

Agreement

Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions*

(Revision 2, including the amendments that entered into force on 16 October 1995)

Basis of this document is: Addendum 47: Regulation No. 48

Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices



UNITED NATION

* Former title of the Agreement: Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

Regulation No. 48

- I: Uniform provisions concerning the approval of vehicles with regard to the installation of lighting and light-signalling devices**
- II: Common provisions for lighting, light-signalling and retro-reflecting devices**

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Paragraph 1 amend to read:

A1. Scope

This Regulation applies to:

Part I. (A) vehicles of categories M, N, and to their trailers (category O)¹ with regard to the installation of lighting and light-signalling devices of an approved type.

Part II. (B) common provisions of Regulations of lighting, light-signalling and retro-reflecting devices and of Regulations for the installation of lighting and light-signalling devices.

PART I APPROVAL OF A VEHICLE WITH REGARD TO THE INSTALLATION OF LIGHTING AND LIGHT SIGNALLING DEVICES OF AN APPROVED TYPE

A2. Definitions

The definitions given in **Part II** shall apply.

A3. Application for approval

Paragraph B3 of this Regulation shall apply.

A4. Approval and marking

Paragraphs B4 (for vehicle type approval) and B5 (for vehicle markings) of this Regulation shall apply.

A5. General requirements

The lighting and light-signalling devices shall be so fitted that in normal conditions of use, and notwithstanding the vibrations to which they may be subjected, they retain the characteristics prescribed by this Regulation and enable the vehicle to comply with the requirements of this Regulation. In particular, it shall not be possible for the lamps to be inadvertently maladjusted.

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

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- A5.1. **For checking the fitment of the lighting and light-signalling devices, if not otherwise specified, the normal conditions of use as defined in paragraphs B2.2.7. shall apply.**
- A5.2. The illuminating lamps described in paragraphs B2.4.1., B2.4.2. and B2.4.3. shall be so installed that correct adjustment of their orientation can easily be carried out.
- A5.2.1. In the case of headlamps fitted with measures to prevent discomfort to other road-users in a country where traffic operates on the side of the road opposite to that of the country for which the headlamp was designed, such measures shall be achieved automatically or by the vehicle user with the vehicle in the park condition without the need for special tools (other than those provided with the vehicle²). Detailed instructions shall be provided by the vehicle manufacturer with the vehicle.
- A5.3. For all light-signalling devices, including those mounted on the side panels, the reference axis of the lamp when fitted to the vehicle shall be parallel to the bearing plane of the vehicle on the road; in addition it shall be perpendicular to the median longitudinal plane of the vehicle in the case of side retro-reflectors and of side-marker lamps and parallel to that plane in the case of all other signalling devices. In each direction a tolerance of $\pm 3^\circ$ shall be allowed. In addition, any specific instructions as regards fitting laid down by the manufacturer shall be complied with.
- A5.4. In the absence of specific instructions, the height and orientation of the lamps shall be verified with the vehicle unladen and placed on a flat, horizontal surface, in the condition defined in paragraph B2.2.7. and, in the case where an AFS is installed, with the system in its neutral state.
- A5.5. In the absence of specific instructions lamps constituting a pair shall:
- A5.5.1. Be fitted to the vehicle symmetrically in relation to the median longitudinal plane (this estimate to be based on the exterior geometrical form of the lamp and not on the edge of its illuminating surface referred to in paragraph B2.3.19.);
- A5.5.2. Be symmetrical to one another in relation to the median longitudinal plane, this requirement is not valid with regard to the interior structure of the lamp;
- A5.5.3. Satisfy the same colorimetric requirements and have substantially identical photometric characteristics. This shall not apply to a matched pair of Class F3 front fog lamps;
- A5.5.4. Have substantially identical photometric characteristics.
- A5.6. On vehicles whose external shape is asymmetrical the above requirements shall be satisfied so far as is possible.
- A5.7. Grouped, combined or reciprocally incorporated lamps
The instructions in paragraph B7.3. shall apply.

² This does not apply to dedicated objects that may be added to the exterior of the headlamp.

A5.8. The maximum height above the ground shall be measured from the highest point and the minimum height from the lowest point of the apparent surface in the direction of the reference axis.

Where the (maximum and minimum) height above the ground clearly meets the requirements of the Regulation, the exact edges of any surface need not be determined.

A5.8.1. For the purposes of reducing the geometric visibility angles, the position of a lamp with regard to height above the ground, shall be measured from the H plane.

A5.8.2. In the case of dipped-beam headlamp, the minimum height in relation to the ground is measured from the lowest point of the effective outlet of the optical system (e.g. reflector, lens, projection lens) independent of its utilization.

A5.8.3. The position, as regards width, will be determined from that edge of the apparent surface in the direction of the reference axis which is the furthest from the median longitudinal plane of the vehicle when referred to the overall width, and from the inner edges of the apparent surface in the direction of the reference axis when referred to the distance between lamps.

Where the position, as regards width, clearly meets the requirements of the Regulation, the exact edges of any surface need not be determined.

A5.9. In the case, that a lamp is intentionally varying during the period of activation of the lamp, the instructions in paragraph B7.5 shall apply.

A5.10. No red light which could give rise to confusion shall be emitted from a lamp as defined in paragraph B2.4 to B2.6, in a forward direction and no white light which could give rise to confusion, shall be emitted from a lamp as defined in paragraph B2.4 to B2.6, in a rearward direction. No account shall be taken of lighting devices fitted for the interior lighting of the vehicle. In case of doubt, this requirement shall be verified as follows:

A5.10.1. For the visibility of red light towards the front of a vehicle, with the exception of a red rearmost side-marker lamp, there shall be no direct visibility of the apparent surface of a red lamp if viewed by an observer moving within Zone 1 as specified in Annex A4,

A5.10.2. For the visibility of white light towards the rear, with the exception of reversing lamps and white side conspicuity markings fitted to the vehicle, there shall be no direct visibility of the apparent surface of a white lamp if viewed by an observer moving within Zone 2 in a transverse plane situated 25 m behind the vehicle (see Annex A4);

A5.10.3. In their respective planes, the zones 1 and 2 explored by the eye of the observer are bounded:

A5.10.3.1. In height, by two horizontal planes 1 m and 2.2 m respectively above the ground;

A5.10.3.2. In width, by two vertical planes which, forming to the front and to the rear respectively an angle of 15° outwards from the vehicle's median longitudinal plane, pass through the point or points of contact of vertical planes parallel to the vehicle's median longitudinal plane delimiting the vehicle's overall width;

if there are several points of contact, the foremost shall correspond to the forward plane and the rearmost to the rearward plane.

- A5.11. The electrical connections shall be such that the front and rear position lamps, the end-outline marker lamps, if they exist, the side-marker lamps, if they exist, and the rear registration plate lamp can only be switched ON and OFF simultaneously.
- A5.11.1. This condition does not apply:
 - A5.11.1.1. When front and rear position lamps are switched ON, as well as side-marker lamps when combined or reciprocally incorporated with said lamps, as parking lamps; or
 - A5.11.1.2. When side-marker lamps flash in conjunction with direction indicators; or
 - A5.11.1.3. When light signalling system operates according to A6.2.7.6.2..
- A5.11.2. To front position lamps when their function is substituted under the provisions of paragraph A5.12.1..
- A5.11.3. In the case of an interdependent lamp system, all light sources shall be switched ON and OFF simultaneously.
- A5.12. The electrical connections shall be such that the main-beam and dipped-beam headlamps and the front fog lamps cannot be switched on unless the lamps referred to in paragraph A5.11. are also switched on. This requirement shall not apply, however, to main-beam or dipped-beam headlamps when their luminous warnings consist of the intermittent lighting up at short intervals of the main-beam headlamp or the intermittent lighting up at short intervals of the dipped-beam headlamp or the alternate lighting up at short intervals of the main-beam and dipped-beam headlamps.
- A5.12.1. The dipped-beam headlamps and/or the main-beam headlamps and/or the front fog lamps may substitute the function of the front position lamps, provided that:
 - A5.12.1.1. Their electrical connections are such that in case of failure of any of these lighting devices the front position lamps are automatically re-activated; and
 - A5.12.1.2. The substituting lamp/function meets, for the respective position lamp, the requirements concerning:
 - (a) The geometric visibility prescribed for the front position lamps in A6.9.5; and
 - (b) The minimum photometric values according to the angles of light distribution; and
 - A5.12.1.3. Appropriate evidence demonstrating compliance with the requirements indicated in paragraph A5.12.1.2. is provided in the test reports of the substituting lamp.
- A5.13. Tell-tale

Where a closed-circuit tell-tale is prescribed by this Regulation it may be replaced by an "operating" tell-tale.
- A5.14. Concealable lamps

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- A5.14.1. The concealment of lamps shall be prohibited, with the exception of the main-beam headlamps, the dipped-beam headlamps and the front fog lamps, which may be concealed when they are not in use.
- A5.14.2. In the event of any failure affecting the operation of the concealment device(s) the lamps shall remain in the position of use, if already in use, or shall be capable of being moved into the position of use without the aid of tools.
- A5.14.3. It shall be possible to move the lamps into the position of use and to switch them on by means of a single control, without excluding the possibility of moving them into the position of use without switching them on. However, in the case of grouped main-beam and dipped-beam headlamps, the control referred to above is required only to activate the dipped-beam headlamps.
- A5.14.4. It shall not be possible deliberately, from the driver's seat, to stop the movement of switched-on lamps before they reach the position of use. If there is a danger of dazzling other road users by the movement of the lamps, they may light up only when they have reached their position of use.
- A5.14.5. When the concealment device has a temperature of $-30\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$ the headlamps shall be capable of reaching the position of use within three seconds of initial operation of the control.
- A5.15. The colours of the light emitted by the lamps³ are **prescribed in paragraph 1 of Annex B4.**
- A5.16. Number of lamps
- A5.16.1. The number of lamps mounted on the vehicle shall be equal to the number indicated in the individual requirements of this Regulation.
- A5.17. Any lamp may be installed on movable components provided that the conditions specified in paragraphs A5.18., A5.19. and A5.20. are fulfilled.
- A5.18. Rear position lamps, rear direction-indicators and rear retro-reflectors, triangular as well as non-triangular, may be installed on movable components only:
- A5.18.1. If at all fixed positions of the movable components the lamps on the movable components meet all the position, geometric visibility, colorimetric and photometric requirements for those lamps.
- A5.18.2. In the case where the functions referred to in paragraph 5.18. are obtained by an assembly of two lamps marked "D" (see paragraph B2.5.16.1. (b)), only one of the lamps needs to meet the position, geometric visibility and photometric requirements for those lamps at all fixed positions of the movable components.
- or

³ Measurement of the chromaticity coordinates of the light emitted by the lamps is not part of this regulation.

A5.18.3. Where additional lamps for the above functions are fitted and are activated, when the movable component is in any fixed open position, provided that these additional lamps satisfy all the position, geometric visibility and photometric requirements applicable to the lamps installed on the movable component.

A5.18.4. In the case where the functions referred to in paragraph A5.18. are obtained by an interdependent lamp system either of the following conditions shall apply:

(a) Should the complete interdependent lamp system be mounted on the moving component(s), the requirements of paragraph A5.18.1. shall be satisfied. However, additional lamps for the above functions may be activated, when the movable component is in any fixed open position, provided that these additional lamps satisfy all the position, geometric visibility, colorimetric and photometric requirements applicable to the lamps installed on the movable component.

or

(b) Should the interdependent lamp system be partly mounted on the fixed component and partly mounted on a movable component, with the exception of direction indicator lamps, the interdependent lamp(s) specified by the Applicant during the device approval procedure shall meet all the position, outwards geometric visibility, colorimetric and photometric requirements for those lamps, at all fixed positions of the movable component(s).

The inwards geometric visibility requirement(s) is(are) deemed to be satisfied if this(these) interdependent lamp(s) still conform(s) to the photometric values prescribed in the field of light distribution for the approval of the device, at all fixed positions of the movable component(s).

For direction indicator lamps, the interdependent lamp(s) specified by the Applicant during the device approval procedure shall meet all the position, geometric visibility, photometric and colorimetric requirements at all fixed positions of the movable component(s). This does not apply where, to fulfil or complete the geometric visibility angle, additional lamps are activated when the movable component is in any fixed open position, provided that these additional lamps satisfy all the position, photometric and colorimetric requirements applicable to the direction indicator lamps installed on the movable component.

A5.19. When the movable components are in a position other than a "normal position of use", the devices installed on them shall not cause undue discomfort to road users.

A5.20. When a lamp is installed on a movable component and the movable component is in the "normal position(s) of use", the lamp shall always return to the position(s) specified by the manufacturer in accordance with this Regulation. In the case of dipped-beam headlamps and front fog lamps, this requirement shall be considered satisfied if, when the movable components are moved and returned to the normal position 10 times, no value of the angular inclination of these lamps, relative to its support, measured after each operation of the movable component, differs by more than 0.15 per cent from the average of the 10 measured values. If this value is exceeded each limit

specified in paragraph A6.2.6.1.1. shall then be modified by this excess to decrease the allowed range of inclinations when checking the vehicle according to Annex A6.

- A5.21. The apparent surface in the direction of the reference axis of front and rear position lamps, front and rear direction-indicator lamps and retro-reflectors shall not be hidden more than 50 per cent by any movable component, with or without a light-signalling device installed on it, in any fixed position different from the "normal position of use".

Fixed position of a movable component means the stable or natural rest position(s) of the movable component specified by the vehicle manufacturer, whether locked or not.

If the above requirement is not practicable:

- A5.21.1. Additional lamps satisfying all the position, geometric visibility, colorimetric and photometric requirements for the above indicated lamps shall be activated when the apparent surface in the direction of the reference axis of these lamps is more than 50 per cent hidden by the movable component; or

- A5.21.2. A remark in the communication form (item 10.1. of Annex A1) shall inform other Administrations that more than 50 per cent of the apparent surface in the direction of the reference axis can be hidden by the movable components; and

A notice in the vehicle shall inform the user that in certain position(s) of the movable components other road users shall be warned of the presence of the vehicle on the road; for example by means of a warning triangle or other devices according to national requirements for use on the road.

- A5.21.3. Paragraph A5.21.2. does not apply to retro-reflectors.

- A5.22. With the exception of retro-reflectors, a lamp even bearing an approval mark is deemed not to be present when it cannot be made to operate by the sole installation of a light source and/or a fuse.

- A5.23. Lamps approved with light source(s) according to Regulation No. 37, except when such light sources are used as non-replaceable light source(s) as defined in paragraph B2.12.1.1.2., shall be fitted in a vehicle in such a way that the light source can be correctly replaced without the need for expert assistance and without the need for special tools, other than those provided with the vehicle by the manufacturer. The vehicle manufacturer shall provide with the vehicle a detailed description of the procedure for replacement.

- A5.23.1. In the case where a light source module includes a holder for an approved replaceable light source according to Regulation No. 37, this light source shall be replaceable as required in paragraph A5.23..

- A5.24. Any temporary fail-safe replacement of the light-signalling function of a rear position lamp is allowed, provided that the replacement function in case of a failure is similar in colour, main intensity and position to the function that has ceased to operate and provided that the replacement device remains operational in its original safety function. During replacement, a tell-tale on the dashboard (paragraph B2.1.5.) shall indicate occurrence of a temporary replacement and need for repair.

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- A5.25. Where an AFS is fitted, it shall be considered equivalent to a pair of dipped-beam headlamps and, if it provides main-beam function(s), it shall be considered equivalent to a pair of main-beam headlamps.
- A5.26. Rear direction-indicator lamps, rear position lamps, stop lamps (except stop lamps of category S4) and rear fog lamps with variable luminous intensity control are allowed, which respond simultaneously to at least one of the following external influences: ambient lighting, fog, snowfall, rain, spray, dust clouds, contamination of the light emitting surface, provided that their prescribed intensity relationship is maintained throughout variation transitions. No sharp variation of intensity shall be observed during transition. Stop lamps of category S4 may produce variable luminous intensity independent from the other lamps. It may be possible for the driver to set the functions above to luminous intensities corresponding to their steady category and to return them to their automatic variable category.
- A5.27. For vehicles of M and N categories, the applicant shall demonstrate to the Technical Service responsible for type approval testing that the electric power supply conditions for the devices indicated in paragraphs **B2.4.1., B2.4.2., B2.6.2., B2.6.5. and B2.6.6.** comply, when the electrical system of the vehicle is in a constant voltage operating condition, representative for the relevant category of powered vehicle as specified by the applicant, with the following provisions:
- A5.27.1. The voltage supplied at the terminals of devices which, according to their type approval documentation, have been tested by the application of a special power supply/electronic light source control gear, or in a secondary operating mode or at a voltage requested by the applicant, shall not exceed the voltage specified for the relevant devices or functions as they have been approved.
- A5.27.2. In all cases of electric power supply conditions not covered by paragraph A5.27.1., the voltage at the terminals of the device(s) or function(s) shall not exceed 6.75 V (6 Volt-Systems), 13.5 V (12 Volt-Systems) or 28 V (24 Volt-Systems) by more than 3 per cent. The means of controlling the maximum voltage at the terminals of the device may, for convenience, be located within the body of the device.
- A5.27.3. The provisions of paragraphs A5.27.1. and A5.27.2. shall not apply to devices which include an electronic light source control gear or a variable intensity control being part of the device.
- A5.27.4. A report shall be attached to the approval documentation describing the methods used to demonstrate compliance and the results obtained.
- A5.28. General provisions relating to geometric visibility
- A5.28.1. There shall be no obstacle on the inside of the angles of geometric visibility to the propagation of light from any part of the apparent surface of the lamp observed from infinity. However, no account is taken of obstacles, if they were already presented when the lamp was type-approved.
- A5.28.2. If measurements are taken closer to the lamp, the direction of observation shall be shifted parallel to achieve the same accuracy.
- A5.28.3. If, when the lamp is installed, any part of the apparent surface of the lamp is hidden by any further parts of the vehicle, proof shall be furnished that the part of the lamp not hidden by obstacles still conforms to the photometric values prescribed for the approval of the device.

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- A5.28.4. When the vertical angle of geometric visibility below the horizontal may be reduced to 5° (lamp at less than 750 mm above the ground measured according to the provisions of paragraph A5.8.1.) the photometric field of measurements of the installed optical unit may be reduced to 5° below the horizontal.
- A5.28.5. In the case of an interdependent lamp system the geometric visibility requirements shall be fulfilled when all its interdependent lamps are operated together.
- A5.29. A LED module does not need to be replaceable, if so stated in the communication sheet of the component type approval.

A6. Individual Requirements

- A6.1. Main-beam headlamp (Regulations Nos. 98 and 112)
- A6.1.1. Presence
Mandatory on motor vehicles. Prohibited on trailers.
- A6.1.2. Number
Two or four, type approved according to Regulations Nos. 98 or 112, excluding Class A headlamp.
For vehicles of the category N₃: Two extra main-beam headlamps may be installed.
Where a vehicle is fitted with four concealable headlamps the installation of two additional headlamps shall only be authorized for the purpose of light-signalling, consisting of intermittent illumination, at short intervals (see paragraph A5.12.) in daylight.
- A6.1.3. Arrangement
No individual requirements.
- A6.1.4. Position
- A6.1.4.1. In width: No individual requirements.
- A6.1.4.2. In height: No individual requirements.
- A6.1.4.3. In length: At the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly or indirectly through the devices for indirect vision and/or other reflecting surfaces of the vehicle.
- A6.1.5. Geometric visibility
The visibility of the illuminating surface, including its visibility in areas which do not appear to be illuminated in the direction of observation considered, shall be ensured within a divergent space defined by generating lines based on the perimeter of the illuminating surface and forming an angle of not less than 5° with the axis of reference of the headlamp. The origin of the angles of geometric visibility is the perimeter of the projection of the illuminating surface on a transverse plane tangent to the foremost part of the lens of the headlamp.
- A6.1.6. Orientation

Towards the front.

Not more than one main-beam headlamp on each side of the vehicle may swivel to produce bend lighting.

A6.1.7. Electrical connections

A6.1.7.1. Except when they are used to give intermittent luminous warnings at short intervals the main-beam headlamps may be switched ON, only when the master light switch is in headlamps ON position or in "AUTO" (automatic) position and the conditions for automatic activation of dipped-beam exist. In the latter case, the main beam headlamps shall be switched off automatically when the conditions for automatic activation of dipped-beam ceased to exist.

A6.1.7.2. The control of the main-beam headlamps may be automatic regarding their activation and deactivation, the control signals being produced by a sensor system which is capable of detecting and reacting to each of the following inputs:

- (a) Ambient lighting conditions;
- (b) The light emitted by the front lighting devices and front light-signalling devices of oncoming vehicles;
- (c) The light emitted by the rear light-signalling devices of preceding vehicles.

Additional sensor functions to improve performance are allowed.

For the purpose of this paragraph, "vehicles" means vehicles of categories L, M, N, O, T, as well as bicycles, such vehicles being equipped with retro-reflectors, with lighting and light-signalling devices, which are switched ON.

A6.1.7.3. It shall always be possible to switch the main-beam headlamps ON and OFF manually and to manually switch OFF the automatic control of the main-beam headlamps.

Moreover, the switching OFF, of the main-beam headlamps and of their automatic control, shall be by means of a simple and immediate manual operation; the use of sub-menus is not allowed.

A6.1.7.4. The main-beam headlamps may be switched on either simultaneously or in pairs. In case the extra two main-beam headlamps are installed, as permitted under paragraph A6.1.2. for vehicles of the category N₃ only, no more than two pairs may be simultaneously lit. For changing over from the dipped to the main beam at least one pair of main-beam headlamps shall be switched on. For changing over from the main-beam to the dipped-beam all main-beam headlamps shall be switched off simultaneously.

A6.1.7.5. The dipped-beams may remain switched on at the same time as the main beams.

A6.1.7.6. Where four concealable headlamps are fitted their raised position shall prevent the simultaneous operation of any additional headlamps fitted, if these are intended to provide light signals consisting of intermittent illumination at short intervals (paragraph A5.12.) in daylight.

A6.1.8. Tell-tale

Circuit-closed tell-tale mandatory.

- A6.1.8.1. If the control of the main-beam headlamps is automatic as described in paragraph A6.1.7.1. an indication shall be provided to the driver that the automatic control of the main-beam function is activated. This information shall remain displayed as long as the automatic operation is activated.
- A6.1.9. Other requirements
- A6.1.9.1. The aggregate maximum intensity of the main-beam headlamps which can be switched on simultaneously shall not exceed 430,000 cd, which corresponds to a reference value of 100.
- A6.1.9.2. This maximum intensity shall be obtained by adding together the individual reference marks which are indicated on the several. The reference mark "10" shall be given to each of the headlamps marked "R" or "CR".
- A6.1.9.3. Automatic activation and deactivation of the main-beam headlamps:
- A6.1.9.3.1. The sensor system used to control the automatic activation and deactivation of the main-beam headlamps, as described in paragraph A6.1.7.1., shall comply with the following requirements:
- A6.1.9.3.1.1. The boundaries of the minimum fields in which the sensor is able to detect light emitted from other vehicles defined in paragraph A6.1.7.1. are defined by the angles indicated below.
- A6.1.9.3.1.1.1. Horizontal angles: 15° to the left and 15° to the right.

