other passing beam class: 50V, B50L (or R), and HV, if applicable.

59.9.1.4.2.2 Driving beam, under neutral state conditions: point of Emax.

59.9.2 Dirty test sample: After test, The test mixture shall be uniformly applied to the entire light- emitting surface(s) of the test sample and then left to dry. This procedure shall be repeated until the illuminating value has dropped to 15-20 per cent of the values measured for each following point under the conditions: point Emax in driving beam, under neutral state conditions, 50V for a class C passing beam, and each specified passing beam mode.

59.9.2.1 For a system or parts thereof with the outside lens in glass: A mixture of water and polluting agent to be applied to the test sample shall be composed of:

9 parts by weight of silica sand with a particle size of 0-100 micrometer corresponding to distribution prescribed in paragraph 59.9.2.3,

1 part by weight of vegetable carbon dust (beechwood) with a particle size of 0-100 micrometer, 0.2 parts by weight of NaCMC 5/, and

an appropriate quantity of distilled water with a conductivity of less than 1 mS/m.

59.9.2.2 For a system or parts thereof with the outside lens in plastic material:

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

9 parts by weight of silica sand with a particle size of 0-100 micrometer corresponding to distribution prescribed in paragraph 59.9.2.3,

1 part by weight of vegetable carbon dust (beechwood) with a particle size of 0-100 micrometer,

0.2 parts by weight of NaCMC 5/,

5 parts by weight of sodium chloride (pure at 99 per cent),

13 parts by weight of distilled water with a conductivity of less than 1 mS/m, and

2 +/- 1 parts by weight of surface-actant

59.9.2.3 Particle-size distribution

Particle size (in micrometer)	Particle-size distribution in (%)
0 to 5	12 +/- 2
5 to 10	12 +/- 3
10 to 20	14 +/- 3
20 to 40	23 +/- 3
40 to 80	30 +/- 3
80 to 100	9 +/- 3

59.9.2.4 The mixture must not be more than 14 days old.

59.9.3 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 a system or part(s) of emitting a class C (basic) passing beam, or each specified passing beam mode.

59.9.3.1 If the test sample 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. The test sample tested in accordance with paragraph 1. shall be subjected to the test described in paragraph 2.1., without being removed from or readjusted in relation to its test fixture. If the test sample 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.

59.9.3.2 For the purpose of this test, the voltage shall be adjusted as specified in paragraph 59.9.1.1.5.The test sample shall be operated and tested on class C passing beam, class V passing beam, class E passing beam and class W passing beam, whatever applies. The position of the cut-off line in its horizontal part between VV and the vertical line passing through point B50L (or R) 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.

59.9.3.3 The result expressed in milliradians (mrad) shall be considered as acceptable for a passing beam test sample, when the absolute value delta rI = | r3 - r60 | recorded on the test sample is not more than 1.0 mrad (delta rI < 1.0 mrad).

59.9.3.4 However, if this value is more than 1.0 mrad but not more than 1.5 mrad (1.0 mrad < delta rI < 1.5 mrad), a second test sample shall be tested as described in paragraph 59.9.3.2 after being subjected three consecutive times to the cycle as described below, in order to stabilize the position of mechanical parts of the test sample on a base representative of the correct installation on the

vehicle: Operation of the passing beam for one hour.

59.10 Testing of lens or material samples and complete systems or part(s) of systems: After offering 14 lens and assign numbers that shall comply with table 7 to do the test: after offering the two samples of complete systems or part and assign numbers that shall comply with table 8 to do the test. If the system manufacturer announced that the system or part thereof is designed for right-hand installation only, or for left-hand installation only, tests pursuant to this annex may be done on one sample only, at the choice of the applicant. Each testing items of testing methods and standard as below:

59.10.1 Tests:

59.10.1.1 Three new samples (lenses) shall be subjected to five cycles of temperature and humidity (RH = relative humidity) change in accordance with the following programme:

3 hours at 40 degrees C +/- 2 degrees C and 85-95 per cent RH;

1 hour at 23 degrees C +/- 5 degrees C and 60-75 per cent RH;

15 hours at -30 degrees C +/- 2 degrees C;

1 hour at 23 degrees C +/- 5 degrees C and 60-75 per cent RH;

3 hours at 80 degrees C +/- 2 degrees C;

1 hour at 23 degrees C +/- 5 degrees C and 60-75 per cent RH;

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

59.10.2 Resistance to atmospheric and chemical agents

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 (before 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 (before test)	Yes	Flux diffused by the tested material

59.10.2.1 The 3 samples shall be exposed to an energetic illumination of 1200 W/m2 +/- 200 W/m2 for a period such that the luminous energy that they receive is equal to 4500 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 degrees C +/- 5 degrees C. In order to ensure a regular exposure, the samples shall revolve around the source of radiation at a speed between 1 and 5 min-1. The samples shall be sprayed with distilled water of conductivity lower than 1 mS/m at a temperature of 23 degrees C +/- 5 degrees C, in accordance with the following cycle: spraying: 5 minutes; drying: 25 minutes.