Vertical angles:

| | | | |
|--|---------------|----------------------------|--------------------|
| Upward angle | 5° | | |
| Mounting height of the sensor (centre of sensor aperture above the ground) | Less than 2 m | Between 1.5 m and 2.5 m | Greater than 2.0 m |
| Downward angle | 2° | 2° to 5° | 5° |

These angles are measured from the centre of the sensor aperture relative to a horizontal straight line through its centre and parallel to the longitudinal median plane of the vehicle.

- A6.1.9.3.1.2. The sensor system shall be able to detect on a straight level road:
- An oncoming power driven vehicle at a distance extending to at least 400 m;
 - A preceding power driven vehicle or a vehicle-trailers combination at a distance extending to at least 100 m;
 - An oncoming bicycle at a distance extending to at least 75 m, its illumination represented by a white lamp with a luminous intensity of 150 cd with a light emitting area of $10 \text{ cm}^2 \pm 3 \text{ cm}^2$ and a height above a ground of 0.8 m.

To verify compliance with (a) and (b) above, the oncoming and preceding power driven vehicle (or vehicle-trailer combination) shall have position lamps (if applicable) and dipped-beam headlamps switched ON.

- A6.1.9.3.2. The transition from main-beam to dipped-beam and vice versa according to the conditions indicated in paragraph A6.1.7.1. may be performed automatically and shall not cause discomfort, distraction or glare.

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- A6.1.9.3.3. The overall performance of the automatic control shall be verified by:
- A6.1.9.3.3.1. Means of simulation or other means of verification accepted by the Type Approval Authority, as provided by the applicant.
- A6.1.9.3.3.2. A test drive according to paragraph 1 in Annex A11. The performance of the automatic control shall be documented and checked against the applicant's description. Any obvious malfunctioning shall be contested (e. g. excessive angular movement or flicker).
- A6.1.9.3.4. The control of the main-beam headlamps may be such that the main-beam headlamps are switched ON automatically only when:
- (a) No vehicles, as mentioned in paragraph A6.1.7.1., are detected within the fields and distances according to paragraphs A6.1.9.3.1.1. and A6.1.9.3.1.2.; and
- (b) The detected ambient lighting levels are as prescribed in paragraph A6.1.9.3.5..
- A6.1.9.3.5. In the case where main-beam headlamps are switched ON automatically, they shall be switched OFF automatically when oncoming or preceding vehicles, as mentioned in paragraph A6.1.7.1., are detected within the fields and distances according to paragraphs A6.1.9.3.1.1. and A6.1.9.3.1.2.

Moreover, they shall be switched OFF automatically when the illuminance produced by ambient lighting conditions exceeds 7000 lx.

Compliance with this requirement shall be demonstrated by the applicant, using simulation or other means of verification accepted by the Type Approval Authority. If necessary the illuminance shall be measured on a horizontal surface, with a cosine corrected sensor on the same height as the mounting position of the sensor on the vehicle. This may be demonstrated by the manufacturer by sufficient documentation or by other means accepted by the Type Approval Authority.

- A6.2. Dipped-beam headlamp (Regulations Nos. 98 and 112)
- A6.2.1. Presence
Mandatory on motor vehicles. Prohibited on trailers.
- A6.2.2. Number
Two, type approved according to Regulations Nos. 98 or 112, excluding Class A headlamp.
- A6.2.3. Arrangement
No special requirement.
- A6.2.4. Position
- A6.2.4.1. In width: that edge of the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall be not more than 400 mm from the extreme outer edge of the vehicle.
- The inner edges of the apparent surfaces in the direction of the reference axes shall be not less than 600 mm apart. This does not apply, however, for M₁ and N₁ category vehicles; for all other categories of motor vehicles this distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.

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- A6.2.4.2. In height: not less than 500 mm and not more than 1,200 mm above the ground. For category N₃G (off-road) vehicles⁴ the maximum height may be increased to 1,500 mm.
- A6.2.4.3. In length: at the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly, or indirectly through the devices for indirect vision and/or other reflecting surfaces of the vehicle.
- A6.2.5. Geometric visibility
 Defined by angles α and β as specified in paragraph B2.3.11.:
 $\alpha = 15^\circ$ upwards and 10° downwards,
 $\beta = 45^\circ$ outwards and 10° inwards.
 The presence of partitions or other items of equipment near the headlamp shall not give rise to secondary effects causing discomfort to other road users.
- A6.2.6. Orientation
 Towards the front
- A6.2.6.1. Vertical orientation
- A6.2.6.1.1. The initial downward inclination of the cut-off of the dipped-beam to be set in the unladen vehicle state with one person in the driver's seat shall be specified within an accuracy of 0.1 per cent by the manufacturer and indicated in a clearly legible and indelible manner on each vehicle close to either headlamp or the manufacturer's plate by the symbol shown in Annex 7.
 The value of this indicated downward inclination shall be defined in accordance with paragraph A6.2.6.1.2.
- A6.2.6.1.2. Depending on the mounting height in metres (h) of the lower edge of the apparent surface in the direction of the reference axis of the dipped-beam headlamp, measured on the unladen vehicles, the vertical inclination of the cut-off of the dipped- beam shall, under all the static conditions of Annex 5, remain between the following limits and the initial aiming shall have the following values:
- | | |
|--|---|
| $h < 0.8$ | |
| Limits: | between -0.5 per cent and -2.5 per cent |
| Initial aiming: | between -1.0 per cent and -1.5 per cent |
| $0.8 < h < 1.0$ | |
| Limits: | between -0.5 per cent and -2.5 per cent |
| Initial aiming: | between -1.0 per cent and -1.5 per cent |
| Or, at the discretion of the manufacturer, | |
| Limits: | between -1.0 per cent and -3.0 per cent |
| Initial aiming: | between -1.5 per cent and -2.0 per cent |

⁴ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2 - www.unece.org/trans/main/wp29/wgs/wp29gen/wp29resolutions.html

The application for the vehicle type-approval shall, in this case, contain information as to which of the two alternatives is to be used.

$h > 1.0$

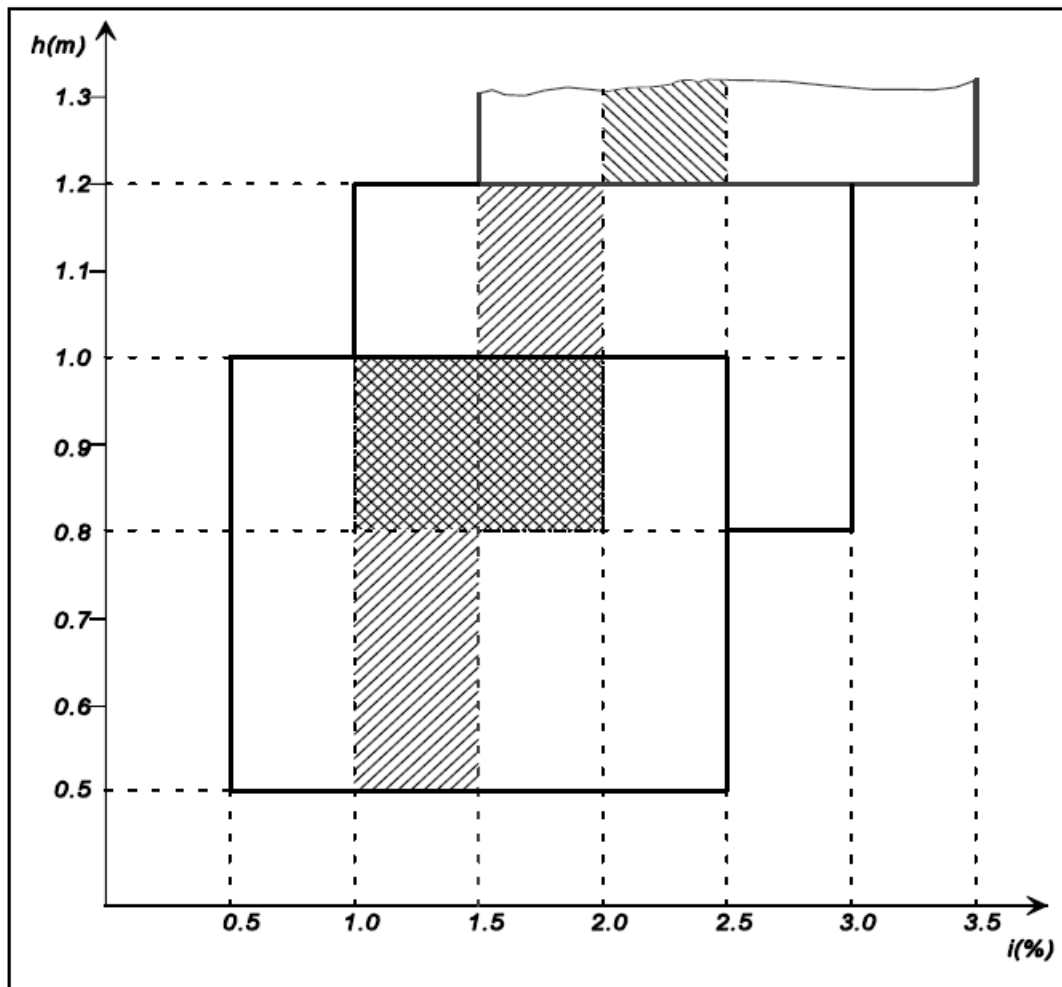
Limits: between -1.0 per cent and -3.0 per cent

Initial aiming: between -1.5 per cent and -2.0 per cent

The above limits and the initial aiming values are summarized in the diagram below.

For category N₃G (off-road) vehicles where the headlamps exceed a height of 1,200 mm, the limits for the vertical inclination of the cut-off shall be between: -1.5 per cent and -3.5 per cent.

The initial aim shall be set between: -2 per cent and -2.5 per cent.



A6.2.6.2. Headlamp levelling device

A6.2.6.2.1. In the case where a headlamp levelling device is necessary to satisfy the requirements of paragraphs A6.2.6.1.1. and A6.2.6.1.2., the device shall be automatic.

A6.2.6.2.2. However, devices which are adjusted manually, either continuously or non-continuously, shall be permitted, provided they have a stop position at

which the lamps can be returned to the initial inclination defined in paragraph A6.2.6.1.1. by means of the usual adjusting screws or similar means.

These manually adjustable devices shall be operable from the driver's seat.

Continually adjustable devices shall have reference marks indicating the loading conditions that require adjustment of the dipped-beam.

The number of positions on devices which are not continuously adjustable shall be such as to ensure compliance with the range of values prescribed in paragraph 6.2.6.1.2. in all the loading conditions defined in Annex A5 **to this Regulation**.

For these devices also, the loading conditions of Annex A5 that require adjustment of the dipped-beam shall be clearly marked near the control of the device (Annex A8).

A6.2.6.2.3. In the event of a failure of devices described in paragraphs A6.2.6.2.1. and A6.2.6.2.2., the dipped-beam shall not assume a position in which the dip is less than it was at the time when the failure of the device occurred.

A6.2.6.3. Measuring procedure

A6.2.6.3.1. After adjustment of the initial inclination, the vertical inclination of the dipped-beam, expressed in per cent, shall be measured in static conditions under all the loading conditions defined in Annex A5.

A6.2.6.3.2. The measurement of the variation of dipped-beam inclination as a function of load shall be carried out in accordance with the test procedure set out in Annex A6.

A6.2.6.4. Horizontal orientation

The horizontal orientation of one or both dipped-beam headlamps may be varied to produce bend lighting, provided that if the whole beam or the kink of the elbow of the cut-off is moved, the kink of the elbow of the cut-off shall not intersect the line of the trajectory of the centre of gravity of the vehicle at distances from the front of the vehicle which are larger than 100 times the mounting height of the respective dipped-beam headlamps.

A6.2.7. Electrical connections

A6.2.7.1. The control for changing over to the dipped-beam shall switch off all main-beam headlamps simultaneously.

A6.2.7.2. The dipped-beam may remain switched on at the same time as the main beams.

A6.2.7.3. In the case of dipped-beam headlamps according to Regulation No. 98, the gas-discharge light sources shall remain switched on during the main-beam operation.

A6.2.7.4. One additional light source or one or more LED module(s), located inside the dipped-beam headlamps or in a lamp (except the main-beam headlamp) grouped or reciprocally incorporated with the respective dipped-beam headlamps, may be activated to produce bend lighting, provided that the horizontal radius of curvature of the trajectory of the centre of gravity of the vehicle is 500 m or less. This may be demonstrated by the manufacturer by calculation or by other means accepted by the Type Approval Authority.

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- A6.2.7.5. Dipped-beam headlamps may be switched ON or OFF automatically. However, it shall be always possible to switch these dipped-beam headlamps ON and OFF manually.
- A6.2.7.6. If daytime running lamps are present and operate according to paragraph A6.19., either
- A6.2.7.6.1. The dipped-beam headlamps shall be switched ON and OFF automatically relative to the ambient light conditions (e.g. switch ON during night-time driving conditions, tunnels, etc.) according to the requirements of Annex A12; or
- A6.2.7.6.2. Daytime running lamps operate in conjunction with the lamps listed in paragraph A5.11. where, as a minimum requirement, at least the rear position lamps shall be activated; or
- A6.2.7.6.3. Distinctive means are provided to inform the driver that the headlamps, position lamps and if so equipped end outline marker lamps and side marker lamps are not illuminated. Such means are:
- A6.2.7.6.3.1. Two distinctly different levels of instrument panel illumination intensity are provided during night and day, indicating to the driver that the dipped-beam headlamps shall be switched ON; or
- A6.2.7.6.3.2. Non-illuminated indicators and identification of hand controls that are required by Regulation No. 121 to be illuminated when the headlamps are activated; or
- A6.2.7.6.3.3. A tell-tale visual, auditory or both, shall be activated only in reduced ambient lighting conditions as defined in Annex A3 to inform the driver that the dipped-beam headlamps should be switched ON. Once the tell-tale is activated, it shall only be extinguished when the dipped-beam headlamps have been switched on or the device which starts and/or stops the engine (propulsion system) is set in a position which makes it impossible for the engine (propulsion system) to operate.
- A6.2.7.7. Without prejudice to paragraph A6.2.7.6.1., the dipped-beam headlamps may switch ON and OFF automatically relative to other factors such as time or ambient conditions (e.g. time of the day, vehicle location, rain, fog, etc.)
- A6.2.8. Tell-tale
- A6.2.8.1. Tell-tale optional
- A6.2.8.2. A visual tell-tale whether flashing or not is mandatory:
- (a) In the case where the whole beam or the kink of the elbow of the cut-off is moved to produce bend lighting; or
- (b) If one or more LED modules are used to produce the principal dipped-beam, except when they are wired so that the failure of any one LED module causes all of them to stop emitting light.
- It shall be activated:
- (a) In the event of a malfunction of the displacement of the kink of the elbow of the cut-off; or
- (b) In case of a failure of any one of the LED module(s) producing the principal dipped-beam, except when they are wired so that the failure of any one LED module causes all of them to stop emitting light.

It shall remain activated while the failure is present. It may be cancelled temporarily, but shall be repeated whenever the device, which starts and stops the engine, is switched on and off.

A6.2.9. Other requirements

The requirements of paragraph A5.5.2. shall not apply to dipped-beam headlamps.

Dipped-beam headlamps with a light source or LED module(s) producing the principal dipped-beam and having a total objective luminous flux which exceeds 2,000 lumen shall only be installed in conjunction with the installation of headlamp cleaning device(s) according to Regulation No. 45.⁵

With respect to vertical inclination the provisions of paragraph A6.2.6.2.2. shall not be applied for dipped-beam headlamps:

- (a) With LED module(s) producing the principal dipped-beam, or
- (b) With a light source producing the principal dipped-beam and having an objective luminous flux which exceeds 2,000 lumens.

In the case of filament lamps for which more than one test voltage is specified, the objective luminous flux which produces the principal dipped-beam, as indicated in the communication form for the type approval of the device, is applied.

In the case of dipped-beam headlamps equipped with an approved light source, the applicable objective luminous flux is the value at the relevant test voltage as given in the relevant data sheet in the Regulation, according to which the applied light source was approved, without taking into account the tolerances to the objective luminous flux specified on this datasheet.

Only dipped-beam headlamps according to Regulation Nos. 98 or 112 may be used to produce bend lighting.

If bend lighting is produced by a horizontal movement of the whole beam or the kink of the elbow of the cut-off, it shall be activated only if the vehicle is in forward motion; this shall not apply if bend lighting is produced for a right turn in right hand traffic (left turn in left hand traffic).

A6.3. Front fog lamp (Regulation No. 19)

A6.3.1. Presence

Optional on motor vehicles. Prohibited on trailers.

A6.3.2. Number

Two; complying with the requirements of the 03 and subsequent series of amendments to Regulation No. 19.

A6.3.3. Arrangement

No special requirement.

A6.3.4. Position

⁵ Contracting Parties to the respective regulations can still prohibit the use of mechanical cleaning systems when headlamps with plastic lenses, marked "PL", are installed.

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- A6.3.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.
- A6.3.4.2. In height:
- Minimum: Not less than 250 mm above the ground.
- Maximum: For M₁ and N₁ category vehicles: not more than 800 mm above the ground.
- For all other categories except N₃G (off-road)⁶ vehicles: not more than 1,200 mm above the ground.
- For category N₃G vehicles: the maximum height may be increased to 1,500 mm.
- No point on the apparent surface in the direction of the reference axis shall be higher than the highest point on the apparent surface in the direction of the reference axis of the dipped-beam headlamp.
- A6.3.4.3. In length: at the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly, or indirectly through the devices for indirect vision and/or other reflecting surfaces of the vehicle.
- A6.3.5. Geometric visibility
- Defined by angles α and β as specified in paragraph **B2.3.11.**,
- $\alpha = 5^\circ$ upwards and downwards,
- $\beta = 45^\circ$ outwards and 10° inwards.
- The presence of partitions or other items of equipment near the front fog lamp shall not give rise to secondary effects causing discomfort to other road users.⁷
- A6.3.6. Orientation
- Toward the front.
- A6.3.6.1. Vertical orientation
- A6.3.6.1.1. In the case of class "B" front fog lamps the vertical inclination of the cut-off to be set in the unladen vehicle state with one person in the driver's seat shall be -1.5 per cent or lower.¹³
- A6.3.6.1.2. In the case of class "F3" front fog lamps:
- A6.3.6.1.2.1. When the total objective luminous flux of the light source does not exceed 2,000 lumens:
- A6.3.6.1.2.1.1. The vertical inclination of the cut-off to be set in the unladen vehicle state with one person in the driver's seat shall be - 1.0 per cent or lower

⁶ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

⁷ New vehicle types which do not comply with this provision may continue to be approved until 18 months after the entry into force of Supplement 4 to the 03 series of amendments.

A6.3.6.1.2.2. When the total objective luminous flux of the light source exceeds 2,000 lumens:

A6.3.6.1.2.2.1. Depending on the mounting height in metres (h) of the lower edge of the apparent surface in the direction of the reference axis of the front fog lamp, measured on the unladen vehicles, the vertical inclination of the cut-off shall under all the static conditions of Annex A5 automatically remain between the following values:

$h \leq 0.8$

Limits: between -1.0 per cent and -3.0 per cent

Initial aiming: between -1.5 per cent and -2.0 per cent

$h > 0.8$

Limits: between -1.5 per cent and -3.5 per cent

Initial aiming: between -2.0 per cent and -2.5 per cent.

A6.3.6.1.2.2.2. The initial downward inclination of the cut-off to be set in the unladen vehicle state with one person in the driver's seat shall be specified within an accuracy of one decimal place by the manufacturer and indicated in a clearly legible and indelible manner on each vehicle close to either the front fog lamp or the manufacturer's plate or in combination with the indication referred to in paragraph 6.2.6.1.1. by the symbol shown in Annex A7. The value of this indicated downward inclination shall be defined in accordance with paragraph A6.3.6.1.2.2.1..

A6.3.6.2. Front fog lamp levelling device

A6.3.6.2.1. Where a levelling device is fitted for a front fog lamp, independent or grouped with other front lighting and light signalling functions, it shall be such that the vertical inclination, under all the static loading conditions of Annex A5, shall remain between the limits prescribed in paragraph A6.3.6.1.2.2.1..

A6.3.6.2.2. In the case where the front fog lamp of category "F3" is part of the dipped-beam headlamp or is part of an AFS system, the requirements of paragraph A6.2.6. shall be applied during the use of the front fog beam as part of the dipped-beam.

In this case the levelling limits defined in paragraph A6.2.6. may be applied also when this front fog lamp is used as such.

A6.3.6.2.3. The levelling device may also be used to automatically adapt the inclination of the front fog beam in relation to the prevailing ambient conditions, provided that the limits for the downward inclination specified in paragraph A6.3.6.1.2.2.1. are not exceeded.

A6.3.6.2.4. In the case of a failure of the levelling device, the front fog beam shall not assume a position in which the cut off is less inclined than it was at the time when the failure of the device occurred.

A6.3.7. Electrical connections

It shall be possible to switch the front fog lamps ON and OFF independently of the main-beam headlamps, the dipped-beam headlamps or any combination of main- and dipped-beam headlamps, unless the front fog lamps are used as part of another lighting function in an AFS; however, the

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- switching ON of the front fog lamps function shall have the priority over the function for which the front fog lamps are used as a part.
- A6.3.8. Tell-tale
Circuit-closed tell-tale mandatory. An independent non-flashing warning light.
- A6.3.9. Other requirements
In the case where there is a positive indication in the communication form in item 10.9. of Annex 1 of Regulation No. 19 the alignment and the luminous intensities of the class "F3" front fog beam may be automatically adapted in relation to the prevailing ambient conditions. Any variations of the luminous intensities or alignment shall be performed automatically and in such a way that no discomfort, neither for the driver nor to other road users, is caused.
- A6.4. Reversing lamp (Regulation No. 23)
- A6.4.1. Presence
Mandatory on motor vehicles and on trailers of categories O₂, O₃ and O₄.
Optional on trailers of category O₁.
- A6.4.2. Number
- A6.4.2.1. One device mandatory and a second device optional on motor vehicles of category M₁ and on all other vehicles with a length not exceeding 6,000 mm.
- A6.4.2.2. Two devices mandatory and two devices optional on all vehicles with a length exceeding 6,000 mm, except vehicles of category M₁.
- A6.4.3. Arrangement
No special requirement.
- A6.4.4. Position
- A6.4.4.1. In width: no special requirement.
- A6.4.4.2. In height: not less than 250 mm and not more than 1,200 mm above the ground.
- A6.4.4.3. In length: at the rear of the vehicle
However, if installed, the two optional devices mentioned in paragraph A6.4.2.2. may be fitted on the side of the vehicle, provided that the requirements of paragraphs A6.4.5.2. and A6.4.6.2. are fulfilled.
- A6.4.5. Geometric visibility
- A6.4.5.1. Devices installed at the rear of the vehicle:
Defined by angles α and β , as specified in paragraph **B2.3.11.**:
 $\alpha = 15^\circ$ upwards and 5° downwards,
 $\beta = 45^\circ$ to right and to left if there is only one device,
 45° outwards and 30° inwards if there are two.
- A6.4.5.2. Two optional devices mentioned in paragraph A6.4.2.2. if fitted on the side of the vehicle:
The geometric visibility is considered to be ensured if the reference axis of the respective device is directed outwards with an angle β not exceeding 15°

relative to the median longitudinal plane of the vehicle. The vertical aim of the two optional devices may be directed downwards.

A6.4.6. Orientation

A6.4.6.1. Rearwards

A6.4.6.2. In addition, if the two optional devices mentioned in paragraph A6.4.2.2., are fitted on the side of the vehicle, the provisions of paragraph A6.4.5.2. shall apply.

A6.4.7. Electrical connections

A6.4.7.1. They shall be such that the lamp can light up only if the reverse gear is engaged and if the device which controls the starting and stopping of the engine is in such a position that operation of the engine is possible. It shall not light up or remain lit if either of the above conditions is not satisfied.

A6.4.7.2. Moreover, the electrical connections of the two optional devices mentioned in paragraph A6.4.2.2. shall be such that these devices cannot illuminate unless the lamps referred to in paragraph A5.11. are switched on.

The devices fitted on the side of the vehicle may be switched on for slow manoeuvres in forward motion of the vehicle up to a maximum speed of 10 km/h, provided that the following conditions are fulfilled:

- (a) The devices shall be activated and deactivated manually by a separate switch;
- (b) If so activated, they may remain illuminated after reverse gear is disengaged;
- (c) They shall be automatically switched off if the forward speed of the vehicle exceeds 10 km/h, regardless of the position of the separate switch; in this case they shall remain switched off until deliberately being switched on again.

A6.4.8. Tell-tale

Tell-tale optional.

A6.4.9. Other requirements

None.

A6.5. Direction-indicator lamp (Regulation No. 6)

A6.5.1. Presence (see figure below)

Mandatory. Types of direction-indicator lamps fall into categories (1, 1a, 1b, 2a, 2b, 5 and 6) the assembly of which on one vehicle constitutes an arrangement ("A" and "B").

Arrangement "A" shall apply to all motor vehicles.

Arrangement "B" shall apply to trailers only.

A6.5.2. Number

According to the arrangement.

A6.5.3. Arrangements (see figure below)

A: Two front direction-indicator lamps of the following categories:

1 or 1a or 1b,

If the distance between the edge of the apparent surface in the direction of the reference axis of this lamp and that of the apparent surface in the direction of the reference axis of the dipped-beam headlamp and/or the front fog lamp, if there is one, is at least 40 mm;

1a or 1b,

If the distance between the edge of the apparent surface in the direction of the reference axis of this lamp and that of the apparent surface in the direction of the reference axis of the dipped-beam headlamp and/or the front fog lamp, if there is one, is greater than 20 mm and less than 40 mm;

1b,

If the distance between the edge of the apparent surface in the direction of the reference axis of this lamp and that of the apparent surface in the direction of the reference axis of the dipped-beam headlamp and/or the front fog lamp, if there is one, is less than or equal to 20 mm;

Two rear direction-indicator lamps (category 2a or 2b);

Two optional lamps (category 2a or 2b) on all vehicles in categories M₂, M₃, N₂, N₃.

Two side direction-indicator lamps of the categories 5 or 6 (minimum requirements):

5

For all M₁ vehicles;

For N₁, M₂ and M₃ vehicles not exceeding 6 metres in length.

6

For all N₂ and N₃ vehicles;

For N₁, M₂ and M₃ vehicles exceeding 6 metres in length.

It is permitted to replace category 5 side direction-indicator lamps by category 6 side direction-indicator lamps in all instances

A maximum of three optional category 5 or one optional category 6 device per side on vehicles of type M₂, M₃, N₂ and N₃ exceeding 9 m in length.

Where lamps combining the functions of front direction-indicator lamps (categories 1, 1a, 1b) and side direction-indicator lamps (categories 5 or 6) are fitted, two additional side direction-indicator lamps (categories 5 or 6) may be fitted to meet the visibility requirements of paragraph 6.5.5.

B: two rear direction-indicator lamps (Categories 2a or 2b)

Two optional lamps (category 2a or 2b) on all vehicles in categories O₂, O₃ and O₄.

A maximum of three optional category 5 or one optional category 6 device per side on vehicles of type O₂, O₃ and O₄ exceeding 9 m in length.

Where an AFS is fitted, the distance to be considered for the choice of the category is the distance between the front direction-indicator lamp and the closest lighting unit in its closest position contributing to or performing a passing-beam mode.

A6.5.4. Position

A6.5.4.1. In width: the edge of the apparent surface in the direction of the reference axis farthest from the median longitudinal plane of the vehicle shall not be more than 400 mm from the extreme outer edge of the vehicle. This condition shall not apply to the optional rear lamps.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall not be less than 600 mm.

This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.

A6.5.4.2. In height: above the ground.

A6.5.4.2.1. The height of the light-emitting surface of the side direction-indicator lamps of categories 5 or 6 shall not be:

Less than: 350 mm for M₁ and N₁ category of vehicles, and 500 mm for all other categories of vehicles, both measured from the lowest point; and

More than: 1,500 mm, measured from the highest point.

A6.5.4.2.2. The height of the direction-indicator lamps of categories 1, 1a, 1b, 2a and 2b, measured in accordance with paragraph A5.8., shall not be less than 350 mm or more than 1,500 mm.

A6.5.4.2.3. If the structure of the vehicle does not permit these upper limits, measured as specified above, to be respected, and if the optional rear lamps are not installed, they may be increased to 2,300 mm for side direction-indicator lamps of categories 5 and 6, and to 2,100 mm for the direction-indicator lamps of categories 1, 1a, 1b, 2a and 2b.

A6.5.4.2.4. If optional rear lamps are installed, they shall be placed at a height compatible with the applicable requirements of paragraph A6.5.4.1. , the symmetry of the lamps, and at a vertical distance as large as the shape of the bodywork makes it possible, but not less than 600 mm above the mandatory lamps.

A6.5.4.3. In length (see figure below)

The distance between the light-emitting surface of the side direction-indicator lamp (categories 5 and 6) and the transverse plane which marks the forward boundary of the vehicle's overall length, shall not exceed 1,800 mm.

However, this distance shall not exceed 2,500 mm:

- (a) For M₁ and N₁ category vehicles;
- (b) For all other categories of vehicles if the structure of the vehicle makes it impossible to comply with the minimum angles of visibility.

Optional category 5 side direction indicator lamps, shall be fitted, spaced evenly, along the length of the vehicle.

Optional category 6 side direction indicator lamp shall be fitted in the area between the first and last quartiles of the length of a trailer.

A6.5.5. Geometric visibility

A6.5.5.1. Horizontal angles: (see figure below)

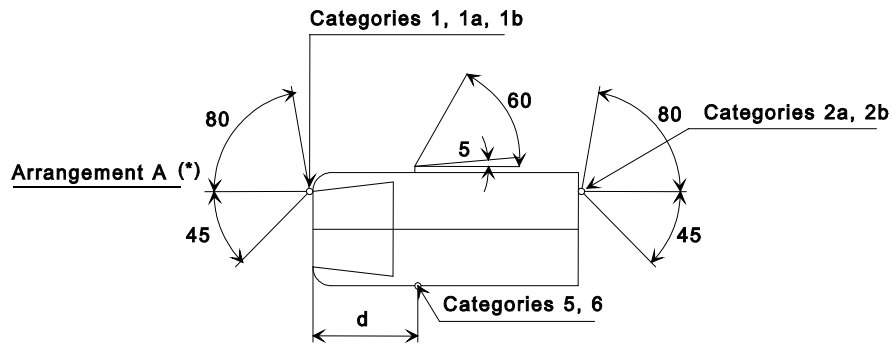
Vertical angles: 15° above and below the horizontal for direction indicator lamps of categories 1, 1a, 1b, 2a, 2b and 5.

However:

- (a) Where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1), the downward angle of 15° may be reduced to 5°;
- (b) Where an optional rear lamp is mounted above 2,100 mm (measured according to the provisions of paragraph A5.8.1.) the upward angle of 15° may be reduced to 5°.

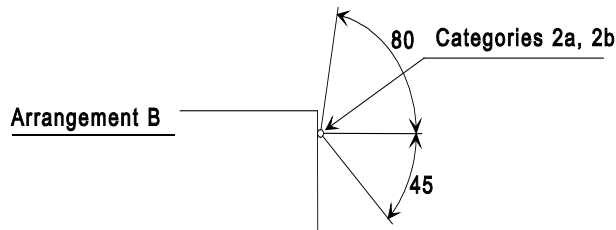
30° above and 5° below the horizontal for direction indicator lamps of category 6.

Figure (see paragraph A6.5.)



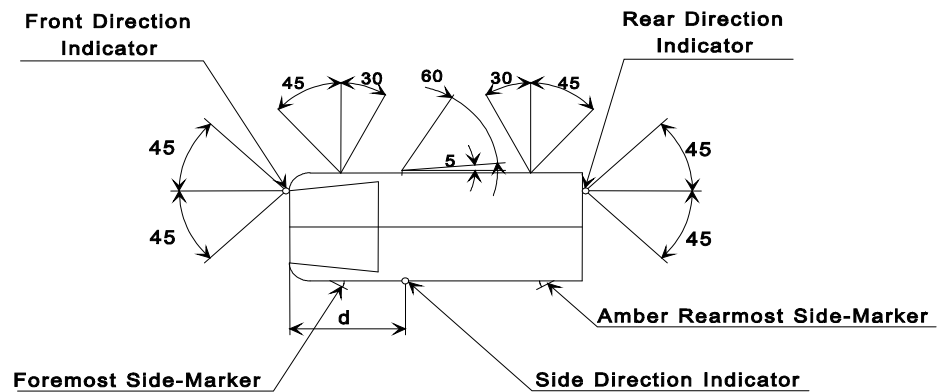
(*) The value of 5° given for dead angle of visibility to the rear of the side direction-indicator is an upper limit $d \leq 1.80$ m (for M_1 and N_1 category vehicles $d \leq 2.50$ m).

For the direction indicator lamps of categories 1, 1a, 1b, 2a and 2b mounted below 750 mm (measured according to the provisions of paragraph A5.8.1), the inward angle of 45° may be reduced to 20° under the H plane.



A6.5.5.2. Or, at the discretion of the manufacturer, for M_1 and N_1 category vehicles: Front and rear direction indicator lamps, as well as side-marker lamps (**).

Horizontal angles: (see figure below)



(**) The value of 5° given for the dead angle of visibility to the rear of the side direction-indicator is an upper limit. $d \leq 2.50$ m

However, for the direction indicator lamps of categories 1, 1a, 1b, 2a and 2b mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.

Vertical angles: 15° above and below the horizontal. However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1), the downward angle of 15° may be reduced to 5°.

To be considered visible, the lamp shall provide an unobstructed view of the apparent surface of at least 12.5 square centimetres, except for side direction-indicators of categories 5 and 6. The illuminating surface area of any retro-reflector that does not transmit light shall be excluded.

A6.5.6. Orientation

According to the requirements for installation by the manufacturer, if any.

A6.5.7. Electrical connections

Direction-indicator lamps shall switch on independently of the other lamps. All direction-indicator lamps on one side of a vehicle shall be switched on and off by means of one control and shall flash in phase.

On M_1 and N_1 vehicles less than 6 m in length, with an arrangement complying with paragraph A6.5.5.2., the amber side-marker lamps, when mounted, shall also flash at the same frequency (in phase) with the direction-indicator lamps.

A6.5.8. Tell-tale

Operating tell-tale mandatory for direction-indicator lamps of categories 1, 1a, 1b, 2a and 2b. It may be visual or auditory or both. If it is visual it shall be a flashing light which, at least in the event of the malfunction of any of these direction-indicator lamps, is either extinguished, or remains alight without flashing, or shows a marked change of frequency. If it is entirely auditory it shall be clearly audible and shall show a marked change of frequency, at least in the event of the malfunction of any of these direction-indicator lamps.

It shall be activated by the signal produced according to paragraph 6.4.2. of Regulation No. 6 or another suitable way¹³.

If a motor vehicle is equipped to draw a trailer, it shall be fitted with a special visual operational tell-tale for the direction-indicator lamps on the trailer unless the tell-tale of the drawing vehicle allows the failure of any one of the direction-indicator lamps on the vehicle combination thus formed to be detected.

For the optional direction-indicator lamps on motor vehicles and trailers, operating tell-tale shall not be mandatory.

A6.5.9. Other requirements

The light shall be a flashing light flashing 90 ± 30 times per minute.

Operation of the light-signal control shall be followed within not more than one second by the emission of light and within not more than one and one-half seconds by its first extinction. If a motor vehicle is equipped to draw a trailer, the control of the direction-indicator lamps on the drawing vehicle shall also operate the indicator lamps of the trailer. In the event of failure, other than short-circuit, of one direction-indicator lamp, the others shall continue to flash, but the frequency in this condition may be different from that prescribed.

A6.6. Hazard warning signal

A6.6.1. Presence

Mandatory.

The signal shall be given by simultaneous operation of the direction-indicator lamps in accordance with the requirements of paragraph A6.5..

A6.6.2. Number

As specified in paragraph A6.5.2.

A6.6.3. Arrangement

As specified in paragraph A6.5.3.

A6.6.4. Position

A6.6.4.1. Width: As specified in paragraph A6.5.4.1.

A6.6.4.2. Height: As specified in paragraph A6.5.4.2.

A6.6.4.3. Length: As specified in paragraph A6.5.4.3.

A6.6.5. Geometric visibility

As specified in paragraph A6.5.5.

A6.6.6. Orientation

As specified in paragraph A6.5.6.

A6.6.7. Electrical connections

A6.6.7.1. The signal shall be operated by means of a separate manual control enabling all the direction-indicator lamps to flash in phase.

A6.6.7.2. The hazard warning signal may be activated automatically in the event of a vehicle being involved in a collision or after the de-activation of the

-
- emergency stop signal, as specified in paragraph A6.23.. In such cases, it may be turned "off" manually.
- A6.6.7.3. On M_1 and N_1 vehicles less than 6 m in length, with an arrangement complying with paragraph A6.5.5.2., the amber side-marker lamps, when mounted, shall also flash at the same frequency (in phase) with the direction-indicator lamps.
- A6.6.8. Tell-tale
Flashing circuit-closed tell-tale mandatory.
- A6.6.9. Other requirements
As specified in paragraph A6.5.9., if a power-driven vehicle is equipped to draw a trailer the hazard warning signal control shall also be capable of bringing the direction-indicator lamps on the trailer into action. The hazard warning signal shall be able to function even if the device which starts or stops the engine is in a position which makes it impossible to start the engine.
- A6.7. Stop lamp (Regulation No.7)
- A6.7.1. Presence
Devices of S1 or S2 categories: mandatory on all categories of vehicles.
Devices of S3 or S4 category: mandatory on M_1 and N_1 categories of vehicles, except for chassis-cabs and those N_1 category vehicles with open cargo space; optional on other categories of vehicles.
- A6.7.2. Number
Two S1 or S2 category devices and one S3 or S4 category device on all categories of vehicles.
- A6.7.2.1. Except in the case where a category S3 or S4 device is installed, two optional category S1 or S2 devices may be installed on vehicles in categories M_2 , M_3 , N_2 , N_3 , O_2 , O_3 , and O_4 .
- A6.7.2.2. Only, when the median longitudinal plane of the vehicle is not located on a fixed body panel but separates one or two movable parts of the vehicle (e.g. doors), and lacks sufficient space to install a single device of the S3 or S4 category on the median longitudinal plane above such movable parts, either:
Two devices of the S3 or S4 category type "D" may be installed; or
One device of the S3 or S4 category may be installed offset to the left or to the right of the median longitudinal plane, or
An interdependent lamp system of category S3 or S4 may be installed.
- A6.7.3. Arrangement
No special requirement.
- A6.7.4. Position
- A6.7.4.1. In width:
For M_1 and N_1 category vehicles:
For S1 or S2 categories devices that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median

longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle;

For the distance in between the inner edges of the apparent surfaces in the direction of the reference axes there is no special requirement.

For all other categories of vehicles:

For S1 or S2 categories devices the distance in between the inner edges of the apparent surfaces in the direction of the reference axes shall be not less than 600 mm. This distance may be reduced to 400 mm if the overall width of the vehicle is less than 1,300 mm.

For S3 or S4 category devices: the centre of reference shall be situated on the median longitudinal plane of the vehicle. However, in the case where the two devices of the S3 or S4 category are installed, according to paragraph 6.7.2., they shall be positioned as close as possible to the median longitudinal plane, one on each side of this plane.

In the case where one S3 or S4 category lamp offset from the median longitudinal plane is permitted according to paragraph A6.7.2. , this offset shall not exceed 150 mm from the median longitudinal plane to the centre of reference of the lamp.

A6.7.4.2. In height:

A6.7.4.2.1. For S1 or S2 categories devices:

Above the ground, not less than 350 mm nor more than 1,500 mm (2,100 mm if the shape of the bodywork makes it impossible to keep within 1,500 mm and if the optional lamps are not installed).

If the optional lamps are installed, they shall be positioned at a height compatible with the requirements of the width and the symmetry of the lamps, and at a vertical distance as large as the shape of the bodywork makes it possible, but not less than 600 mm above the mandatory lamps.

A6.7.4.2.2. For S3 or S4 categories devices:

The horizontal plane tangential to the lower edge of the apparent surface shall: either not be more than 150 mm below the horizontal plane tangential to the lower edge of the exposed surface of the glass or glazing of the rear window, or not be less than 850 mm above the ground.

However, the horizontal plane tangential to the lower edge of the apparent surface of a S3 or S4 category device shall be above the horizontal plane tangential to the upper edge of the apparent surface of S1 or S2 categories devices.

A6.7.4.3. In length:

A6.7.4.4. For S1 or S2 categories devices: at the rear of the vehicle.

A6.7.4.5. For S3 or S4 categories devices: no special requirement.

A6.7.5. Geometric visibility

Horizontal angle:

For S1 or S2 categories devices: 45° to the left and to the right of the longitudinal axis of the vehicle.

However, for the stop lamps of categories S1 and S2 mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.

For S3 or S4 categories devices: 10° to the left and to the right of the longitudinal axis of the vehicle;

Vertical angle:

For S1 or S2 categories devices: 15° above and below the horizontal.

However,

- (a) Where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the downward angle of 15° may be reduced to 5°;
- (b) Where an optional lamp is mounted above 2,100 mm (measured according to the provisions of paragraph 5.8.1.) the upward angle of 15° may be reduced to 5°.

For S3 or S4 categories devices: 10° above and 5° below the horizontal.

A6.7.6. Orientation

Towards the rear of the vehicle.

A6.7.7. Electrical connections

A6.7.7.1. All stop lamps shall light up simultaneously when the braking system provides the relevant signal defined in Regulations Nos. 13 and 13-H.

A6.7.7.2. The stop lamps need not function if the device, which starts and/or stops the engine, is in a position that makes it impossible for the engine to operate.

A6.7.8. Tell-tale

Tell-tale optional; where fitted, this tell-tale shall be an operating tell-tale consisting of a non-flashing warning light which comes on in the event of the malfunctioning of the stop lamps.

A6.7.9. Other requirements

A6.7.9.1. The S3 or S4 category device may not be reciprocally incorporated with any other lamp.

6.7.9.2. The S3 or S4 category device may be installed outside or inside the vehicle.

6.7.9.2.1. In the case where it is installed inside the vehicle:

The light emitted shall not cause discomfort to the driver through the devices for indirect vision and/or other surfaces of the vehicle (i.e. rear window).

A6.8. Rear registration plate lamp (Regulation No. 4)

A6.8.1. Presence

Mandatory.

A6.8.2. Number

Such that the device illuminates the site of the registration plate.

A6.8.3. Arrangement

Such that the device illuminates the site of the registration plate.

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- A6.8.4. Position
- A6.8.4.1. In width: such that the device illuminates the site of the registration plate.
- A6.8.4.2. In height: such that the device illuminates the site of the registration plate.
- A6.8.4.3. In length: such that the device illuminates the site of the registration plate.
- A6.8.5. Geometric visibility
Such that the device illuminates the site of the registration plate.
- A6.8.6. Orientation
Such that the device illuminates the site of the registration plate.
- A6.8.7. Electrical connections
In accordance with paragraph A5.11.
- A6.8.8. Tell-tale
Tell-tale optional. If it exists, its function shall be carried out by the tell-tale required for the front and rear position lamps.
- A6.8.9. Other requirements
When the rear registration plate lamp is combined with the rear position lamp, reciprocally incorporated in the stop lamp or in the rear fog lamp, the photometric characteristics of the rear registration plate lamp may be modified during the illumination of the stop lamp or the rear fog lamp.
- A6.9. Front position lamp (Regulation No. 7)
- A6.9.1. Presence
Mandatory on all motor vehicles.
Mandatory on trailers over 1,600 mm wide.
Optional on trailers which are not more than 1,600 mm wide.
- A6.9.2. Number
Two.
- A6.9.3. Arrangement
No special requirement.
- A6.9.4. Position
- A6.9.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

In the case of a trailer, that point on the apparent surface in the direction of the reference axis which is farthest from the median longitudinal plane shall not be more than 150 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M₁ and N₁ category vehicles: No special requirement;

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- For all other categories of vehicles: Not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.
- A6.9.4.2. In height: above the ground, not less than 250 mm nor more than 1,500 mm (2,100 mm for O₁ and O₂ categories of vehicles, or if for any other categories of vehicles the shape of the bodywork makes it impossible to keep within 1,500 mm).
- A6.9.4.3. In length: no individual specification.
- A6.9.4.4. Where the front position lamp and another lamp are reciprocally incorporated, the apparent surface in the direction of the reference axis of the other lamp shall be used to verify compliance with the positioning requirements (paragraphs A6.9.4.1. to A6.9.4.3.).
- A6.9.5. Geometric visibility
- A6.9.5.1. Horizontal angle: 45° inwards and 80° outwards.
- However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.
- In the case of trailers, the angle inwards may be reduced to 5°.
- Vertical angle: 15° above and below the horizontal. However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the downward angle of 15° may be reduced to 5°.
- A6.9.5.2. For M₁ and N₁ category vehicles, as an alternative to paragraph A6.9.5.1., at the discretion of the manufacturer or his duly accredited representative, and only if a front side-marker lamp is installed on the vehicle:
- Horizontal angle: 45° outwards to 45° inwards.
- However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.
- Vertical angle: 15° above and below the horizontal.
- However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the downward angle of 15° may be reduced to 5°.
- To be considered visible, the lamp shall provide an unobstructed view of the apparent surface of at least 12.5 cm². The illuminating surface area of any retro-reflector that does not transmit light shall be excluded.
- A6.9.6. Orientation
- Forwards.
- A6.9.7. Electrical connections**
- In accordance with paragraph A5.11. and the instructions in paragraph B7.4, shall apply.**
- A6.9.8. Tell-tale

Circuit-closed tell-tale mandatory. This tell-tale shall be non-flashing and shall not be required if the instrument panel lighting can only be turned on simultaneously with the front position lamps.

This requirement does not apply when light signalling system operates according to paragraph A6.2.7.6.2. .