59.10.2.2 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 = (T2-T3)/T2 measured on the three samples according to the procedure shall not exceed 0.020 (delta tm < 0.020).

59.10.2.3 Soak a piece of cotton cloth (as per ISO 105) until saturation with the mixture defined in paragraph 59.10.2.1. above and, apply it for 10 minutes to the outer face of the sample at a pressure of 50 N/cm2, the samples shall be dried in the open air and then washed with the solution at 23 degrees C +/- 5 degrees C. Afterwards the samples shall be carefully rinsed with distilled water containing not more than 0.2 per cent impurities at 23 degrees C +/- 5 degrees C and then wiped off with a soft cloth.

59.10.2.4 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 = (T5-T4)/T2 measured on the three samples according to the procedure shall not exceed 0.020 (delta dm < 0.020).

59.10.3 Resistance to light source radiation

59.10.3.1 If necessary the following test shall be done:

59.10.3.1.1 Flat samples of each light transmitting plastic component of the system are exposed to the light of the light source. The parameters such as angles and distances of those samples shall be the same as in the system. After 1500 hours of continuous exposure, the colorimetric specification of the transmitted light must be met with a new light source, and the surface of the samples shall be free of cracks, scratches, scaling or deformation.

59.10.3.1.2 The UV-resistance testing of internal materials to light source radiation is not necessary if light sources according to “Bulbs” 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.

59.10.4 Resistance to detergents and hydrocarbons

59.10.4.1 The outer face of three samples (lenses or samples of material) shall be heated to 50 degrees C +/- 5 degrees C and then immersed for five minutes in a mixture maintained at 23 degrees C +/- 5 degrees 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 degrees C +/- 5 degrees C. The surface of the samples shall be cleaned with a moist cloth.

59.10.4.2 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.

59.10.4.3 After the above two tests have been performed successively, the mean value of the variation in transmission delta t = (T2-T3)/T2 measured on the three samples according to the procedure d shall not exceed 0.010 (delta tm < 0.010).

59.10.5 Resistance to mechanical deterioration

59.10.5.1 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 on the surface exposed to deterioration, at a distance of 380 mm +/- 10 mm from the nozzle. The mixture shall be sprayed until the variation in the diffusion of light on the sample or samples measured by the method, is such that: delta d = (T5-T4)/T2 = 0.0250 +/- 0.0025.

59.10.5.2 The outer face of the three new samples (lenses) shall be subjected to the uniform mechanical deterioration test by the method. After this test, the variations: in transmission: delta t = (T2-T3)/T2 and in diffusion: delta d = (T5-T4)/T2 The mean value of the three samples shall be such that: delta tm < 0.100; delta dm < 0.050.

59.10.6 Test of adherence of coatings

59.10.6.1 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. This adhesive tape, which shall be at least 25 mm wide, shall be pressed for at least five minutes to the surface prepared, the tape shall be torn off at a constant speed of 1.5 m/s +/- 0.2 m/s.

59.10.6.2 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.

59.10.7 Tests of the complete system incorporating a lens of plastic material

59.10.7.1 Tests（The lens of system sample No. 1 shall be subjected to the test）

59.10.7.1.1 The test described in paragraph 59.10.5 above.

59.10.7.1.2 After the test, the results of photometric measurements carried out on the system or part thereof shall not exceed by more than 30 per cent the maximum values prescribed at points B50L and HV and not be more than 10 per cent below the minimum values prescribed at point 75R, if applicable.

59.10.7.2 Test of adherence of coatings, if any The lens of installation unit sample No. 2 shall be subjected to the test described in paragraph 59.10.6 above.