- A6.9.9. Other requirements
- A6.9.9.1. If one or more infrared radiation generator(s) is (are) installed inside the front position lamp, it (they) is (are) allowed to be activated only when the headlamp on the same side of the vehicle is switched on and the vehicle is in forward motion. In the event that the front position lamp or the headlamp on the same side fails, the infrared radiation generator(s) shall be automatically switched off.
- A6.9.9.2. In case an AFS providing a bending mode is installed, the front position lamp may be swivelled together with a lighting unit to which it is reciprocally incorporated.
- A6.10. Rear position lamp (Regulation No. 7)
- A6.10.1. Presence
Devices of R or R1 or R2 categories: Mandatory
- A6.10.2. Number
Two.
- A6.10.2.1. Except the case where end-outline marker lamps are installed, two optional position lamps may be installed on all vehicles in categories M₂, M₃, N₂, N₃, O₂, O₃, and O₄.
- A6.10.3. Arrangement
No special requirement.
- A6.10.4. Position
- A6.10.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle. This condition shall not apply to the optional rear lamps.
- The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:
- For M₁ and N₁ category vehicles: have no special requirement;
- For all other categories of vehicles: be not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.
- A6.10.4.2. In height: above the ground, not less than 350 mm nor more than 1,500 mm (2,100 mm if the shape of the bodywork makes it impossible to keep within 1,500 mm and if the optional lamps are not installed). If the optional lamps are installed, they shall be placed at a height compatible with the applicable requirements of paragraph A6.10.4.1., the symmetry of the lamps, and at a vertical distance as large as the shape of the bodywork makes it possible, but not less than 600 mm above the mandatory lamps.
- A6.10.4.3. In length: The rear of the vehicle.

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- A6.10.5. Geometric visibility
- A6.10.5.1. Horizontal angle: 45° inwards and 80° outwards.
- However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.
- Vertical angle: 15° above and below the horizontal.
- However,
- (a) Where a lamp is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the downward angle of 15° may be reduced to 5°;
- (b) Where an optional lamp is mounted above 2,100 mm (measured according to the provisions of paragraph A5.8.1.) the upward angle of 15° may be reduced to 5°.
- A6.10.5.2. For M₁ and N₁ category vehicles, as an alternative to paragraph A6.10.5.1., at the discretion of the manufacturer or his duly accredited representative, and only if a rear side-marker lamp is installed on the vehicle,
- Horizontal angle: 45° outwards to 45° inwards. However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.
- Vertical angle: 15° above and below the horizontal.
- However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the downward angle of 15° may be reduced to 5°.
- To be considered visible, the lamp shall provide an unobstructed view of the apparent surface of at least 12.5 square centimetres. The illuminating surface area of any retro-reflector that does not transmit light shall be excluded.
- A6.10.6. Orientation
- Rearwards.
- A6.10.7. Electrical connections**
- In accordance with paragraph A5.11. and the instructions in paragraph B7.4. shall apply.**
- A6.10.8. Tell-tale
- Circuit-closed tell-tale mandatory. It shall be combined with that of the front position lamps.
- This requirement does not apply when light signalling system operates according to paragraph A6.2.7.6.2. .
- A6.10.9. Other requirements
- None.
- A6.11. Rear fog lamp (Regulation No. 38)

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- A6.11.1. Presence
Devices of F or F1 or F2 categories: Mandatory.
- A6.11.2. Number
One or two.
- A6.11.3. Arrangement
No special requirement.
- A6.11.4. Position
- A6.11.4.1. In width: if there is only one rear fog-lamp, it shall be on the opposite side of the median longitudinal plane of the vehicle to the direction of traffic prescribed in the country of registration, the centre of reference may also be situated on the median longitudinal plane of the vehicle.
- A6.11.4.2. In height: not less than 250 mm nor more than 1,000 mm above the ground. For rear fog lamps grouped with any rear lamp or for category N₃G (off-road) vehicles, the maximum height may be increased to 1,200 mm.
- A6.11.4.3. In length: at the rear of the vehicle.
- A6.11.5. Geometric visibility
Defined by angles α and β as specified in paragraph **B2.3.11.:**
 $\alpha = 5^\circ$ upwards and 5° downwards;
 $\beta = 25^\circ$ to right and to left.
- A6.11.6. Orientation
Rearwards.
- A6.11.7. Electrical connections
These shall be such that:
- A6.11.7.1. The rear fog-lamp(s) cannot be switched on unless the main beams, dipped-beams or front fog-lamps are lit;
- A6.11.7.2. The rear fog-lamp(s) can be switched off independently of any other lamp;
- A6.11.7.3. Either of the following applies:
- A6.11.7.3.1. The rear fog lamp(s) may continue to operate until the position lamps are switched off, and the rear fog lamp(s) shall then remain off until deliberately switched on again;
- A6.11.7.3.2. A warning, at least audible, additional to the mandatory tell-tale (paragraph A6.11.8.) shall be given if the ignition is switched off or the ignition key is withdrawn and the driver's door is opened, whether the lamps in (paragraph A6.11.7.1.) are on or off, whilst the rear fog lamp switch is in the "on" position.
- A6.11.7.4. Except as provided in paragraphs A6.11.7.1., A6.11.7.3. and A6.11.7.5., the operation of the rear fog lamp(s) shall not be affected by switching on or off any other lamps.
- A6.11.7.5. The rear fog lamp(s) of a drawing motor vehicle may be automatically switched off while a trailer is connected and the rear fog lamp(s) of the trailer is (are) activated.

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- A6.11.8. Tell-tale
Circuit-closed tell-tale mandatory. An independent non-flashing warning light.
- A6.11.9. Other requirements
In all cases, the distance between the rear fog-lamp and each stop-lamp shall be greater than 100 mm.
- A6.12. Parking lamp (Regulation No. 77 or 7)
- A6.12.1. Presence
On motor vehicles not exceeding 6 m in length and not exceeding 2 m in width, optional.
On all other vehicles, prohibited.
- A6.12.2. Number
According to the arrangement.
- A6.12.3. Arrangement
Either two lamps at the front and two lamps at the rear, or one lamp on each side.
- A6.12.4. Position
- A6.12.4.1. In width: that point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.
Furthermore, if there are two lamps, they shall be on the sides of the vehicle.
- A6.12.4.2. In height:
For M_1 and N_1 category vehicles: no special requirement;
For all other categories of vehicles: above the ground, not less than 350 mm nor more than 1,500 mm (2,100 mm if the shape of the bodywork makes it impossible to keep within 1,500 mm).
- A6.12.4.3. In length: no special requirement.
- A6.12.5. Geometric visibility
Horizontal angle: 45° outwards, forwards and rearwards.
However, where a front or rear parking lamp is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the inward angle of 45° may be reduced to 20° under the H plane.
Vertical angle: 15° above and below the horizontal.
However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the downward angle of 15° may be reduced to 5°.
- 6.12.6. Orientation
Such that the lamps meet the requirements for visibility forwards and rearwards.
- A6.12.7. Electrical connections

The connection shall allow the parking lamp(s) on the same side of the vehicle to be lit independently of any other lamps.

The parking lamp(s) and, if applicable, the front and rear position lamps according to paragraph A6.12.9., shall be able to operate even if the device which starts the engine is in a position which makes it impossible for the engine to operate. A device which automatically deactivates these lamps as a function of time is prohibited.

A6.12.8. Tell-tale

Circuit-closed tell-tale optional. If there is one, it shall not be possible to confuse it with the tell-tale for the front and rear position lamps.

A6.12.9. Other requirements

The functioning of this lamp may also be performed by simultaneously switching on the front and rear position lamps on the same side of the vehicle. In this case, lamps that meet the requirements of front or rear position lamps are deemed to meet the requirements of parking lamps.

A6.13. End-outline marker lamp (Regulation No. 7)

A6.13.1. Presence

Devices of A or AM categories (visible from the front), and devices of R, R₁, R₂, RM₁ or RM₂ Categories (visible from the rear):

Mandatory on vehicles exceeding 2.10 m in width. Optional on vehicles between 1.80 and 2.10 m in width. On chassis-cabs the rear end-outline marker lamps are optional.

A6.13.2. Number

Two visible from the front and two visible from the rear.

Optional: additional lamps may be fitted as follows:

- (a) Two visible from the front;
- (b) Two visible from the rear.

A6.13.3. Arrangement

No special requirement.

A6.13.4. Position

A6.13.4.1. In width:

Front and rear: as close as possible to the extreme outer edge of the vehicle. This condition is deemed to have been met when the point on the apparent surface in the direction of the reference axis which is farthest from the vehicle's median longitudinal plane is not more than 400 mm from the extreme outer edge of the vehicle.

A6.13.4.2. In height:

Front: Motor vehicles - the horizontal plane tangential to the upper edge of the apparent surface in the direction of the reference axis of the device shall not be lower than the horizontal plane tangential to the upper edge of the transparent zone of the wind-screen.

Trailers and semi-trailers - at the maximum height compatible with the requirements relating to the width, design and operational requirements of the vehicle and to the symmetry of the lamps.

Rear: At the maximum height compatible with the requirements relating to the width, design and operational requirements of the vehicle and to the symmetry of the lamps.

Both optional and mandatory (as applicable) lamps to be fitted as far separated in height as practicable and compatible with design/operational requirements of the vehicle and symmetry of the lamps.

A6.13.4.3. In length, no special requirement.

The additional lamps visible from the front, as specified in paragraph 6.13.4.2., as close as practicable to the rear. However, the distance between the additional lamps and the rear of the vehicle shall not exceed 400 mm.

A6.13.5. Geometric visibility

Horizontal angle: 80° outwards.

Vertical angle: 5° above and 20° below the horizontal.

A6.13.6. Orientation

Such that the lamps meet the requirements for visibility forwards and rearwards.

A6.13.7. Electrical connections

In accordance with paragraph A5.11.

A6.13.8. Tell-tale

Tell-tale optional. If it exists, its function shall be carried out by the tell-tale required for the front and rear position lamps.

A6.13.9. Other requirements

Provided that all other requirements are met, the mandatory or optional lamps, visible from the front and the mandatory or optional lamps visible from the rear on the same side of the vehicle may be combined into one device.

Two of the lamps visible from the rear may be grouped, combined or reciprocally incorporated in accordance with paragraph A5.7.

The position of an end-outline marker lamp in relation to corresponding position lamp shall be such that the distance between the projections on a transverse vertical plane of the points nearest to one another on the apparent surfaces in the direction of the respective reference axes of the two lamps considered is not less than 200 mm.

A6.14. Rear retro-reflector, non-triangular (Regulation No. 3)

A6.14.1. Presence

Mandatory on motor vehicles.

Provided that they are grouped together with the other rear light-signalling devices, optional on trailers.

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- A6.14.2. Number
Two, the performances of which shall conform to the requirements concerning Class IA or IB retro-reflectors in Regulation No. 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph A6.14.4.), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.
- A6.14.3. Arrangement
No special requirement.
- A6.14.4. Position
- A6.14.4.1. In width: that point on the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M₁ and N₁ category vehicles: have no special requirement;

For all other categories of vehicles: be not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.
- A6.14.4.2. In height: Above the ground, not less than 250 mm nor more than 900 mm (not more than 1,200 mm if grouped with any rear lamp(s), 1,500 mm if the shape of the bodywork makes it impossible to keep within 900 mm or 1200 mm respectively).
- A6.14.4.3. In length: at the rear of the vehicle.
- A6.14.5. Geometric visibility

Horizontal angle: 30° inwards and outwards.

Vertical angle: 10° above and below horizontal.

However, where a retro-reflector is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the downward angle of 10° may be reduced to 5°.
- A6.14.6. Orientation

Rearwards.
- A6.14.7. Other requirements

The illuminating surface of the retro-reflector may have parts in common with the apparent surface of any other lamp situated at the rear.
- A6.15. Rear retro-reflector, triangular (Regulation No. 3)
- A6.15.1. Presence

Mandatory on trailers.

Prohibited on motor vehicles.
- A6.15.2. Number

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- Two, the performances of which shall conform to the requirements concerning Class IIIA or Class IIIB retro-reflectors in Regulation No. 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph A6.15.4.), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.
- A6.15.3. Arrangement
- The apex of the triangle shall be directed upwards.
- A6.15.4. Position
- A6.15.4.1. In width: that point on the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.
- The inner edges of the retro-reflectors shall not be less than 600 mm apart. This distance may be reduced to 400 mm if the overall width of the vehicle is less than 1,300 mm.
- A6.15.4.2. In height: Above the ground, not less than 250 mm nor more than 900 mm (not more than 1,200 mm if grouped with any rear lamp(s), 1,500 mm if the shape of the bodywork makes it impossible to keep within 900 mm or 1,200 mm respectively).
- A6.15.4.3. In length: at the rear of the vehicle.
- A6.15.5. Geometric visibility
- Horizontal angle: 30° inwards and outwards.
- Vertical angle: 15° above and below the horizontal. However, where a retro-reflector is mounted below 750 mm (measured according to the provisions of paragraph 5.8.1.), the downward angle of 15° may be reduced to 5°.
- A6.15.6. Orientation
- Rearwards.
- A6.15.7. Other requirements
- The illuminating surface of the retro-reflector may have parts in common with the apparent surface of any other lamp situated at the rear.
- A6.16. Front retro-reflector, non-triangular (Regulation No. 3)
- A6.16.1. Presence
- Mandatory on trailers.
- Mandatory on motor vehicles having all forward facing lamps with reflectors concealable.
- Optional on other motor vehicles.
- A6.16.2. Number
- Two, the performances of which shall conform to the requirements concerning Class IA or IB retro-reflectors in Regulation No. 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph A6.16.4.), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

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- A6.16.3. Arrangement
No special requirement.
- A6.16.4. Position
- A6.16.4.1. In width: that point on the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be more than 400 mm from the extreme outer edge of the vehicle.

In the case of a trailer, the point of the illuminating surface which is farthest from the vehicle's median longitudinal plane shall not be farther than 150 mm from the extreme outer edge of the vehicle.

The distance between the inner edges of the two apparent surfaces in the direction of the reference axes shall:

For M_1 and N_1 category vehicles: have no special requirement;

For all other categories of vehicles: be not less than 600 mm. This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.
- A6.16.4.2. In height: above the ground, not less than 250 mm nor more than 900 mm (1,500 mm if the shape of the bodywork makes it impossible to keep within 900 mm).
- A6.16.4.3. In length: at the front of the vehicle.
- A6.16.5. Geometric visibility

Horizontal angle: 30° inwards and outwards. In the case of trailers, the angle inwards may be reduced to 10°. If because of the construction of the trailers this angle cannot be met by the mandatory retro-reflectors, then additional (supplementary) retro-reflectors shall be fitted, without the width limitation (paragraph A6.16.4.1.), which shall, in conjunction with the mandatory retro-reflectors, give the necessary visibility angle.

Vertical angle: 10° above and below the horizontal. However, where a retro-reflector is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the downward angle of 10° may be reduced to 5°.
- A6.16.6. Orientation
Towards the front.
- A6.16.7. Other requirements
The illuminating surface of the retro-reflector may have parts in common with the apparent surface of any other lamp situated at the front.
- A6.17. Side retro-reflector, non-triangular (Regulation No. 3)
- A6.17.1. Presence
Mandatory: On all motor vehicles the length of which exceeds 6 m.
On all trailers.
Optional: On motor vehicles the length of which does not exceed 6 m.
- A6.17.2. Number
Such that the requirements for longitudinal positioning are complied with. The performances of these devices shall conform to the requirements

concerning Class IA or IB retro-reflectors in Regulation No. 3. Additional retro-reflecting devices and materials (including two retro-reflectors not complying with paragraph A6.17.4.), are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

- A6.17.3. Arrangement
No special requirement.
- A6.17.4. Position
- A6.17.4.1. In width: no special requirement.
- A6.17.4.2. In height: Above the ground, not less than 250 mm nor more than 900 mm (not more than 1,200 mm if grouped with any lamp(s), 1,500 mm if the shape of the bodywork makes it impossible to keep within 900 mm or 1,200 mm respectively or if the presence of the device is not mandatory according to paragraph A6.17.1.).
- A6.17.4.3. In length: at least one side retro-reflector shall be fitted to the middle third of the vehicle, the foremost side retro-reflector being not further than 3 m from the front;

The distance between two adjacent side retro-reflectors shall not exceed 3 m. This does not, however, apply to M₁ and N₁ category vehicles.

If the structure, design or the operational use of the vehicle makes it impossible to comply with such a requirement, this distance may be increased to 4 m. The distance between the rearmost side retro-reflector and the rear of the vehicle shall not exceed 1 m. However, for motor vehicles the length of which does not exceed 6 m, it is sufficient to have one side retro-reflector fitted within the first third and/or one within the last third of the vehicle length.

However, for motor vehicles the length of which does not exceed 6 m, it is sufficient to have one side retro-reflector fitted within the first third and/or one within the last third of the vehicle length. For M₁ vehicles the length of which exceeds 6 m but does not exceed 7 m it is sufficient to have one side retro-reflector fitted not further than 3 m from the front and one within the last third of the vehicle length.
- A6.17.5. Geometric visibility

Horizontal angle: 45° to the front and to the rear.

Vertical angle: 10° above and below the horizontal. However, where a retro-reflector is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the downward angle of 10° may be reduced to 5°.
- A6.17.6. Orientation
Towards the side.
- A6.17.7. Other requirements
The illuminating surface of the side retro-reflector may have parts in common with the apparent surface of any other side lamp.
- A6.18. Side-marker lamps (Regulation No. 91)
- A6.18.1. Presence

Mandatory: On all vehicles the length of which exceeds 6 m, except for chassis-cabs.

The SM1 type of side-marker lamp shall be used on all categories of vehicles; however the SM2 type of side-marker lamps may be used on the M₁ category of vehicles.

In addition, on M₁ and N₁ category vehicles less than 6 m in length, side-marker lamps shall be used, if they supplement the reduced geometric visibility requirements of front position lamps conforming to paragraph A6.9.5.2. and rear position lamps conforming to paragraph A6.10.5.2.

Optional: On all other vehicles.

The SM1 or SM2 types of side-marker lamps may be used.

A6.18.2. Minimum number per side

Such that the rules for longitudinal positioning are complied with.

A6.18.3. Arrangement

No individual requirements

A6.18.4. Position

A6.18.4.1. In width: no individual requirements.

A6.18.4.2. In height: Above the ground, not less than 250 mm nor more than 1,500 mm (2,100 mm if the shape of the bodywork makes it impossible to keep within 1,500 mm).

A6.18.4.3. In length: at least one side-marker lamp shall be fitted to the middle third of the vehicle, the foremost side-marker lamp being not further than 3 m from the front. The distance between two adjacent side-marker lamps shall not exceed 3 m. If the structure, design or the operational use of the vehicle makes it impossible to comply with such a requirement, this distance may be increased to 4 m.

The distance between the rearmost side-marker lamp and the rear of the vehicle shall not exceed 1 m.

However, for vehicles the length of which does not exceed 6 m and for chassis-cabs it is sufficient to have one side-marker lamp fitted within the first third and/or within the last third of the vehicle length. For M₁ vehicles the length of which exceeds 6 m but does not exceed 7 m it is sufficient to have one side-marker lamp fitted not further than 3 m from the front and one within the last third of the vehicle length.

A6.18.5. Geometric visibility

Horizontal angle: 45° to the front and to the rear; however for vehicles on which the installation of the side-marker lamps is optional this value can be reduced to 30°.

If the vehicle is equipped with side-marker lamps used to supplement the reduced geometric visibility of front and rear direction indicator lamps conforming to paragraph A6.5.5.2. and/or position lamps conforming to paragraphs A6.9.5.2. and A6.10.5.2., the angles are 45° towards the front and rear ends of the vehicle and 30° towards the centre of the vehicle (see the figure in paragraph A6.5.5.2.).

Vertical angle: 10° above and below the horizontal. However, where a lamp is mounted below 750 mm (measured according to the provisions of paragraph A5.8.1.), the downward angle of 10° may be reduced to 5°.

- A6.18.6. Orientation
Towards the side.
- A6.18.7. Electrical connections
On M₁ and N₁ category vehicles less than 6 m in length amber side-marker lamps may be wired to flash, provided that this flashing is in phase and at the same frequency with the direction-indicator lamps at the same side of the vehicle.
For all other categories of vehicles: no individual specification.
- A6.18.8. Tell-tale
Tell-tale optional. If it exists its function shall be carried out by the tell-tale required for the front and rear position lamps.
- A6.18.9. Other requirements
When the rearmost side-marker lamp is combined with the rear position lamp reciprocally incorporated with the rear fog-lamp or stop lamp, the photometric characteristics of the side-marker lamp may be modified during the illumination of the rear fog lamp or stop lamp.
Rear side-marker lamps shall be amber if they flash with the rear direction-indicator lamp.
- A6.19. Day-time running lamp (Regulation No. 87)⁸
- A6.19.1. Presence
Mandatory on motor vehicles. Prohibited on trailers.
- A6.19.2. Number
Two.
- A6.19.3. Arrangement
No special requirement.
- A6.19.4. Position
- A6.19.4.1. In width: the distance between the inner edges of the apparent surfaces in the direction of the reference axes shall not be less than 600 mm.
This distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.
- A6.19.4.2. In height: above the ground not less than 250 mm nor more than 1,500 mm.
- A6.19.4.3. In length: at the front of the vehicle. This requirement shall be deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly or indirectly through the devices for indirect vision and/or other reflecting surfaces of the vehicle.

⁸ The Contracting Parties not applying Regulation No. 87 may prohibit the presence of DRL (as specified in paragraph 5.22.) on the basis of national regulations.

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- A6.19.5. Geometric visibility
- Horizontal: outwards 20° and inwards 20°.
- Vertical: upwards 10° and downwards 10°.
- A6.19.6. Orientation
- Towards the front.
- A6.19.7. Electrical connections
- A6.19.7.1. The daytime running lamps shall be switched ON automatically when the device which starts and/or stops the engine (propulsion system) is set in a position which makes it possible for the engine (propulsion system) to operate. However, the daytime running lamps may remain OFF while the following conditions exist:
- A6.19.7.1.1. The automatic transmission control is in the park position; or
- A6.19.7.1.2. The parking brake is in the applied position; or
- A6.19.7.1.3. Prior to the vehicle being set in motion for the first time after each manual activation of the propulsion system.
- A6.19.7.2. The daytime running lamps may be switched OFF manually when the vehicle speed does not exceed 10 km/h provided they switch ON automatically when the vehicle speed exceeds 10 km/h or when the vehicle has travelled more than 100 m and they remain ON until deliberately switched off again.
- A6.19.7.3. The daytime running lamp shall switch OFF automatically when the device which starts and/or stops the engine (propulsion system) is set in a position which makes it impossible for the engine (propulsion system) to operate or the front fog lamps or headlamps are switched ON, except when the latter are used to give intermittent luminous warnings at short intervals.⁹
- A6.19.7.4. The lamps referred to in paragraph A5.11. may be switched ON when the daytime running lamps are switched ON, except if daytime running lamps are operating according to paragraph A6.2.7.6.2., where at least the rear position lamps shall be activated.
- A6.19.7.5. If the distance between the front direction-indicator lamp and the daytime running lamp is equal or less than 40 mm, the electrical connections of the daytime running lamp on the relevant side of the vehicle may be such that either:
- (a) It is switched OFF; or
- (b) Its luminous intensity is reduced during the entire period (both ON and OFF cycle) of activation of a front direction-indicator lamp.
- A6.19.7.6. If a direction-indicator lamp is reciprocally incorporated with a daytime running lamp, the electrical connections of the daytime running lamp on the relevant side of the vehicle shall be such that the daytime running lamp is switched OFF during the entire period (both ON and OFF cycle) of activation of the direction-indicator lamp.

⁹ New vehicle types which do not comply with this provision may continue to be approved until 18 months after the entry into force of Supplement 4 to the 03 series of amendments.

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- A6.19.8. Tell-tale
Closed-circuit tell-tale optional.
- 6.19.9. Other prescriptions
No prescription.
- A6.20. Cornering lamp (Regulation No. 119)
- A6.20.1. Presence
Optional on motor vehicles.
- A6.20.2. Number
Two.
- A6.20.3. Arrangement
No special requirement.
- A6.20.4. Position
- A6.20.4.1. In width: one cornering lamp shall be located on each side of the vehicle's median longitudinal plane.
- A6.20.4.2. In length: not further than 1,000 mm from the front.
- A6.20.4.3. In height: minimum: Not less than 250 mm above the ground;
maximum: Not more than 900 mm above the ground.
- However, no point on the apparent surface in the direction of the reference axis shall be higher than the highest point on the apparent surface in the direction of the reference axis of the dipped-beam headlamp.
- A6.20.5. Geometric visibility
Defined by angles α and β as specified in paragraph **B2.3.11.**
 $\alpha = 10^\circ$ upwards and downwards,
 $\beta = 30^\circ$ to 60° outwards.
- A6.20.6. Orientation
Such that the lamps meet the requirements for geometric visibility.
- A6.20.7. Electrical connections
The cornering lamps shall be so connected that they cannot be activated unless the main-beam headlamps or the dipped-beam headlamps are switched ON at the same time.
- A6.20.7.1. The cornering lamp on one side of the vehicle may only be switched ON automatically when the direction-indicators on the same side of the vehicle are switched ON and/or when the steering angle is changed from the straight-ahead position towards the same side of the vehicle.
- The cornering lamp shall be switched OFF automatically when the direction-indicator is switched OFF and/or the steering angle has returned in the straight-ahead position.

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- A6.20.7.2. When the reversing lamp is switched ON, both cornering lamps may be switched on simultaneously, independently from the steering wheel or direction-indicator position. In this case, the cornering lamps shall be switched OFF when the reversing lamp is switched OFF.
- A6.20.8. Tell-tale
None.
- A6.20.9. Other requirements
The cornering lamps shall not be activated at vehicle speeds above 40 km/h.
- A6.21. Conspicuity markings (Regulation No. 104)
- A6.21.1. Presence
- A6.21.1.1. Prohibited: on vehicles of categories M₁ and O₁.
- A6.21.1.2. Mandatory:
- A6.21.1.2.1. To the rear:
Full contour marking on vehicles exceeding 2,100 mm in width of the following categories:
- (a) N₂ with a maximum mass exceeding 7.5 tonnes and N₃ (with the exception of chassis-cabs, incomplete vehicles and tractors for semi-trailers);
 - (b) O₃ and O₄ (with the exception of incomplete vehicles)
- A6.21.1.2.2. To the side:
- A6.21.1.2.2.1. Partial contour marking on vehicles exceeding 6,000 mm in length (including the drawbar for trailers) of the following categories:
- (a) N₂ with a maximum mass exceeding 7.5 tonnes and N₃ (with the exception of chassis-cabs, incomplete vehicles and tractors for semi-trailers);
 - (b) O₃ and O₄ (with the exception of incomplete vehicles)
- A6.21.1.2.3. A line marking may be installed instead of the mandatory contour marking if the shape, structure, design or operational requirements of the vehicle make it impossible to install the mandatory contour marking.
- A6.21.1.2.4. If the exterior surfaces of the bodywork are partially constituted of flexible material, this line marking shall be installed on (a) rigid part(s) of the vehicle. The remaining portion of conspicuity markings may be fitted on the flexible material. However, if the exterior surfaces of the bodywork are fully constituted of flexible material, requirements of paragraph 6.21. shall be met.
- A6.21.1.2.5. In cases where the manufacturer, after verification by the Technical Service, can prove to the satisfaction of the Type Approval Authority that it is impossible, due to the operational requirements which may require special shape, structure or design of the vehicle, to comply with the requirements contained in paragraphs A6.21.2. to A6.21.7.5. then partial fulfilment of some of these requirements is acceptable. This is conditional upon a portion of the requirements being met where possible, and the application of conspicuity markings that partially meet requirements maximised on the vehicle structure. This may include fitting of additional brackets or plates

containing material compliant with Regulation No. 104 where structure is available to ensure clear and uniform signalling compatible with the objective of conspicuity.

Where partial fulfilment is deemed acceptable, retro-reflective devices like retro-reflectors of class IVA of Regulation No. 3 or brackets containing retro-reflecting material compliant with photometric requirements of Class C of Regulation No. 104 may substitute part of the required conspicuity markings. In this case, at least one of these retro-reflective devices shall be installed per 1,500 mm.

The necessary information shall be indicated in the communication form.

A6.21.1.3. Optional:

A6.21.1.3.1. To the rear and to the side:

On all other categories of vehicles, not otherwise specified in paragraphs A6.21.1.1. and A6.21.1.2., including the cab of tractor units for semi-trailers and the cab of chassis-cabs.

Partial or full contour marking may be applied instead of mandatory line markings, and full contour marking may be applied instead of mandatory partial contour marking.

A6.21.1.3.2. To the front:

Line marking on vehicles of categories O₂, O₃ and O₄.

Partial or full contour marking may not be applied to the front.

A6.21.2. Number

According to the presence.

A6.21.3. Arrangement

The conspicuity markings shall be as close as practicable to horizontal and vertical, compatible with the shape, structure, design and operational requirements of the vehicle; if this is not possible, the full or partial contour markings, when fitted, shall follow as close as practicable the contour of the outer shape of the vehicle.

Furthermore, the conspicuity markings shall be spaced as evenly as possible over the horizontal dimensions of the vehicle such that the total length and/or width of the vehicle can be identified.

A6.21.4. Position

A6.21.4.1. Width

A6.21.4.1.1. The conspicuity marking shall be as close as practicable to the edge of the vehicle.

A6.21.4.1.2. The cumulative horizontal length of the conspicuity marking elements, as mounted on the vehicle, shall equate to at least 70 per cent of the overall width of the vehicle, excluding any horizontal overlap of individual elements.

A6.21.4.2. Length

A6.21.4.2.1. The conspicuity marking shall be as close as practicable to the ends of the vehicle and reach to within 600 mm of each end of the vehicle.

A6.21.4.2.1.1. For motor vehicles, each end of the vehicle, or in the case of tractors for semi-trailers each end of the cab;

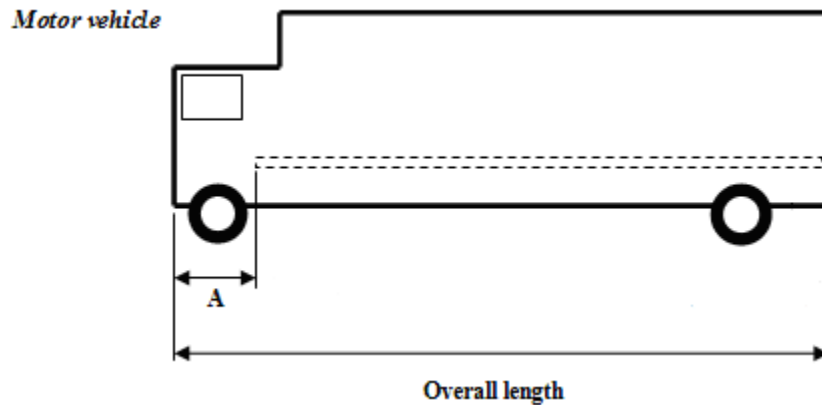
However, an alternative marking mode within 2,400 mm from the front end of the motor vehicle is allowed where a series of retro-reflectors of Class IVA of Regulation No. 3 or Class C of Regulation No. 104 are mounted followed by the required conspicuity marking as follows:

- (a) Retro-reflector size minimum 25 cm²;
- (b) One retro-reflector mounted not more than 600 mm from the front end of the vehicle;
- (c) Additional retro-reflectors spaced not more than 600 mm apart;
- (d) The distance between the last retro-reflector and the start of the conspicuity marking shall not exceed 600 mm;

A6.21.4.2.1.2. For trailers, each end of the vehicle (excluding the drawbar).

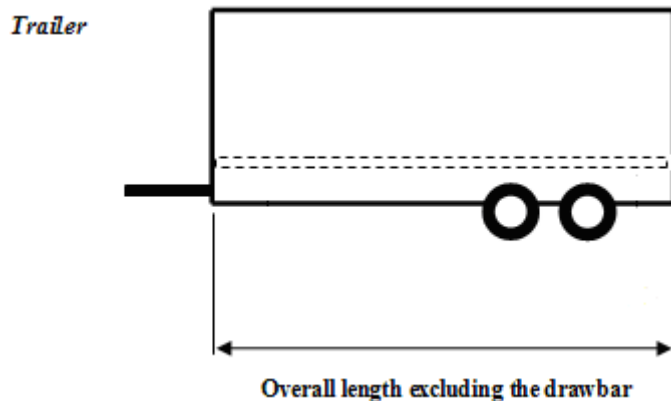
A6.21.4.2.2. The cumulative horizontal length of the conspicuity marking elements, as mounted on the vehicle, excluding any horizontal overlap of individual elements, shall equate to at least 70 per cent of:

A6.21.4.2.2.1. For motor vehicles, length of vehicle, or in the case of tractors for semi-trailers, if fitted, the length of the cab; however, when using the alternative marking mode per paragraph A6.21.4.2.1.1., the distance beginning within 2,400 mm from the front end of vehicle to its rear end.



A is the distance between the foremost conspicuity marking and the front end of the vehicle. The maximum value of A is 2,400 mm (see paragraph A6.21.4.2.1.1.).

A6.21.4.2.2.2. For trailers, the overall length of the vehicle (excluding the drawbar).



A6.21.4.3. Height

A6.21.4.3.1. Line markings and contour markings lower element(s)

As low as practicable within the range:

Minimum: not less than 250 mm above the ground.

Maximum: not more than 1,500 mm above the ground.

However, a maximum mounting height of 2,500 mm may be accepted where the shape, structure, design or operational conditions of the vehicle prevent compliance with the maximum value of 1,500 mm or, if necessary, to fulfil the requirements of paragraphs 6.21.4.1.2., and 6.21.4.2.2., or the horizontal positioning of the line marking or the lower element(s) of the contour marking.

The necessary justification for installation of conspicuity material higher than 1,500 mm shall be indicated in the communication form.

A6.21.4.3.2. Contour markings upper element(s):

As high as practicable, but within 400 mm of the upper extremity of the vehicle.

A6.21.5. Visibility

The conspicuity marking shall be considered visible, if at least 70 per cent of the illuminating surface of the installed marking is visible when viewed by an observer positioned at any point within the observation planes defined below:

A6.21.5.1. For rear and front conspicuity markings (see Annex A10, Figures 1a and 1b) the observation plane is perpendicular to the longitudinal axis of the vehicle situated 25 m from the extreme end of the vehicle and bounded by:

A6.21.5.1.1. In height, by two horizontal planes 1 m and 3.0 m respectively above the ground;

A6.21.5.1.2. In width, by two vertical planes which form an angle of 4° outwards from the vehicle's median longitudinal plane and which pass through the intersection of the vertical planes parallel to the vehicle's median longitudinal plane delimiting the vehicle's overall width, and the plane perpendicular to the longitudinal axis of the vehicle that delimits the end of the vehicle.

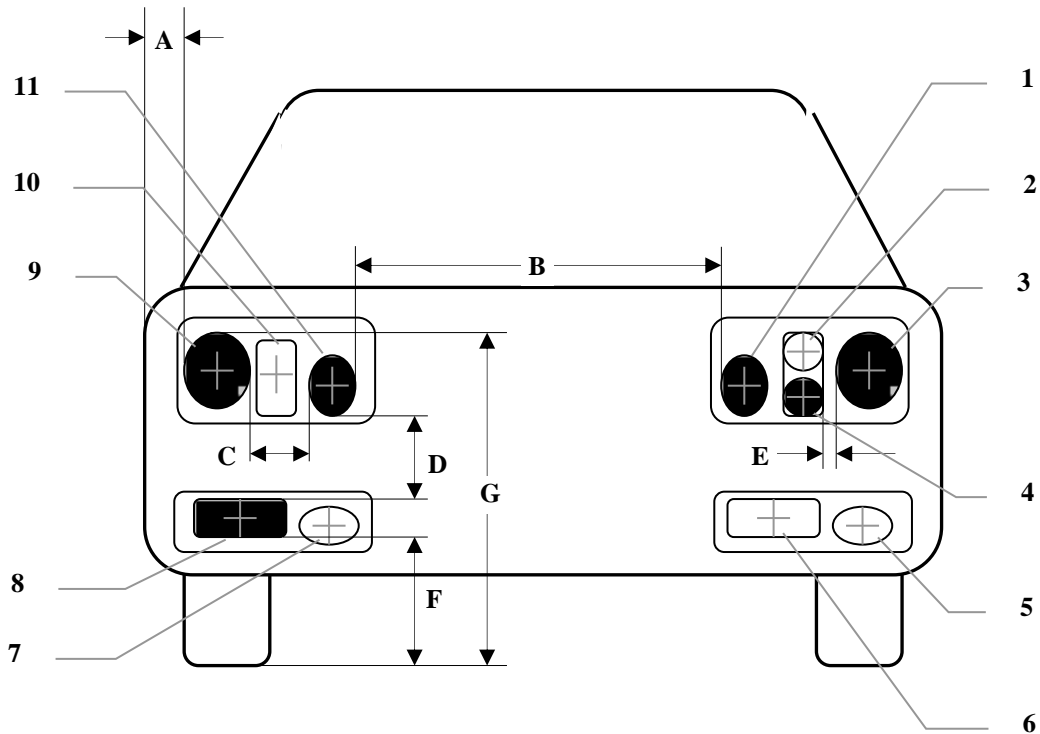
A6.21.5.2. For side conspicuity markings (see Annex A10, Fig. 2) the observation plane is parallel to the longitudinal median plane of the vehicles situated 25 m from the extreme outer edge of the vehicle and bounded by:

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- A6.21.5.2.1. In height, by two horizontal planes 1.0 m and 1.5 m respectively above the ground;
- A6.21.5.2.2. In width, by two vertical planes which form an angle of 4° outwards from a plane perpendicular to the vehicle's longitudinal axis and which pass through the intersection of the vertical planes perpendicular to the vehicle's longitudinal axis delimiting the vehicle's overall length and the extreme outer edge of the vehicle.
- A6.21.6. Orientation
- A6.21.6.1. To the side:
As close as practicable to being parallel to the median longitudinal plane of the vehicle, compatible with the shape, structure, design and operation requirements of the vehicle; if this is not possible, it shall follow as close as practicable the contour of the outer shape of the vehicle.
- A6.21.6.2. To the rear and to the front:
As close as practicable to being parallel to the transverse plane of the vehicle, compatible with the shape, structure, design and operation requirements of the vehicle, if this is not possible, it shall follow as close as practicable the contour of the outer shape of the vehicle.
- A6.21.7. Other requirements
- A6.21.7.1. Conspicuity markings shall be considered continuous if the distance between adjacent elements are as small as possible and do not exceed 50 per cent of the shortest adjacent element length. However, if the manufacturer can prove to the satisfaction of the Type Approval Authority that it is impossible to respect the value of 50 per cent, the distance between adjacent elements may be larger than 50 per cent of the shortest adjacent element, and it shall be as small as possible and not exceed 1,000 mm.
- A6.21.7.2. In the case of a partial contour marking, each upper corner shall be described by two lines at 90°, to each other and each at least 250 mm in length; if this is not possible, the marking shall follow as close as practicable the contour of the outer shape of the vehicle.
- A6.21.7.3. The distance between the conspicuity marking fitted to the rear of a vehicle and each mandatory stop lamp should be greater than 200 mm.
- A6.21.7.4. Where rear marking plates conforming to the 01 series of amendments to Regulation No. 70 are installed these may be considered, at the discretion of the manufacturer, as part of the conspicuity marking to the rear, for the purposes of calculating the length of the conspicuity marking and its proximity to the side of the vehicle.
- A6.21.7.5. The locations on the vehicle designated for conspicuity markings shall allow for the installation of markings of at least 60 mm in width.
- A6.22. Adaptive front lighting system (AFS) (Regulation No. 123)
Where not otherwise specified below, the requirements for main-beam headlamps (paragraph 6.1.) and for dipped-beam headlamps (paragraph 6.2.) of this Regulation apply to the relevant part of the AFS.
- A6.22.1. Presence
Optional on motor vehicles. Prohibited on trailers.

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- A6.22.2. Number
One.
- A6.22.3. Arrangement
No special requirements.
- A6.22.4. Position
The AFS shall, prior to the subsequent test procedures, be set to the neutral state;
- A6.22.4.1. In width and height:
For a given lighting function or mode the requirements indicated in the paragraphs A6.22.4.1.1. through A6.22.4.1.4. shall be fulfilled by those lighting units which are energized simultaneously for that lighting function or mode of a function, according to the applicant's description.
All dimensions refer to the nearest edge of the apparent surface(s) observed in the direction of the reference axis, of the lighting unit(s).
- A6.22.4.1.1. Two symmetrically placed lighting units shall be positioned at a height in compliance with the requirements of the relevant paragraphs A6.1.4. and A6.2.4., where "Two symmetrically placed lighting units" shall be understood to be two lighting units, one on each side of the vehicle, positioned such that the (geometric) centres of gravity of their apparent surfaces are at the same height and at the same distance from the vehicle's longitudinal median plane within a tolerance of 50 mm, each; their light emitting surfaces, illuminating surfaces, and light outputs, however, may differ.
- A6.22.4.1.2. Additional lighting units, if any, on either side of the vehicle shall be positioned at a distance not exceeding 140 mm¹⁰ in horizontal direction (E in the figure) and 400 mm in vertical direction above or below (D in the figure) from the nearest lighting unit;
- A6.22.4.1.3. None of the additional lighting units described in paragraph A6.22.4.1.2. shall be positioned lower than 250 mm (F in the figure) nor higher than indicated in paragraph A6.2.4.2. (G in the figure) above the ground;
- A6.22.4.1.4. Additionally, in width:
For each mode of the passing-beam lighting:
The outer edge of the apparent surface of at least one lighting unit on each side of the vehicle shall not be more than 400 mm from the extreme outer edge of the vehicle (A in the figure); and,
The inner edges of the apparent surfaces in the direction of the reference axes shall be not less than 600 mm apart. This does not apply, however, for M₁ and N₁ category vehicles; for all other categories of motor vehicles this distance may be reduced to 400 mm where the overall width of the vehicle is less than 1,300 mm.

¹⁰ In case of additional "two symmetrically placed lighting units" the horizontal distance may be 200 mm (C in the figure).

Apparent surfaces of lighting units 1 through 11 of an AFS (example)



Lighting units being simultaneously energized for a given lighting mode:

- No. 3 and 9: (two symmetrically placed lighting units)
- No. 1 and 11: (two symmetrically placed lighting units)
- No. 4 and 8: (two additional lighting units)

Lighting units not being energized for said lighting mode:

- No. 2 and 10: (two symmetrically placed lighting units)
- No. 5: (additional lighting unit)
- No. 6 and 7: (two symmetrically placed lighting units)

Horizontal dimensions in mm:

- $A \leq 400$
- $B \geq 600$, or, ≥ 400 if vehicle overall width $< 1,300$ mm, however
no requirement for category M_1 and N_1 vehicles
- $C \leq 200$
- $E \leq 140$

Vertical dimensions in mm:

- $D \leq 400$
- $F \geq 250$
- $G \leq 1,200$

A6.22.4.2. In length:

All lighting units of an AFS shall be mounted at the front. This requirement is deemed to be satisfied if the light emitted does not cause discomfort to the driver either directly or indirectly through the devices for indirect vision and/or other reflecting surfaces of the vehicle.

A6.22.5. Geometric visibility

On each side of the vehicle, for each lighting function and mode provided:

The angles of geometric visibility prescribed for the respective lighting functions according to paragraphs A6.1.5. and A6.2.5., shall be met by at least one of the lighting units that are simultaneously energized to perform said function and mode(s), according to the description of the applicant. Individual lighting units may be used to comply with the requirements for different angles.

A6.22.6. Orientation

Towards the front.

The AFS shall, prior to the subsequent test procedures, be set to the neutral state, emitting the basic passing-beam.

A6.22.6.1. Vertical orientation:

- A6.22.6.1.1. The initial downward inclination of the cut-off of the basic passing-beam to be set in the unladen vehicle state with one person in the driver's seat shall be specified with a precision of 0.1 per cent by the manufacturer and indicated in clearly legible and indelible manner on each vehicle, close to either the front lighting system or the manufacturer's plate, by the symbol shown in Annex A7 .

Where differing initial downward inclinations are specified by the manufacturer for different lighting units that provide or contribute to the cut-off of the basic passing-beam, these values of downward inclination shall be specified with a precision of 0.1 per cent by the manufacturer and indicated in clearly legible and indelible manner on each vehicle, close to either the relevant lighting units or on the manufacturers plate, in such a way that all the lighting units concerned can be unambiguously identified.

- A6.22.6.1.2. The downward inclination of the horizontal part of the "cut-off" of the basic passing-beam shall remain between the limits indicated in paragraph A6.2.6.1.2. under all the static loading conditions of the vehicle of Annex A5; and the initial aiming shall be within the specified values.

- A6.22.6.1.2.1. In case the passing-beam is generated by several beams from different lighting units, the provisions according to paragraph A6.22.6.1.2. apply to each said beam's "cut-off" (if any), which is designed to project into the angular zone, as indicated under item 9.4. of the communication form conforming to the model in Annex 1 to Regulation No. 123.

A6.22.6.2. Headlamp levelling device

- A6.22.6.2.1. In the case where a headlamp levelling device is necessary to satisfy the requirements of paragraph A6.22.6.1.2., the device shall be automatic.

- A6.22.6.2.2. In the event of a failure of this device, the passing-beam shall not assume a position in which the dip is less than it was at the time when the failure of the device occurred.

A6.22.6.3. Horizontal orientation:

For each lighting unit the kink of the elbow of the cut-off line, if any, when projected on the screen, shall coincide with the vertical line through the reference axis of said lighting unit. A tolerance of 0.5 degree to that side which is the side of the traffic direction shall be allowed. Other lighting units shall be adjusted according to the applicant's specification, as defined according to Annex 10 of Regulation No. 123.

A6.22.6.4. Measuring procedure:

After adjustment of the initial setting of beam orientation, the vertical inclination of the passing-beam or, when applicable, the vertical inclinations of all the different lighting units that provide or contribute to the cut-off(s) according to paragraph A6.22.6.1.2.1. of the basic passing-beam, shall be verified for all loading conditions of the vehicle in accordance with the requirements in paragraphs A6.2.6.3.1. and A6.2.6.3.2..