Table 1:Passing beam photometric requirements

Tabled requirements expressed in lux @ 25m			Position/deg			Passing beam							
			horizontal		vertical	class C		class V		class E		class W	
	No	Element	at/from	至	to	min	max	min	max	min	max	min	max
Part A	1	B50L 4/	L 3.43		U 0.57		0.4		0.4		0.7 8/		0.7
	2	HV 4/	V		H		0.7		0.7				
	3	BR 4/	R 2.5		U 1	0.2	2	0.1	1	0.2	2	0.2	3
	4	Segment BRR 4/	R 8	R 20	U 0.57		4		1		4		6
	5	Segment BLL	L 8	L 20	U 0.57		0.7		1		1		1
	6	P	L 7		H	0.1						0.1	
	7	Zone III(as specified by Table 3)					0.7		0.7		1		1
	8a	S50, S50LL, S50RR 5/			U 4	0.1 7/				0.1 7/		0.1 7/	

	9a	S100, S100LL, S100RR 5/			U 2	0.2 7/				0.2 7/		0.2 7/	
	10	50R	R 1.72		D 0.86			6					
	11	75R	R 1.15		D 0.57	12				18		24	
	12	50V	V		D 0.86	6		6		12		12	
	13	50L	L 3.43		D 0.86	4.2	15 9/	4.2	15 9/	8		8	30 9/
	14	25LL	L 16		D 1.72	1.4		1		1.4		4	
	15	25RR	R 11		D 1.72	1.4		1		1.4		4	
	16	Segment 20 and below it	L 3.5	V	D 2								20 2/
	17	Segment 10 and below it	L 4.5	R 2.0	D 4		14 1/		14 1/		14 1/		8 2/
	18	Emax 3/				20	50	10	50	20	90 8/	35	80 2/

Part B (bending modes): Table 1 Part A applies, however with the lines Nos.1,2,7,13 and 18 being replaced by those listed hereunder

Part B	1	B50L 4/	L 3.43		U 0.57		0.6		0.6				0.9
	2	HV 4/					1		1				
	7	Zone III(as specified Table 3)					1		1		1		1
	13	50L	L 3.43		D 0.86	2		2		4		4	
	18	Emax 6/				12	50	6	50	12	90 8/	24	80 2/

Note：

1.max 18 lx, if the system is designed to provide also a class W passing beam.
2.requirements according to the provisions indicated in Table 4 below apply in addition
3.Position requirements according to the provisions of Table 2 below（"Segment Emax"）.
4.the contribution of each side of the system, shall not be less than 0.1 lx.
5.Position requirements according to the provisions of Table 5 below.
6.Position requirements as indicated in paragraph 5.1.6.2 of this Regulation
7.One pair of position lamps, being incorporated with the system or being intended to be installed together with the system may be activate according to the indications of the applicant.
8.Requiremtns according to the provisions indicated in Table 6 below apply in addition.
9.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 2: Passing beam elements angular position/extend, additional requirements

	angular position / extend in deg	Class C passing beam		Class V passing beam		Class E passing beam		Class W passing beam	
No	beam part designation and requirement	horizontal	vertical	horizontal	vertical	horizontal	vertical	horizontal	vertical
2.1.	Emax shall not be positioned outside of the rectangle extending (above "segment Emax")	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

	angular position / extend in deg	Class C passing beam		Class V passing beam		Class E passing beam		Class W passing beam	
No	beam part designation and requirement	horizontal	vertical	horizontal	vertical	horizontal	vertical	horizontal	vertical
2.2.	the "cut-off" and part(s) of shall: - comply with the requirements of paragraph 1. of Annex 8 to this Regulation and be positioned with its " kink" at V-V and								
	- be positioned with its "flat horizontal part"		at V = 0.57 D		not above 0.57D not below		not above 0.23D [8/] not below 0.57D		not above 0.23D not below 0.57D

[8/] Requirements according to the provisions indicated in Table 6 below apply in addition.

Table 3: Passing beam zones III, defining corner points

Angular Position in Deg	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 4: Additional provisions for class W passing beam, expressed in lx@25m

4.1.	Definition and Requirements for Segments E, F1, F2, and F3 (not shown in Fig.1 above)
	Not more than 0.2 lx are allowed: a) on a segment E extending at U 10 deg from L 20 to R 20 deg and b) on three vertical segments F1, F2 and F3 at horizontal positions L10 deg, V and R 10 deg, each extending from U 10 to U 60 deg.
4.2.	Alternative/ Additional Set of Requirements for Emax, segment 20 and segment 10: Table 1 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 according to paragraph 2.2.2.(e) of this Regulation a class W passing beam is designed to produce on segment 20 and below it not more than 10 lx and on segment 10 and below it not more than 4 lx, the design value for Emax of that beam shall not exceed 100 lx