A6.22.7. Electrical connections

A6.22.7.1. Main-beam lighting (if provided by the AFS)

A6.22.7.1.1. The lighting units for the main-beam may be activated either simultaneously or in pairs. For changing over from the dipped-beam to the main-beam at least one pair of lighting units for the main-beam shall be activated. For changing over from the main-beam to the dipped-beam all lighting units for the main-beam shall be de-activated simultaneously.

A6.22.7.1.2. The main-beam may be designed to be adaptive, subject to the provisions in paragraph A6.22.9.3., the control signals being produced by a sensor system which is capable of detecting and reacting to each of the following inputs:

- (a) Ambient lighting conditions;
- (b) The light emitted by the front lighting devices and front light-signalling devices of oncoming vehicles;
- (c) The light emitted by the rear light-signalling of preceding vehicles;

Additional sensor functions to improve performance are allowed.

For the purpose of this paragraph, "vehicles" means vehicles of categories L, M, N, O, T, as well as bicycles, such vehicles being equipped with retro-reflectors, with lighting and light-signalling devices, which are switched ON.

A6.22.7.1.3. It shall always be possible to switch the main-beam headlamps, adaptive or non-adaptive, ON and OFF manually and to manually switch OFF the automatic control.

Moreover, the switching OFF, of the main-beam headlamps and of their automatic control, shall be by means of a simple and immediate manual operation; the use of sub-menus is not allowed.

A6.22.7.1.4. The dipped-beams may remain switched ON at the same time as the main beams.

A6.22.7.1.5. Where four concealable lighting units are fitted their raised position shall prevent the simultaneous operation of any additional headlamps fitted, if these are intended to provide light signals consisting of intermittent illumination at short intervals (see paragraph A5.12.) in day-light.

A6.22.7.2. Passing-beam lighting:

- (a) The control for changing over to the dipped-beam shall switch off all main-beam headlamps or de-activate all AFS lighting units for the main-beam simultaneously;
- (b) The dipped-beam may remain switched on at the same time as the main-beams;
- (c) In the case of lighting units for the dipped-beam being equipped with gas discharge light sources, the gas-discharge light sources shall remain switched on during the main-beam operation.

A6.22.7.3. Switching ON and OFF the passing-beam may be automatic, however subject to the requirements for "Electrical connection" in paragraph A5.12..

A6.22.7.4. Automatic operation of the AFS

The changes within and between the provided classes and their modes of the AFS lighting functions as specified below, shall be performed automatically without causing discomfort, distraction or glare, neither for the driver nor for other road users.

The following conditions apply for the activation of the classes and their modes of the passing-beam and, where applicable, of the main-beam and/or the adaptation of the main-beam.

A6.22.7.4.1. The class C mode(s) of the passing-beam shall be activated if no mode of another passing-beam class is activated.

A6.22.7.4.2. The class V mode(s) of the passing-beam shall not operate unless one or more of the following conditions is/are automatically detected (V-signal applies):

- (a) Roads in built-up areas and the vehicle's speed not exceeding 60 km/h;
- (b) Roads equipped with a fixed road illumination, and the vehicle's speed not exceeding 60 km/h;
- (c) A road surface luminance of 1 cd/m² and/or a horizontal road illumination of 10 lx being exceeded continuously;
- (d) The vehicle's speed not exceeding 50 km/h.

A6.22.7.4.3. The class E mode(s) of the passing-beam shall not operate unless the vehicle's speed exceeds 60 km/h and one or more of the following conditions is/are automatically detected:

- (a) The road characteristics correspond to motorway conditions¹¹ or the vehicle's speed exceeds 110 km/h (E-signal applies);
- (b) In case of a class E mode of the passing-beam which, according to the system's approval documents /communication sheet, complies with a "data set" of Regulation No. 123, Annex 3, Table 6, only.

Data set E1: the vehicle's speed exceeds 100 km/h (E1-signal applies);

¹¹ Traffic directions being separated by means of road construction, or, a corresponding lateral distance of opposing traffic is identified. This implies a reduction of undue glare from vehicles headlamps in opposing traffic.

Data set E2: the vehicle's speed exceeds 90 km/h (E2-signal applies);

Data set E3: the vehicle's speed exceeds 80 km/h (E3-signal applies).

A6.22.7.4.4. The class W-mode(s) of the passing-beam shall not operate unless the front fog lamps, if any, are switched OFF and one or more of the following conditions is/are automatically detected (W-signal applies):

- (a) The wetness of the road has been detected automatically;
- (b) The windshield wiper is switched ON and its continuous or automatically controlled operation has occurred for a period of at least two minutes.

A6.22.7.4.5. A mode of a class C, V, E, or W passing-beam shall not be modified to become a bending mode of said class (T-signal applies in combination with the signal of said passing-beam class according to paragraphs A6.22.7.4.1. through A6.22.7.4.4.) unless at least one of the following characteristics (or equivalent indications) are evaluated:

- (a) The angle of lock of the steering;
- (b) The trajectory of the centre of gravity of the vehicle.

In addition the following provisions apply:

- (i) A horizontal movement of the asymmetric cut-off side-wards from the longitudinal axis of the vehicle, if any, is allowed only when the vehicle is in forward motion¹² and shall be such that the longitudinal vertical plane through the kink of the elbow of the cut-off does not intersect the line of the trajectory of the centre of gravity of the vehicle at distances from the front of the vehicle which are larger than 100 times the mounting height of the respective lighting unit;
- (ii) One or more lighting units may be additionally energized only when the horizontal radius of curvature of the trajectory of the centre of gravity of the vehicle is 500 m or less.

A6.22.7.5. It shall always be possible for the driver to set the AFS to the neutral state and to return it to its automatic operation.

A6.22.8. Tell-tale:

A6.22.8.1. The provisions of paragraphs A6.1.8. (for the main-beam headlamp) and A6.2.8. (for the dipped-beam headlamp) of this Regulation apply to the respective parts of an AFS.

A6.22.8.2. A visual failure tell-tale for AFS is mandatory. It shall be non-flashing. It shall be activated whenever a failure is detected with respect to the AFS control signals or when a failure signal is received in accordance with paragraph 5.9. of Regulation No. 123. It shall remain activated while the failure is present. It may be cancelled temporarily, but shall be repeated whenever the device which starts and stops the engine is switched on and off.

¹² This provision does not apply for passing-beam lighting when bend lighting is produced for a right turn in right hand traffic (left turn in left-hand traffic).

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- A6.22.8.3. If the main-beam is adaptive, a visual tell-tale shall be provided to indicate to the driver that the adaptation of the main beam is activated. This information shall remain displayed as long as the adaptation is activated.
- A6.22.8.4. A tell-tale to indicate that the driver has set the system into a state according to paragraph 5.8. of Regulation No. 123 is optional.
- A6.22.9. Other requirements
- A6.22.9.1. An AFS shall be permitted only in conjunction with the installation of headlamp cleaning device(s) according to Regulation No. 45¹³ for at least those lighting units, which are indicated under item 9.3. of the communication form conforming to the model in Annex 1 to Regulation No. 123, if the total objective luminous flux of the light sources of these units exceeds 2,000 lm per side, and which contribute to the class C (basic) passing-beam.
- A6.22.9.2. Verification of compliance with AFS automatic operating requirements
- A6.22.9.2.1. The applicant shall demonstrate with a *concise description* or other means acceptable to the Type Approval Authority:
- (a) The correspondence of the *AFS control signals*
 - i) To the description required in paragraph 3.2.6.; and
 - ii) To the respective AFS control signals specified in the AFS type approval documents; and
 - (b) Compliance with the *automatic operating* requirements according to paragraphs A6.22.7.4.1. through A6.22.7.4.5..
- A6.22.9.2.2. To verify, whether, according to the paragraph A6.22.7.4., the AFS automatic operation of the passing-beam functions does not cause any discomfort, the technical service shall perform a test drive which comprises any situation relevant to the system control on the basis of the applicants description; it shall be notified whether all modes are activated, performing and de-activated according to the applicant's description; obvious malfunctioning, if any, shall be contested (e.g. excessive angular movement or flicker).
- A6.22.9.2.3. The overall performance of the automatic control shall be demonstrated by the applicant by documentation or by other means accepted by the Type Approval Authority. Furthermore the manufacturer shall provide a documentation package which gives access to the design of "the safety concept" of the system. This "safety concept" is a description of the measures designed into the system, for example within the electronic units, so as to address system integrity and thereby ensure safe operation even in the event of mechanical or electrical failure which could cause any discomfort, distraction or glare, either to the driver or to oncoming and preceding vehicles. This description shall also give a simple explanation of all the control functions of the "system" and the methods employed to achieve the objectives, including a statement of the mechanism(s) by which control is exercised.

¹³ Contracting Parties to the respective Regulations can still prohibit the use of mechanical cleaning systems when headlamps with plastic lenses, marked 'PL', are installed.

A list of all input and sensed variables shall be provided and the working range of these shall be defined. The possibility of a fall-back to the basic passing-beam (class C) function shall be a part of the safety concept.

The functions of the system and the safety concept, as laid down by the manufacturer, shall be explained. The documentation shall be brief, yet provide evidence that the design and development has had the benefit of expertise from all the system fields which are involved.

For periodic technical inspections, the documentation shall describe how the current operational status of the "system" can be checked.

For Type Approval purposes this documentation shall be taken as the basic reference for the verification process.

A6.22.9.2.4. To verify, that the adaptation of the main-beam does not cause any discomfort, distraction or glare, neither to the driver nor to oncoming and preceding vehicles, the technical service shall perform a test drive according to paragraph 2. in Annex A11.. This shall include any situation relevant to the system control on the basis of the applicant's description. The performance of the adaptation of the main-beam shall be documented and checked against the applicant's description. Any obvious malfunctioning shall be contested (e.g. excessive angular movement or flicker).

A6.22.9.3. Adaptation of the main-beam

A6.22.9.3.1. The sensor system used to control the adaptation of the main-beam, as described in paragraph A6.22.7.1.2., shall comply with the following requirements:

A6.22.9.3.1.1. The boundaries of the minimum fields in which the sensor is able to detect light emitted from other vehicles as defined in paragraph A6.22.7.1.2. are given by the angles indicated in paragraph A6.1.9.3.1.1..

A6.22.9.3.1.2. The sensor system sensitivity shall comply with the requirements in paragraph A6.1.9.3.1.2..

A6.22.9.3.1.3. The adaptive main-beam shall be switched off when the illuminance produced by ambient lighting conditions exceeds 7,000 lx.

Compliance with this requirement shall be demonstrated by the applicant, using simulation or other means of verification accepted by the Type Approval Authority. If necessary the illuminance shall be measured on a horizontal surface, with a cosine corrected sensor on the same height as the mounting position of the sensor on the vehicle. This may be demonstrated by the manufacturer by sufficient documentation or by other means accepted by the Type Approval Authority.

A6.22.9.4. The aggregate maximum intensity of the lighting units that can be energized simultaneously to provide the main-beam lighting or its modes, if any, shall not exceed 430,000 cd, which corresponds to a reference value of 100.

This maximum intensity shall be obtained by adding together the individual reference marks indicated on the several installation units that are simultaneously used to provide the main-beam.

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- A6.22.9.5. The means according to the provisions of paragraph 5.8. of Regulation No 123, which allow the vehicle to be used temporarily in a territory with the opposite direction of driving than that for which approval is sought, shall be explained in detail in the owner's manual.
- A6.23. Emergency stop signal
- A6.23.1. Presence
- Optional
- The emergency stop signal shall be given by the simultaneous operation of all the stop or direction-indicator lamps fitted as described in paragraph 6.23.7.
- A6.23.2. Number
- As specified in paragraph A6.5.2. or A6.7.2.
- A6.23.3. Arrangement
- As specified in paragraph A6.5.3. or A6.7.3.
- A6.23.4. Position
- As specified in paragraph A6.5.4. or A6.7.4.
- A6.23.5. Geometric visibility
- As specified in paragraph A6.5.5. or A6.7.5.
- A6.23.6. Orientation
- As specified in paragraph A6.5.6. or A6.7.6.
- A6.23.7. Electrical connections
- A6.23.7.1. All the lamps of the emergency stop signal shall flash in phase at a frequency of 4.0 ± 1.0 Hz.
- A6.23.7.1.1. However, if any of the lamps of the emergency stop signal to the rear of the vehicle use filament light sources the frequency shall be $4.0 +0.0/-1.0$ Hz.
- A6.23.7.2. The emergency stop signal shall operate independently of other lamps.
- A6.23.7.3. The emergency stop signal shall be activated and deactivated automatically.
- A6.23.7.3.1. The emergency stop signal shall be activated only when the vehicle speed is above 50 km/h and the braking system is providing the emergency braking logic signal defined in Regulations Nos. 13 and 13-H.
- A6.23.7.3.2. The emergency stop signal shall be automatically deactivated if the emergency braking logic signal as defined in Regulations Nos. 13 and 13-H is no longer provided or if the hazard warning signal is activated.
- A6.23.8. Tell-tale
- Optional
- A6.23.9. Other requirements
- A6.23.9.1. Except as provided in paragraph A6.23.9.2., if a motor vehicle is equipped to tow a trailer, the control of the emergency stop signal on the motor vehicle shall also be capable of operating the emergency stop signal on the trailer.
- When the motor vehicle is electrically connected to a trailer, the operating frequency of the emergency stop signal for the combination shall be limited

to the frequency specified in paragraph A6.23.7.1.1. However, if the motor vehicle can detect that filament light sources are not being used on the trailer for the emergency stop signal, the frequency may be that specified in paragraph A6.23.7.1.

- A6.23.9.2. If a motor vehicle is equipped to tow a trailer fitted with a service braking system of either continuous or semi-continuous type, as defined in Regulation No.13, it shall be ensured that a constant power supply is provided via the electrical connector for the stop lamps to such trailers while the service brake is applied.

The emergency stop signal on any such trailer may operate independently of the towing vehicle and is not required to operate either at the same frequency as, or in phase with that on the towing vehicle.

- A6.24. Exterior courtesy lamp

- A6.24.1. Presence

Optional on motor vehicles

- A6.24.2. Number

Two, however further exterior courtesy lamps to illuminate steps and/or door handles are permitted. Each door handle or step shall be illuminated by not more than one lamp.

- A6.24.3. Arrangement

No special requirement, however the requirements of paragraph A6.24.9.3. apply.

- A6.24.4. Position

No special requirement.

- A6.24.5. Geometric visibility

No special requirement.

- A6.24.6. Orientation

No special requirement.

- A6.24.7. Electrical connections

No special requirement.

- A6.24.8. Tell-tale

No special requirement.

- A6.24.9. Other requirements

- A6.24.9.1. The exterior courtesy lamp shall not be activated unless the vehicle is stationary and one or more of the following conditions is satisfied:

- (a) The engine is stopped; or
- (b) A driver or passenger door is opened; or
- (c) A load compartment door is opened.

The provisions of paragraph A5.10. shall be met in all fixed positions of use.

A6.24.9.2. Approved lamps emitting white light with the exception of main beam head lamps, day time running lamps and reversing lamps may be activated as courtesy lamp function. They may also be activated together with the exterior courtesy lamps and the condition of paragraphs A5.11. and A5.12. may not apply.

A6.24.9.3. The technical service shall, to the satisfaction of the Type Approval Authority, perform a visual test to verify that there is no direct visibility of the apparent surface of the exterior courtesy lamps, if viewed by an observer moving on the boundary of a zone on a transverse plane 10 m from the front of the vehicle, a transverse plane 10 m from the rear of the vehicle , and two longitudinal planes 10 m from each side of the vehicle; these four planes to extend from 1 m to 3 m above and perpendicular to the ground as shown in Annex A12..

At the request of the applicant and with the consent of the Technical Service this requirement may be verified by a drawing or simulation.

A6.25. Rear-end collision alert signal

A6.25.1. Presence

Optional

The rear-end collision alert signal shall be given by the simultaneous operation of all the direction indicator lamps fitted as described in paragraph A6.25.7.

A6.25.2. Number

As specified in paragraph A6.5.2.

A6.25.3. Arrangement

As specified in paragraph A6.5.3.

A6.25.4. Position

As specified in paragraph A6.5.4.

A6.25.5. Geometric visibility

As specified in paragraph A6.5.5.

A6.25.6. Orientation

As specified in paragraph A6.5.6.

A6.25.7. Electrical connections. Compliance with these requirements shall be demonstrated by the applicant, by simulation or other means of verification accepted by the Technical Service responsible for type approval.

A6.25.7.1. All the lamps of the rear-end collision alert signal shall flash in phase at a frequency of 4.0 +/- 1.0 Hz.

A6.25.7.1.1. However, if any of the lamps of the rear end collision alert signal to the rear of the vehicle use filament light sources the frequency shall be 4.0 +0.0/-1.0 Hz.

A6.25.7.2. The rear-end collision alert signal shall operate independently of other lamps.

A6.25.7.3. The rear-end collision alert signal shall be activated and deactivated automatically.

A6.25.7.4. The rear-end collision alert signal shall not be activated if the direction indicator lamps, the hazard warning signal or the emergency stop signal is activated.

A6.25.7.5. The rear-end collision alert signal may only be activated under the following conditions:

| <i>V_r</i> | <i>activation</i> |
|----------------------------|--------------------------------|
| $V_r > 30 \text{ km/h}$ | $TTC \leq 1.4$ |
| $V_r \leq 30 \text{ km/h}$ | $TTC \leq 1.4 / 30 \times V_r$ |

"*V_r* (Relative Speed)": means the difference in speed between a vehicle with rear-end collision alert signal and a following vehicle in the same lane.

"TTC (Time to collision)": means the estimated time for a vehicle with rear-end collision alert signal and a following vehicle to collide assuming the relative speed at the time of estimation remains constant.

A6.25.7.6. The activation period of the rear-end collision alert signal shall be not more than 3 seconds.

A6.25.8. Tell-tale
Optional

A6.26. Manoeuvring lamps (Regulation No. 23)

A6.26.1. Presence
Optional on motor vehicles.

A6.26.2. Number
One or two (one per side)

A6.26.3. Arrangement
No special requirement, however the requirements of paragraph A6.26.9. apply.

A6.26.4. Position
No special requirement.

A6.26.5. Geometric Visibility
No special requirement.

A6.26.6. Orientation
Downwards, however the requirements of paragraph A6.26.9. apply.

A6.26.7. Electrical Connections
Manoeuvring lamps shall be so connected that they cannot be activated unless the main-beam headlamps or the dipped-beam headlamps are switched ON at the same time.

The manoeuvring lamp(s) shall be activated automatically for slow manoeuvres up to 10 km/h provided that one of the following conditions is fulfilled:

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- (a) Prior to the vehicle being set in motion for the first time after each manual activation of the propulsion system; or
 - (b) Reverse gear is engaged; or
 - (c) A camera based system which assists parking manoeuvres is activated

The manoeuvring lamps shall be automatically switched off if the forward speed of the vehicle exceeds 10 km/h and they shall remain switched off until the conditions for activation are met again.

A6.26.8. Tell-tale

No special requirement.

A6.26.9. Other requirements

A6.26.9.1. The Technical Service shall, to the satisfaction of the Type Approval Authority, perform a visual test to verify that there is no direct visibility of the apparent surface of these lamps, if viewed by an observer moving on the boundary of a zone on a transverse plane 10 m from the front of the vehicle, a transverse plane 10 m from the rear of the vehicle, and two longitudinal planes 10 m from each side of the vehicle; these four planes to extend from 1 m to 3 m above and parallel to the ground as shown in Annex A12..

A6.26.9.2. At the request of the applicant and with the consent of the Technical Service the requirement of A6.26.9.1 may be verified by a drawing or simulation or deemed to be satisfied if the installation conditions comply with paragraph 6.2.3 of Regulation No. 23, as noticed in the communication document in Annex A1, paragraph 9..

A7. Modifications and extensions of approval of the vehicle type or of the installation of its lighting and light-signalling devices

Paragraph B10 shall apply.

A8. Conformity of production

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2), with the following requirements:

A8.1. Any vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set out in paragraphs A4., A5. and A6..

A8.2. The holder of the approval shall in particular:

A8.2.1. Ensure existence of procedures for effective quality control of the vehicle as regards all aspects relevant to compliance with the requirements set out in paragraphs A4. A5. and A6.;

A8.2.2. Ensure that for each type of vehicle at least the tests prescribed in Annex A1 or physical checks from which equivalent data may be derived are carried out;

A8.3. The Type Approval Authority may carry out any test prescribed in this Regulation. These tests will be on samples selected at random without causing distortion of the manufacturers delivery commitments.

A8.4. The Type Approval Authority shall strive to obtain a frequency of inspection of once per year. However, this is at the discretion of the Type Approval Authority and their confidence in the arrangements for ensuring effective control of the conformity of production. In the case where negative results are recorded, the Type Approval Authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

A9. Penalties for non-conformity of production

Paragraph B12 shall apply.

A10. Production definitively discontinued

Paragraph B13 shall apply.

A11. Names and addresses of Technical Services responsible for conducting approval tests and of Type Approval Authorities

Paragraph B14 shall apply.

A12. Transitional provisions

A12.1 General

A12.1.1. As from the official date of entry into force of the most recent series of amendments, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by this most recent series of amendments.

A12.1.2. As from the official date of entry into force of the most recent series of amendments, no Contracting Party applying this Regulation shall refuse national or regional type approval to a vehicle type approved under this Regulation as amended by this most recent series of amendments.

A12.1.3. During the time period from the official date of entry into force of the most recent series of amendments and its mandatory application to new type approvals, Contracting Parties applying this Regulation shall continue to grant approvals to those types of vehicles which comply with the requirements of this Regulation as amended by all the applicable preceding series of amendments.

A12.1.4. Existing approvals under this Regulation granted before the date of mandatory application of the most recent series of amendment shall remain valid indefinitely and Contracting Parties applying this Regulation shall

continue to recognize them and shall not refuse to grant extensions of approvals to them (except for what indicated in paragraph A12.1.5.).