Table 5: Overhead sign requirements, angular position of measurement points

Point Designation	S50LL	S50	S50RR	S100LL	S100	S100RR
Angular Position in Deg	4 U / 8 L	4 U / V-V	4 U / 8 R	2 U / 4 L	2 U / V-V	2 U / 4 R

Table 6: Additional provisions for class E passing beam

Table 1 Part A or B and Table 2 above apply, however with the lines No.1 and 18 of Table 1 and item 2.2. of Table 2 being replaced as indicated hereunder				
Item	Designation	Line 1 of Table 1 above, Part A or B	Line 18 of Table 1 above, Part A or B	Item 2.2. of Table 2 above
No.	Data Set	EB50L in lx@25m	Emax in lx@25m	cut-off flat part aimed in deg
		max	max	not above
6.1.	E1	0.6	80	0.34 D
6.2.	E2	0.5	70	0.45 D
6.3.	E3	0.4	60	0.57 D

For information only: Passing beam photometric values of Table 1 above, expressed in candelas

Table: 7 Tests on plastic materials (lenses or sample of material)

Tests \ Samples	Lenses or samples of material										Lenses			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Temperature change											○	○	○	
Atmospheric agents	○	○	○											
Chemical agents	○	○	○											
Detergents and Hydrocarbons				○	○	○								
Deterioration							○	○	○					
Adherence														○
Resistance to light source radiation										○				

Notes: 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 measuring at least 15 x 15 mm.

Sample No. / Tests	Complete Systems	
	1	2
Deterioration	○	
Adherence		○

Table: 8 Tests on complete systems or part(s)

"above it" means vertically above, only; "below it" means vertically below, only.

Angular positions are expressed in deg up (U) or down (D) from H-H respectively right (R) or left (L) from V-V.

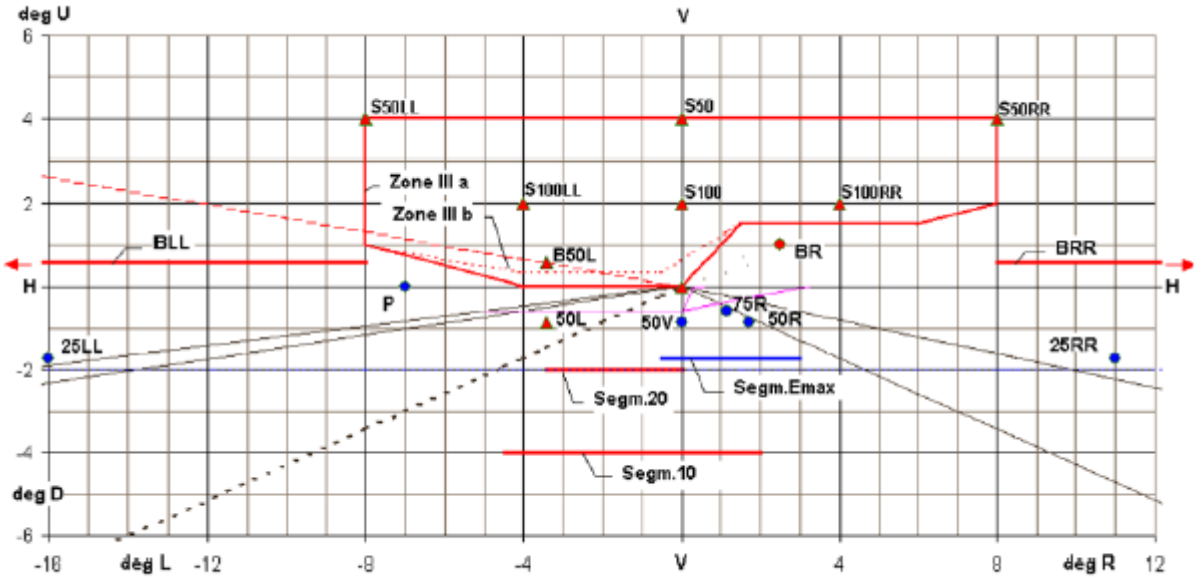


Figure 1: Angular positions of passing beam photometric requirements (indicated for right-hand traffic)

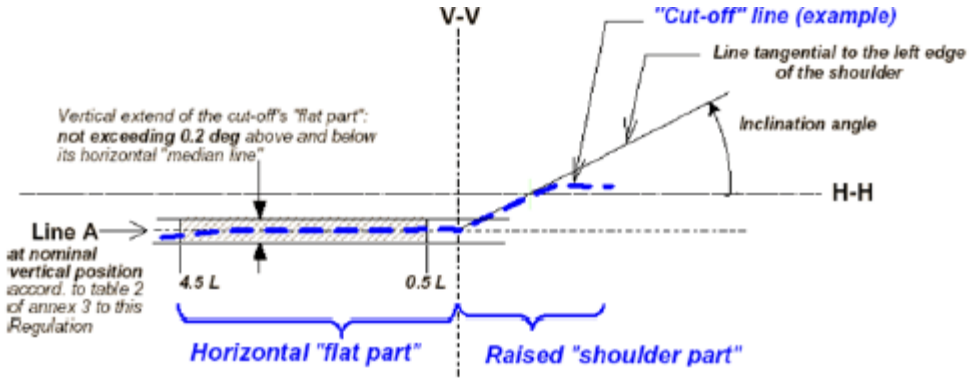


Figure:2 Shape of the “cut-off” line

59.11 Requirements for LED modules and AFS including LED modules

59.11.1 General specifications

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

59.11.1.2 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.

59.11.1.3 LED module(s) shall be tamperproof.

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

59.11.1.4.1 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 specifications of the AFS shall be met;

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

59.11.2 Manufacturer

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

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

59.11.3 Test conditions

59.11.3.1 All samples shall be tested as specified in paragraph 11.4 below.The kind of light sources on a LED MODULE shall be light-emitting diodes (LED).Other kinds of light sources are not permitted.

59.11.3.2 Operating conditions

59.11.3.2.1 LED module operating conditions: All samples shall be tested under the conditions as specified in paragraphs 59.4.9 of this Regulation. If not specified differently in this LED modules shall be tested inside the AFS as submitted by the manufacturer.

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

59.11.3.3 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.

59.11.4 Specific specifications and tests

59.11.4.1 Colour rendering: Red content

In addition to measurements as described in paragraph 7. of this Regulation:

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

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

where:

Ee(lambda) (unit: W) is the spectral distribution of the irradiance;

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

(lambda) (unit: nm) is the wavelength.

This value shall be calculated using intervals of one nanometre.

59.11.4.2 UV-radiation:

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

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

where:

S(lambda)(unit: 1) is the spectral weighting function;

km = 683 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 in the Table UV below:（See table 9）

λ	S(λ)	λ	S(λ)	λ	S(λ)
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	325	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	0.000 530

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 9 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.

59.11.4.3 Temperature stability

59.11.4.3.1 Illuminance

59.11.4.3.1.1 For each existing class of passing beam and for the driving beam, a photometric measurement shall be carried out after one minute of operation of the respective lighting units and for the following test points:

Passing beam: 50V

Driving beam: HV

59.11.4.3.1.2 Operation of the lighting units mentioned in paragraph 59.11.4.3.1.1 above shall then be continued until photometric stability has occurred; this condition is considered to be fulfilled if the variation of the illuminance for the test points indicated in paragraph 59.11.4.3.1.1 above is less than 3 per cent within any 15 minute period. After photometric stability has occurred, aiming for complete photometry shall be performed and the photometric values at all required test points shall be determined.

59.11.4.3.1.3 The ratio between the photometric values measured after one minute of operation and those measured after photometric stability has occurred shall be calculated for the test points indicated in paragraph 59.11.4.3.1.1 above. This ratio shall then be applied to all other applicable test points to determine their photometric values after one minute of operation.

59.11.4.3.1.4 The illuminance values determined after one minute of operation and after occurrence of photometric stability shall comply with applicable photometric requirements.

59.11.4.3.2 Colour: The colour of the light emitted measured after one minute and measured after photometric stability has been obtained, as described in paragraph 59.11.4.3.1.2, shall both be within the required colour boundaries.

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

follows:

59.11.5.1 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.

59.11.5.2 Three LED modules of each type shall be submitted by the applicant with the light source control gear, if applicable, and sufficient instructions.

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

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

59.11.5.2.3 In the case of an integrating sphere is used, 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 the CIE-Publication 84-1989, regarding the room temperature, positioning, etc., shall be taken into consideration.

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

59.11.5.2.5 The flux shall be measured after stability has occurred, as explained in paragraph 59.11.4.3.1.2.

59.11.5.2.6 The average of the measurements of the three samples of each type of LED module shall be deemed to be its objective luminous flux.