- A12.1.5. When the vehicle type approved to any of the preceding series of amendments meets the requirements of this Regulation as amended by the most recent series of amendments, the Contracting Party which granted the approval shall notify the other Contracting Parties applying this Regulation thereof.
- A12.1.6. Notwithstanding paragraph A12.1.4., Contracting Parties whose application of this Regulation comes into force after the date of entry into force of the most recent series of amendments are not obliged to accept approvals which were granted in accordance with any of the preceding series of amendments to this Regulation.
- A12.1.7. Until the United Nations Secretary-General is notified otherwise, Japan declares that in relation to the installation of lighting and light signalling devices, Japan will only be bound by the obligations of the Agreement to which this Regulation is annexed with respect to vehicles of categories M₁ and N₁.
- A12.2. Transitional provisions applicable to 03 series of amendments.
Contracting Parties applying this Regulation:
- (a) From 10 October 2007 (12 months after the date of entry into force), shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 03 series of amendments;
 - (b) Up to 09 October 2009 (36 months after the date of entry into force) shall not refuse national or regional type approval of a vehicle type approved to any of the preceding series of amendments to this Regulation.
 - (c) From 10 October 2009 (36 months after the entry into force) may refuse first national or regional entry into service of a vehicle of categories N₂ (with a maximum mass exceeding 7.5 tonnes), N₃, O₃ and O₄ exceeding 2,100 mm in width (for rear markings) and exceeding 6,000 mm in length (for side markings), except tractors for semi-trailers and incomplete vehicles, which do not meet the requirements of the 03 series of amendments to this Regulation.
 - (d) Notwithstanding paragraph 12.1.4., from 10 October 2011 (60 months after the date of entry into force) shall no more recognize approvals to this Regulation granted to type of vehicles of categories N₂ (with a maximum mass exceeding 7.5 tons), N₃, O₃ and O₄ exceeding 2,100 mm in width (for rear markings) and exceeding 6,000 mm in length (for side markings), except tractors for semi-trailers and incomplete vehicle, under any preceding series of amendment, that ceases to be valid.
 - (e) From 12 June 2010 (36 months from the entry into force of Supplement 3 to the 03 series of amendments) shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by Supplement 3 to the 03 series of amendments.
 - (f) Up to 11 January 2010 (18 months after the official date of entry into force of Supplement 4 to the 03 series of amendments) shall continue to grant approvals to new vehicle types which do not meet the

requirements on vertical orientation of front fog lamps (paragraph A6.3.6.1.1.) and/or on direction indicator operating tell-tale (paragraph A6.5.8.) and/or on daytime running lamps switching off (paragraph A6.19.7.3.).

- (g) Up to 10 October 2011 (60 month after the official date of entry into force) shall continue to grant approvals to new vehicle types which do not meet the requirements on cumulative length of conspicuity markings (paragraph A6.21.4.1.3.).¹⁴

A12.3. Transitional provisions applicable to 04 series of amendments.

Contracting Parties applying this Regulation:

- (a) From 07 February 2011 for vehicles of categories M₁ and N₁, and from 07 August 2012 for vehicles of other categories (respectively 30 and 48 months after the official date of entry into force) shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 04 series of amendments.
- (b) After 22 July 2009 (date of entry into force of Supplement 2 to the 04 series of amendments) shall continue to grant approvals to vehicle types which do not meet the requirements of paragraph 5.2.1. as amended by the Supplement 2 to 04 series of amendments if they are fitted with headlamps approved to Regulation No. 98 (prior to Supplement 9) or Regulation No. 112 (prior to Supplement 8).
- (c) From 24 October 2012 (36 months from the entry into force of Supplement 3 to the 04 series of amendments) shall grant approvals only if the vehicle type to be approved meets the requirements on voltage limitation of paragraphs A3.2.7. and A5.27 to A5.27.4. of this Regulation as amended by Supplement 3 to the 04 series of amendments.
- (d) Up to 07 February 2011 for vehicles of categories M₁ and N₁ and to 07 August 2012 for vehicles of other categories (respectively 30 and 48 months after the official date of entry into force of Supplement 2 to the 04 series of amendments) shall continue to grant approvals to new vehicle types which do not meet the requirements on switching OFF of daytime running lamps reciprocally incorporated with front direction indicator lamps (paragraph A6.19.7.6.).

A12.3.1. Notwithstanding the transitional provisions above, Contracting Parties whose application of Regulation No. 112 comes into force after 07 August 2008 (date of entry into force of the 04 series of amendments to the present Regulation) are not obliged to accept approvals if the vehicle type to be approved does not meet the requirements of paragraph A 6.1.2. and A6.2.2. of this Regulation as amended by the 04 series of amendments to this Regulation with regard to Regulation No. 112.

A12.4. Transitional provisions applicable to 05 series of amendments.

Contracting Parties applying this Regulation:

¹⁴ Note by the secretariat: for paragraph A6.21.4.1.3., please refer to the text of the 03 series of amendments as contained in document E/ECE/324/Rev.1/Add.47/Rev.6 - E/ECE/TRANS/505/Rev.1/Add.47/Rev.6

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- (a) From 30 January 2015 (48 months from the official date of entry into force) shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 05 series of amendments.
 - (b) Until 30 July 2016 for new vehicles types of categories M₁ and N₁ and until 30 January 2018 for new vehicle types of other categories (respectively 66 and 84 months after the official date of entry into force) shall grant approvals if the new vehicle type to be approved meets the requirements of one or more of paragraphs A6.2.7.6.2. or A6.2.7.6.3. to A6.2.7.6.3.3. instead of those of paragraph A6.2.7.6.1. of this Regulation as amended by the 05 series of amendments.

A12.5. Transitional provisions applicable to 06 series of amendments.

Contracting Parties applying this Regulation:

From 18 November 2017 (60 month after the date of entry into force) shall grant approvals only if the vehicle type to be approved meets the requirements of this Regulation as amended by the 06 series of amendments.

Annex A1

Communication

(maximum format: A4 (210 x 297 mm))

issued by: Name of administration:

.....
.....
.....



concerning: ² Approval granted
Approval extended
Approval refused
Approval withdrawn
Production definitively discontinued

of a type of vehicle with regard to the installation of lighting and light- signalling devices,
pursuant to Regulation No. 48.

Approval No.: Extension No.:

1. Trade name or mark of the vehicle:
2. Manufacturer's name for the type of vehicle:
3. Manufacturer's name and address:
4. If applicable, name and address of the manufacturer's representative:
.....
5. Submitted for approval on:
6. Technical Service responsible for conducting approval tests:
.....
7. Date of test report:
8. Number of test report:

¹ Distinguishing number of the country which has granted/refused/withdrawn approval (see approval provisions in the Regulation).

² Strike out which does not apply.

| | | |
|---------|---|---|
| 9. | Concise description: | |
| | Lighting and light-signalling devices on the vehicle: | |
| 9.1. | Main-beam headlamps: | yes/no ² |
| 9.2. | Dipped-beam headlamps: | yes/no ² |
| 9.3. | Front-fog lamps: | yes/no ² |
| 9.4. | Reversing lamps: | yes/no ² |
| 9.5. | Front direction-indicators: | yes/no ² |
| 9.6. | Rear direction-indicators: | yes/no ² |
| 9.7. | Side direction-indicators: | yes/no ² |
| 9.8. | Hazard warning signal: | yes/no ² |
| 9.9. | Stop-lamps: | yes/no ² |
| 9.10. | Rear registration plate illuminating device: | yes/no ² |
| 9.11. | Front position lamps: | yes/no ² |
| 9.12. | Rear position lamps: | yes/no ² |
| 9.13. | Rear fog-lamps: | yes/no ² |
| 9.14. | Parking lamps: | yes/ no ² |
| 9.15. | End-outline marker lamps: | yes/no ² |
| 9.16. | Rear retro-reflectors, non-triangular: | yes/no ² |
| 9.17. | Rear retro-reflectors, triangular: | yes/no ² |
| 9.18. | Front retro-reflectors, non-triangular: | yes/no ² |
| 9.19. | Side retro-reflectors, non-triangular: | yes/no ² |
| 9.20. | Side marker lamps: | yes/no ² |
| 9.21. | Daytime running lamps: | yes/no ² |
| 9.22. | Adaptive front lighting system (AFS): | yes/no ² |
| 9.23. | Cornering lamps: | yes/no ² |
| 9.24. | Conspicuity markings: | Rear Side |
| 9.24.1. | Full contour markings: | yes/no ² yes/no ² |
| 9.24.2. | Partial contour markings: | yes/no ² yes/no ² |
| 9.24.3. | Line markings: | yes/no ² yes/no ² |

-
- 9.24.4. Exemption regarding conspicuity marking according to paragraph 6.21.1.2.5.
- Rear
yes/no²
Comments:
- Side
yes/no²
Comments
- 9.25. Emergency stop signal: yes/no²
- 9.26. Manoeuvring lamps: yes/no²
- 9.27. Exterior courtesy lamps: yes/no²
- 9.28. Equivalent lamps: yes/no²
- 9.29. Maximum permissible load in the boot:
10. Comments:
- 10.1. Any comments on movable components:
.....
- 10.2. Method used for the definition of the apparent surface:
(a) Boundary of the illuminating surface² or
(b) Light-emitting surface²
- 10.3. Other comments (valid for right-hand or left-hand drive vehicles):
- 10.4. Comments concerning AFS (according to paragraphs A3.2.6. and A6.22.7.4.):
- 10.5. Comments regarding the extent of coverage of the conspicuity marking if it is less than the minimum value of 70 per cent required by paragraphs A6.21.4.1.2. and A6.21.4.2.2..
- 10.6. For vehicles of M and N categories comments regarding the electrical supply conditions (according to paragraphs A3.2.7 and A5.27).
- 10.7. Comments regarding conspicuity marking (according to paragraphs A6.21.1.2.5. and A6.21.4.3.1.)
- 10.8. Comments regarding conspicuity marking (Incomplete vehicle or Complete Vehicles according to paragraphs A6.21.1.2.1. and A6.21.1.2.1.1.):
- Incomplete vehicles: yes/no²
- Complete vehicles: yes/no²
- Completed vehicles: yes/no²
11. Position of the approval mark:

-
12. Reason(s) for extension (if applicable):.....
 13. Approval granted/extended/refused/withdrawn²
 14. Place:
 15. Date:
 16. Signature:.....
 17. The following documents, bearing the approval number shown above, are available on request:
 -

Annex A2

Control of conformity of production

1. Tests
 - 1.1. Position of lamps

The position of lamps, as defined in paragraphs **B2.4. to 2.6.**, in width, in height and in length shall be checked in accordance with the **definitions** set out in paragraphs **B2.3.17. to B2.3.20., and B2.3.12. to B2.3.15.** and the **general requirement set out in paragraph A5.4.**

The values measured for the distances shall be such that the individual requirements applicable to each lamp are fulfilled.
 - 1.2. Visibility of lamps
 - 1.2.1. The angles of geometric visibility shall be checked in accordance with paragraph **B2.3.11.**
 - 1.2.2. The visibility of red light towards the front and of white light towards the rear shall be checked in accordance with paragraph A5.10..
 - 1.3. Alignment of dipped-beam headlamps and class "F3" front fog lamps towards the front
 - 1.3.1. Initial downward inclination

The initial downward inclination of the cut-off of the dipped-beam and the class "F3" front fog lamps shall be set to the plated figure as required and shown in Annex A7..

Alternatively the manufacturer shall set the initial aim to a figure that is different from the plated figure where it can be shown to be representative of the type approved when tested in accordance with the procedures contained in Annex A6 and in particular paragraph 4.1.
 - 1.3.2. Variation of inclination with load

The variation of the dipped-beam downward inclination as a function of the loading conditions specified within this section shall remain within the range:

| | |
|------------------------------|---|
| 0.2 per cent to 2.8 per cent | for headlamp mounting height $h < 0.8$; |
| 0.2 per cent to 2.8 per cent | for headlamp mounting height $0.8 \leq h \leq 1.0$; or |
| 0.7 per cent to 3.3 per cent | (according to the aiming range chosen by the manufacturer at the approval); |
| 0.7 per cent to 3.3 per cent | for headlamp mounting height $1.0 < h \leq 1.2$ m; |
| 1.2 per cent to 3.8 per cent | for headlamp mounting height $h > 1.2$ m. |

In the case of a class "F3" front fog lamp with (a) light source(s) having a total objective luminous flux which exceeds 2,000 lumens, the variation of the downward inclination as a function of the loading conditions specified within this section shall remain within the range:

0.7 per cent to 3.3 per cent for front fog lamp mounting height $h \leq 0.8$;

1.2 per cent to 3.8 per cent for front fog lamp mounting height $h > 0.8$ m.

The states of loading to be used shall be as follows, as indicated in Annex A5, for every system adjusted accordingly.

1.3.2.1. Vehicles in category M_1 :

Paragraph 2.1.1.1.

Paragraph 2.1.1.6. taking into account

Paragraph 2.1.2.

1.3.2.2. Vehicles in category M_2 and M_3 :

Paragraph 2.2.1.

Paragraph 2.2.2.

1.3.2.3. Vehicles in category N with load surfaces:

Paragraph 2.3.1.1.

Paragraph 2.3.1.2.

1.3.2.4. Vehicles in category N without load surfaces:

1.3.2.4.1. Drawing vehicles for semi-trailers:

Paragraph 2.4.1.1.

Paragraph 2.4.1.2.

1.3.2.4.2. Drawing vehicles for trailers:

Paragraph 2.4.2.1.

Paragraph 2.4.2.2.

1.4. Electrical connections and tell-tales

The electrical connections shall be checked by switching on every lamp supplied by the electrical system of the vehicle.

The lamps and tell-tales shall function in accordance with the provisions set out in paragraphs A5.11. to A5.14. and with the individual requirements applicable to each lamp.

1.5. Light intensities

1.5.1. Main-beam headlamps

The aggregate maximum intensity of the main beam headlamps shall be checked by the procedure described in paragraph A6.1.9.2.. The value obtained shall be such that the requirement in paragraph A6.1.9.1. is fulfilled.

-
- 1.6. The presence, number, colour, arrangement and, where applicable, the category of lamps shall be checked by visual inspection of the lamps and their markings.

These shall be such that the requirements set out in paragraphs A5.15. and A5.16. as well as in the individual requirements applicable to each lamp are fulfilled.

Annex A3

Test drive

1. Test drive requirements for the automatic control of the main-beam headlamps
 - 1.1. The test drive shall be carried out in clear atmosphere¹ and with clean headlamps
 - 1.2. The test course shall comprise test sections with traffic conditions, at speed corresponding to the relevant type of road, as described in Table 1 below:

Table 1

| | | Road type | | |
|--------------|--|--------------|--------------------------------|--------------|
| | | Urban areas | Multi-lane road, e.g. motorway | Country road |
| Test Section | Traffic conditions | | | |
| | Speed | 50 ± 10 km/h | 100 ± 20 km/h | 80 ± 20 km/h |
| | Average percentage of the full test course length | 10 per cent | 20 per cent | 70 per cent |
| A | Single oncoming vehicle or single preceding vehicle in a frequency so that the main beam will switch ON and OFF. | | X | X |
| B | Combined oncoming and preceding traffic situations, in a frequency so that the main beam will switch ON and OFF. | | X | X |
| C | Active and passive overtaking manoeuvres, in a frequency so that the main beam will switch ON and OFF. | | X | X |
| D | Oncoming bicycle, as described in paragraph A6.1.9.3.1.2. | | | X |
| E | Combined oncoming and preceding traffic situations | X | | |

¹ Good visibility (meteorological optical range MOR > 2,000 m defined according to WMO, Guide to Meteorological Instruments and Methods of Observation, Sixth Edition, ISBN: 92-63-16008-2, pp 1.9. 1/ 1. 9. 11, Geneva 1996).

- 1.3. Urban areas shall comprise roads with and without illumination.
- 1.4. Country roads shall comprise sections having two lanes and sections having four or more lanes and shall include junctions, hills and/or slopes, dips and winding roads.
- 1.5. Multi-lane roads (e.g. motorways) and country roads shall comprise sections having straight level parts with a length of more than 600 m. Additionally they shall comprise sections having curves to the left and to the right.
- 1.6. Dense traffic situations shall be taken into account."
2. Test drive requirements for adaptive main-beam headlamps
- 2.1. The test drive shall be carried out in clear atmosphere² and with clean headlamps.
- 2.2. The test course shall comprise test sections with traffic conditions, at speed corresponding to the relevant type of road, as described in Table 2 below:

Table 2

| | | <i>Road type</i> | | |
|---------------------|---|--------------------|---------------------------------------|---------------------|
| | | <i>Urban areas</i> | <i>Multi-lane road, e.g. motorway</i> | <i>Country road</i> |
| <i>Test Section</i> | <i>Traffic conditions</i> | | | |
| | <i>Speed</i> | <i>50 ± 10km/h</i> | <i>100 ± 20km/h</i> | <i>80 ± 20km/h</i> |
| | <i>Average percentage of the full test course length</i> | <i>10 per cent</i> | <i>20 per cent</i> | <i>70 per cent</i> |
| A | Single oncoming vehicle or single preceding vehicle in a frequency so that the adaptive main beam will react to demonstrate the adaptation process. | | X | X |
| B | Combined oncoming and preceding traffic situations. in a frequency so that the adaptive main beam will react to demonstrate the adaptation process. | | X | X |
| C | Active and passive overtaking manoeuvres, in a frequency so that the adaptive main beam will react to demonstrate the adaptation process. | | X | X |
| D | Oncoming bicycle, as described in paragraph 6.22.9.3.1.2. | | | X |
| E | Combined oncoming and preceding traffic situations | X | | |

² Good visibility (meteorological optical range MOR > 2,000 m defined according to WMO, Guide to Meteorological Instruments and Methods of Observation, Sixth Edition, ISBN: 92-63-16008-2, pp 1. 9. 1/ 1. 9. 11, Geneva 1996)

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- 2.3. Urban areas shall comprise roads with and without illumination.
 - 2.4. Country roads shall comprise sections having two lanes and sections having four or more lanes and shall include junctions, hills and/or slopes, dips and winding roads.
 - 2.5. Multi lane roads (e.g. motorways) and country roads shall comprise sections having straight level parts with a length of more than 600 m. Additionally they shall comprise of sections having curves to the left and to the right.
 - 2.6. Dense traffic situations shall be taken into account
 - 2.7. For the test sections A and B in the table above the engineers conducting the tests shall evaluate and record the acceptability of the performance of the adaptation process in relation to oncoming and preceding road users. This means that the test engineers shall be seated in the vehicle being tested and additionally be seated in the oncoming and preceding vehicles.

Annex A4

Automatic switching conditions dipped-beam headlamps

| <i>Automatic switching conditions dipped-beam headlamps¹</i> | | |
|---|------------------------------|---|
| Ambient light outside the vehicle ² | Dipped-beam headlamps | Response time |
| less than 1,000 lux | ON | no more than 2 seconds |
| between 1,000 lux and 7,000 lux | at manufacturer's discretion | at manufacturer's discretion |
| more than 7,000 lux | OFF | more than 5 seconds, but no more than 300 seconds |

¹ Compliance with these conditions shall be demonstrated by the applicant, by simulation or other means of verification accepted by the Type Approval Authority.

² The illuminance shall be measured on a horizontal surface, with a cosine corrected sensor on the same height as the mounting position of the sensor on the vehicle. This may be demonstrated by the manufacturer by sufficient documentation or by other means accepted by the Type Approval Authority.

Annex A5

States of loading to be taken into consideration in determining variations in the vertical orientation of the dipped-beam headlamps

Loading conditions on axles referred to in paragraphs A6.2.6.1. and A6.2.6.3.1.

1. For the following tests, the mass of the passengers shall be calculated on the basis of 75 kg per person.
2. Loading conditions for different types of vehicles:
 - 2.1. Vehicles in category M_1 :¹
 - 2.1.1. The angle of the light beam of the dipped-beam headlamps shall be determined under the following load conditions:
 - 2.1.1.1. One person in the driver's seat;
 - 2.1.1.2. The driver, plus one passenger in the front seat farthest from the driver;
 - 2.1.1.3. The driver, one passenger in the front seat farthest from the driver, all the seats farthest to the rear occupied;
 - 2.1.1.4. All the seats occupied;
 - 2.1.1.5. All the seats occupied, plus an evenly distributed load in the luggage boot, in order to obtain the permissible load on the rear axle or on the front axle if the boot is at the front. If the vehicle has a front and a rear boot, the additional load shall be appropriately distributed in order to obtain the permissible axle loads. However, if the maximum permissible laden mass is obtained before the permissible load on one of the axles, the loading of the boot(s) shall be limited to the figure which enables that mass to be reached;
 - 2.1.1.6. Driver, plus an evenly distributed load in the boot, in order to obtain the permissible load on the corresponding axle.

However, if the maximum permissible laden mass is obtained before the permissible load on the axle, the loading of the boot(s) shall be limited to the figure which enables that mass to be reached.
 - 2.1.2. In determining the above loading conditions, account shall be taken of any loading restrictions laid down by the manufacturer.
 - 2.2. Vehicles in categories M_2 and M_3 :¹

The angle of the light beam from the dipped-beam headlamps shall be determined under the following loading conditions:
 - 2.2.1. Vehicle unladen and one person in the driver's seat;

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.3, para. 2 - www.unece.org/trans/main/wp29/wgs/wp29gen/wp29resolutions.html

-
- 2.2.2. Vehicles laden such that each axle carries its maximum technically permissible load or until the maximum permissible mass of the vehicle is attained by loading the front and rear axles proportionally to their maximum technically permissible loads, whichever occurs first.
 - 2.3. Vehicles in category N with load surfaces:
 - 2.3.1. The angle of the light beam from the dipped-beam headlamps shall be determined under the following loading conditions:
 - 2.3.1.1. Vehicle unladen and one person in the driver's seat;
 - 2.3.1.2. Driver, plus a load so distributed as to give the maximum technically permissible load on the rear axle or axles, or the maximum permissible mass of the vehicle, whichever occurs first, without exceeding a front axle load calculated as the sum of the front axle load of the unladen vehicle plus 25 per cent of the maximum permissible payload on the front axle. Conversely, the front axle is so considered when the load platform is at the front.
 - 2.4. Vehicles in category N without a load surface:
 - 2.4.1. Drawing vehicles for semi-trailers:
 - 2.4.1.1. Unladen vehicle without a load on the coupling attachment and one person in the driver's seat;
 - 2.4.1.2. One person in the driver's seat: technically permissible load on the coupling attachment in the position of the attachment corresponding to the highest load on the rear axle.
 - 2.4.2. Drawing vehicles for trailers:
 - 2.4.2.1. Vehicle unladen and one person in the driver's seat;
 - 2.4.2.2. One person in the driver's seat, all the other places in the driving cabin being occupied.

Annex A6

Measurement of the variation of dipped-beam inclination as a function of load

1. Scope

This annex specifies a method for measuring variations in motor vehicle dipped-beam inclination, in relation to its initial inclination, caused by changes in vehicle attitude due to loading.

2. Definitions

2.1. Initial inclination

2.1.1. Stated initial inclination

The value of the dipped-beam initial inclination specified by the motor vehicle manufacturer serving as a reference value for the calculation of permissible variations.

2.1.2. Measured initial inclination

The mean value of dipped-beam inclination or vehicle inclination measured with the vehicle in condition No. 1, as defined in Annex A5, for the category of vehicle under test. It serves as a reference value for the assessment of variations in beam inclination as the load varies.

2.2. Dipped-beam inclination

It may be defined as follows:

Either as the angle, expressed in milliradians, between the direction of the beam towards a characteristic point on the horizontal part of the cut-off in the luminous distribution of the headlamp and the horizontal plane,

Or by the tangent of that angle, expressed in percentage inclination, since the angles are small (for these small angles, 1 per cent is equal to 10 mrad).

If the inclination is expressed in percentage inclination, it can be calculated by means of the following formula:

$$\frac{(h_1 - h_2)}{L} \times 100$$

where:

h_1 is the height above the ground, in millimetres, of the above-mentioned characteristic point, measured on a vertical screen perpendicular to the vehicle longitudinal median plane, placed at a horizontal distance L .

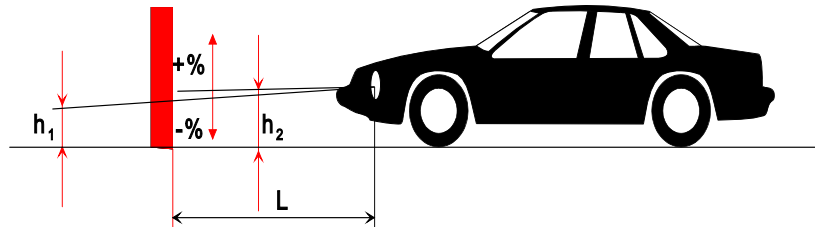
h_2 is the height above the ground, in millimetres, of the centre of reference (which is taken to be the nominal origin of the characteristic point chosen in h_1):

L is the distance, in millimetres, from the screen to the centre of reference.

Negative values denote downward inclination (see Figure 1).

Positive values denote upward inclination.

Figure 1
Dipped-beam downward inclination of a category M₁ vehicle



Notes:

1. This drawing represents a category M₁ vehicle, but the principle shown applies equally to vehicles of other categories.
2. Where the vehicle does not incorporate a headlamp levelling system, the variation in dipped-beam inclination is identical with the variation in the inclination of the vehicle itself.
3. Measurement conditions
 - 3.1. If a visual inspection of the dipped-beam pattern on the screen or a photometric method is used, measurement shall be carried out in a dark environment (for example, a dark room) of sufficient area to allow the vehicle and the screen to be placed as shown in Figure 1. Headlamp centres of reference shall be at a distance from the screen of at least 10 m.
 - 3.2. The ground on which measurements are made shall be as flat and horizontal as possible, so that the reproducibility of measurements of dipped-beam inclination can be assured with an accuracy of $\nabla 0.5$ mrad (± 0.05 per cent inclination).
 - 3.3. If a screen is used, its marking, position and orientation in relation to the ground and to the median longitudinal plane of the vehicle, shall be such that the reproducibility of the measurement of the dipped-beam inclination can be assured with an accuracy of $\nabla 0.5$ mrad ($\nabla 0.05$ per cent inclination).
 - 3.4. During measurements, the ambient temperature shall be between 10 and 30 °C.
4. Vehicle preparation
 - 4.1. Measurements shall be carried out on a vehicle which has travelled a distance of between 1,000 km and 10,000 km, preferably 5,000 km.
 - 4.2. Tyres shall be inflated to the full-load pressure specified by the vehicle manufacturer. The vehicle shall be fully replenished (fuel, water, oil) and equipped with all the accessories and tools specified by the manufacturer. Full fuel replenishment means that the fuel tank shall be filled to not less than 90 per cent of its capacity.
 - 4.3. The vehicle shall have the parking brake released and the gearbox in neutral.

-
- 4.4. The vehicle shall be conditioned for at least 8 h at the temperature specified in paragraph 3.4..
- 4.5. If a photometric or visual method is used, headlamps with a well- defined dipped-beam cut-off should preferably be installed on the vehicle under test in order to facilitate the measurements. Other means are allowed to obtain a more precise reading (for example, removal of the headlamp lens).
5. Test procedure
- 5.1. General
- The variations in either dipped-beam or vehicle inclination, depending on the method chosen, shall be measured separately for each side of the vehicle. The results obtained from both left and right headlamps under all the load conditions specified in Annex A5 shall be within the limits set out in paragraph 5.5.. The load shall be applied gradually without subjecting the vehicle to excessive shocks.
- 5.1.1. Where an AFS is fitted, the measurements shall be carried out with the AFS in its neutral state.
- 5.2. Determination of the measured initial inclination
- The vehicle shall be prepared as specified in paragraph 4. and laden as specified in Annex A5. (first loading condition of the respective vehicle category). Before each measurement, the vehicle shall be rocked as specified in paragraph 5.4.. Measurements shall be made three times.
- 5.2.1. If none of the three measured results differ by more than 2 mrad (0.2 per cent inclination) from the arithmetic mean of the results, that mean shall constitute the final result.
- 5.2.2. If any measurement differs from the arithmetic mean of the results by more than 2 mrad (0.2 per cent inclination), a further series of 10 measurements shall be made, the arithmetic mean of which shall constitute the final result.
- 5.3. Measurement methods
- Any method may be used to measure variations of inclination provided that the readings are accurate to within ± 0.2 mrad (± 0.02 per cent inclination).
- 5.4. Treatment of vehicle in each loading condition
- The vehicle suspension and any other part likely to affect dipped-beam inclination shall be activated according to the methods described below.
- However, the technical authorities and manufacturers may jointly propose other methods (either experimental or based upon calculations), especially when the test poses particular problems, provided such calculations are clearly valid.
- 5.4.1. M_1 category vehicles with conventional suspension
- With the vehicle standing on the measuring site and, if necessary, with the wheels resting on floating platforms (which shall be used if their absence would lead to restriction of the suspension movement likely to affect the results of measurements), rock the vehicle continuously for at least three complete cycles, for each cycle, first the rear and then the front end of the vehicle is pushed down.

The rocking sequence shall end with the completion of a cycle. Before making the measurements, the vehicle shall be allowed to come to rest spontaneously. Instead of using floating platforms, the same effect can be achieved by moving the vehicle backwards and forwards for at least a complete wheel revolution.

- 5.4.2. M₂, M₃ and N category vehicles with conventional suspension
 - 5.4.2.1. If the treatment method for category M₁ vehicles described in paragraph 5.4.1. is not possible, the method described in paragraphs 5.4.2.2. or 5.4.2.3. may be used.
 - 5.4.2.2. With the vehicle standing on the measuring site and the wheels on the ground, rock the vehicle by temporarily varying the load.
 - 5.4.2.3. With the vehicle standing on the measuring site and the wheels on the ground, activate the vehicle suspension and all other parts which may affect the dipped-beam inclination by using a vibration rig. This can be a vibrating platform on which the wheels rest.
- 5.4.3. Vehicles with non-conventional suspension, where the engine has to be running.

Before making any measurement wait until the vehicle has assumed its final attitude with the engine running.
- 5.5. Measurements

The variation of the inclination of the dipped-beam shall be assessed for each of the different loading conditions in relation to the measured initial inclination determined in accordance with paragraph 5.2..

If the vehicle is fitted with a manual headlamp-levelling system, the latter shall be adjusted to the positions specified by the manufacturer for given loading conditions (according to Annex A5.).

 - 5.5.1. To begin with, a single measurement shall be made in each loading condition. Requirements have been met if, for all the loading conditions, the variation in inclination is within the calculated limits (for example, within the difference between the stated initial inclination and the lower and upper limits specified for approval) with a safety margin of 4 mrad (0.4 per cent inclination).
 - 5.5.2. If the result(s) of any measurement(s) does (do) not lie within the safety margin indicated in paragraph 5.5.1. or exceed(s) the limit values, a further three measurements shall be made in the loading conditions corresponding to this (these) result(s) as specified in paragraph 5.5.3.
 - 5.5.3. For each of the above loading conditions:
 - 5.5.3.1. If none of the three measured results differs by more than 2 mrad (0.2 per cent inclination) from the arithmetic mean of the results, that mean shall constitute the final result.
 - 5.5.3.2. If any measurement differs from the arithmetic mean of the results by more than 2 mrad (0.2 per cent inclination), a further series of 10 measurements shall be made, the arithmetic mean of which shall constitute the final result.
 - 5.5.3.3. If a vehicle is fitted with an automatic headlamp-levelling system which has an inherent hysteresis loop, average results at the top and bottom of the hysteresis loop shall be taken as significant values.

All these measurements shall be made in accordance with paragraphs 5.5.3.1. and 5.5.3.2.

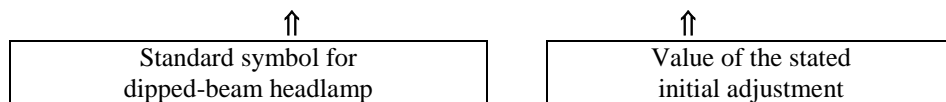
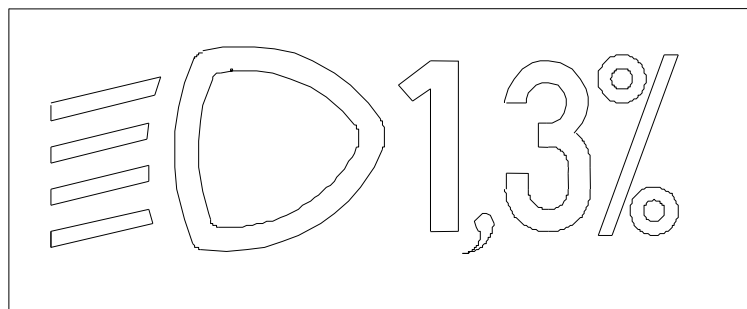
- 5.5.4. Requirements have been met, if, under all loading conditions, the variation between the measured initial inclination determined in accordance with paragraph 5.2. and the inclination measured under each loading condition is less than the values calculated in paragraph 5.5.1. (without safety margin).
- 5.5.5. If only one of the calculated upper or lower limits of variation is exceeded, the manufacturer shall be permitted to choose a different value for the stated initial inclination, within the limits specified for approval.

Annex A7

Indication of the downward inclination of the dipped-beam headlamps cut-off referred to in paragraph A6.2.6.1.1. and downward inclination of the front fog lamp cut-off referred to in paragraph A6.3.6.1.2. .

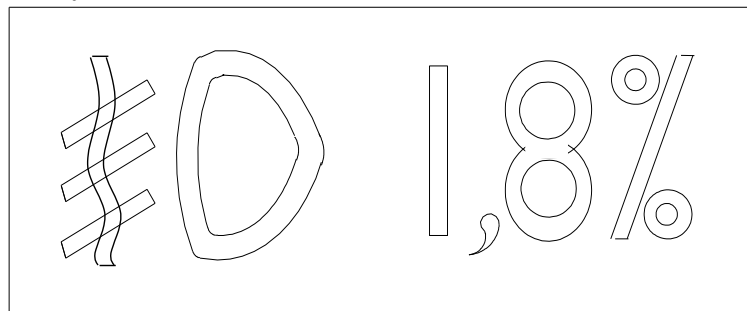
Example 1

The size of the symbol and characters is left to the discretion of the manufacturer.



Example 2

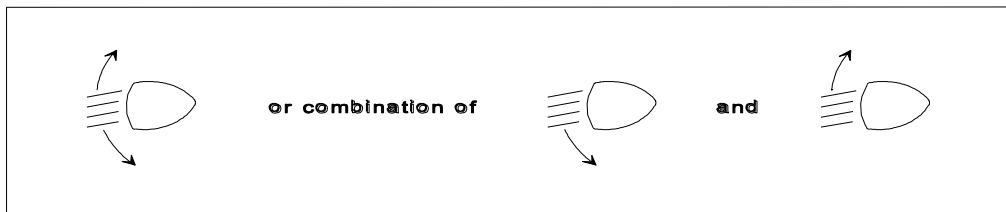
The size of the symbol and characters is left to the discretion of the manufacturer.



Annex A8

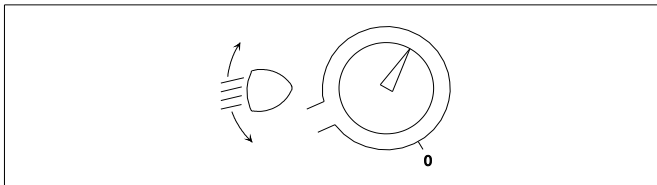
The controls for the headlamp-levelling devices referred to in paragraph A6.2.6.2.2. .

1. Requirements
 - 1.1. Downward inclination of the dipped-beam shall in all cases be produced in one of the following ways:
 - (a) By moving a control downwards or to the left;
 - (b) By rotating a control in a counter clockwise direction;
 - (c) By depressing a button (push-pull control).
 - If several buttons are used to adjust the beam, the button which gives the greatest downward inclination shall be installed to the left or below the button(s) for other dipped-beam positions.
 - A rotary control which is installed edge-on, or with only the edge visible, should follow the operating principles of control of types (a) or (c).
 - 1.1.1. This control shall carry symbols indicating clearly the movements corresponding to the downward and upward inclination of the dipped-beam.
 - 1.2. The "0" position corresponds to the initial inclination according to paragraph A6.2.6.1.1..
 - 1.3. The "0" position which, according to paragraph A6.2.6.2.2. has to be a "stop position", need not necessarily be at the end of the scale.
 - 1.4. The marks used on control shall be explained in the owner's handbook.
 - 1.5. Only the following symbols may be used to identify the controls:

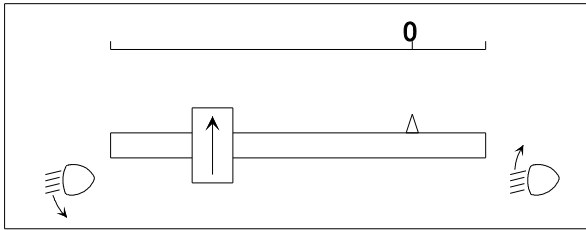


Symbols employing five lines instead of four may also be used

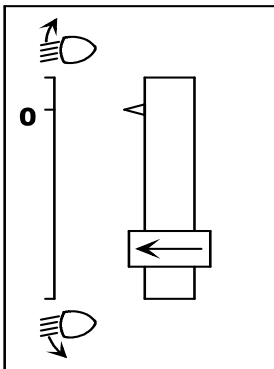
Example 1



Example 2



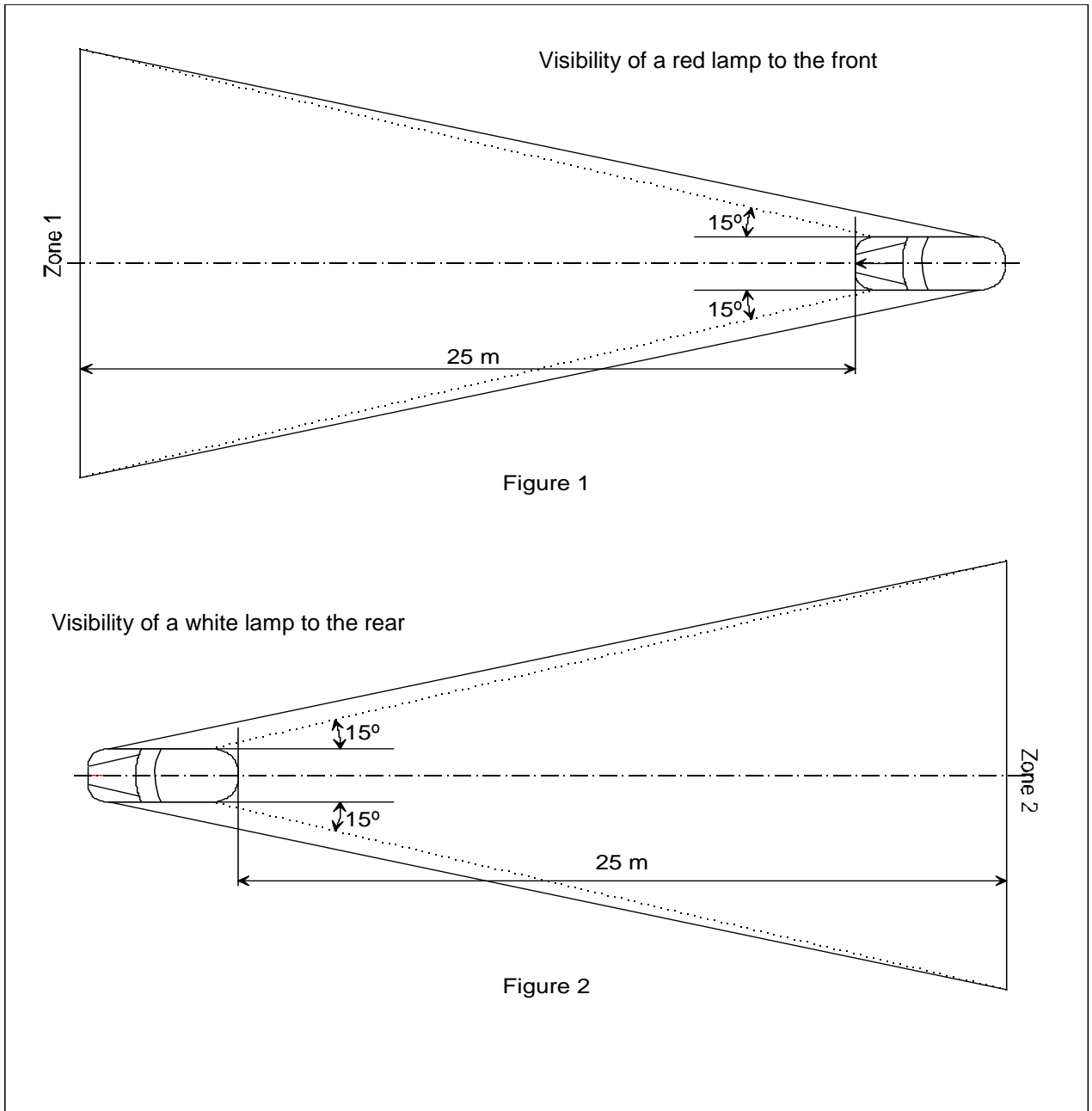
Example 3



Annex A9

Visibility of a red lamp to the front and visibility of a white lamp to the rear

(See paragraphs A5.10.1. and A5.10.2..)



Annex A10

Visibility of conspicuity markings to the rear, front and side of a vehicle

(See paragraph A6.21.5..)

Figure 1a

Rear

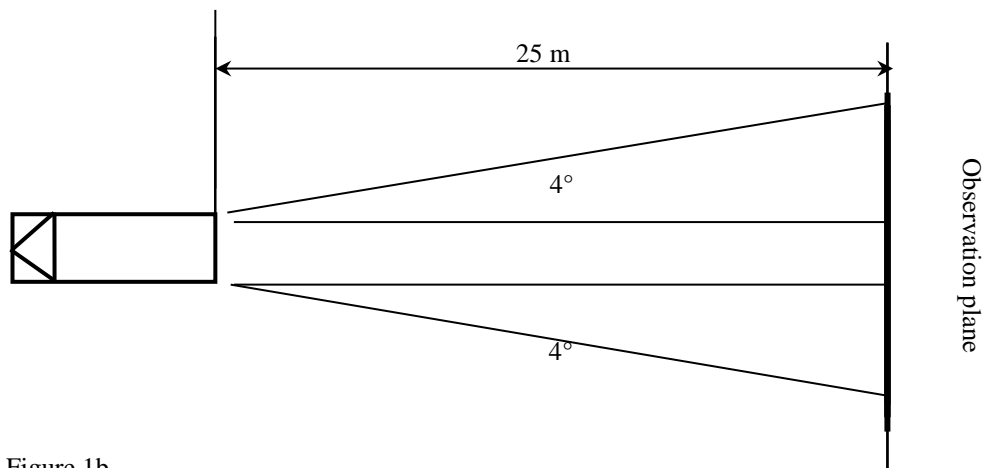


Figure 1b

Front (trailers only)

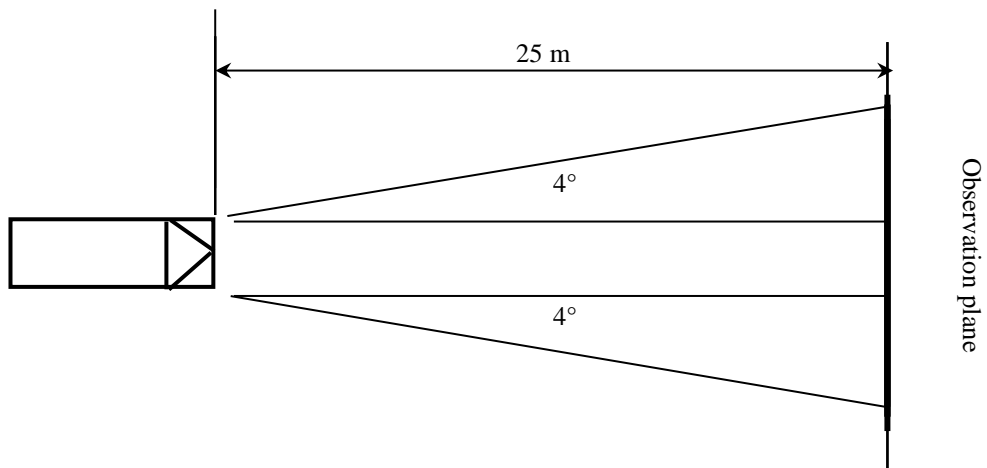
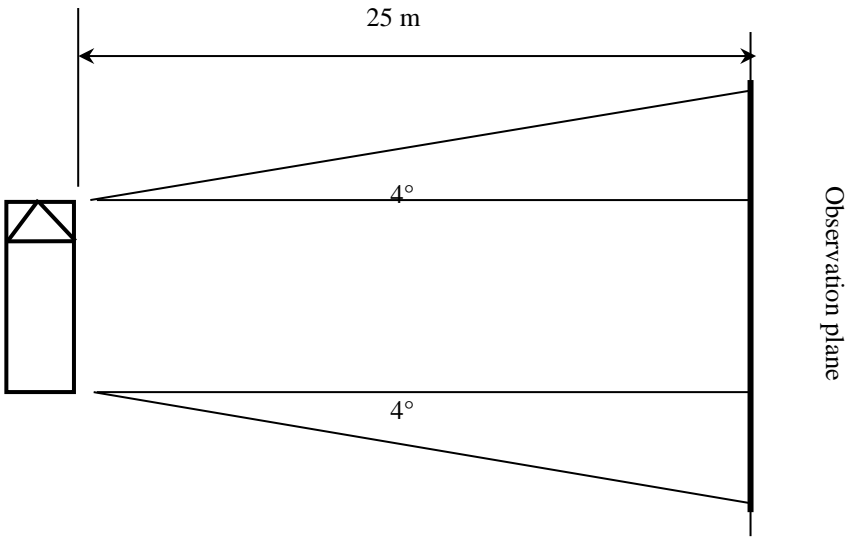


Figure 2
Side

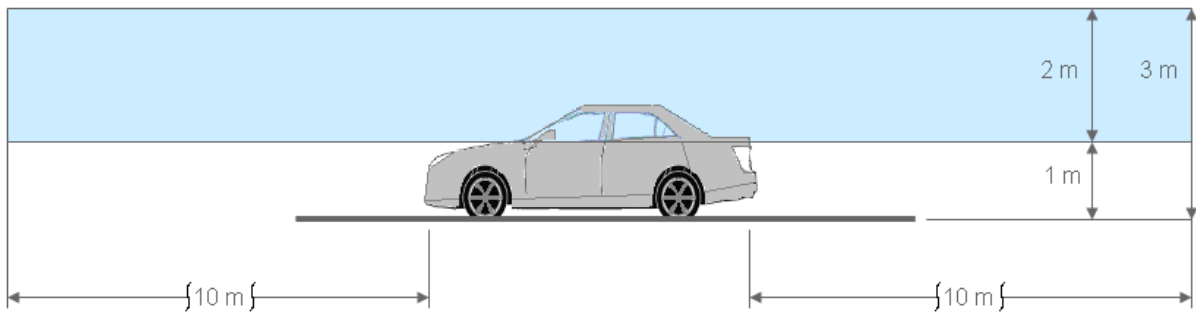


Annex A11

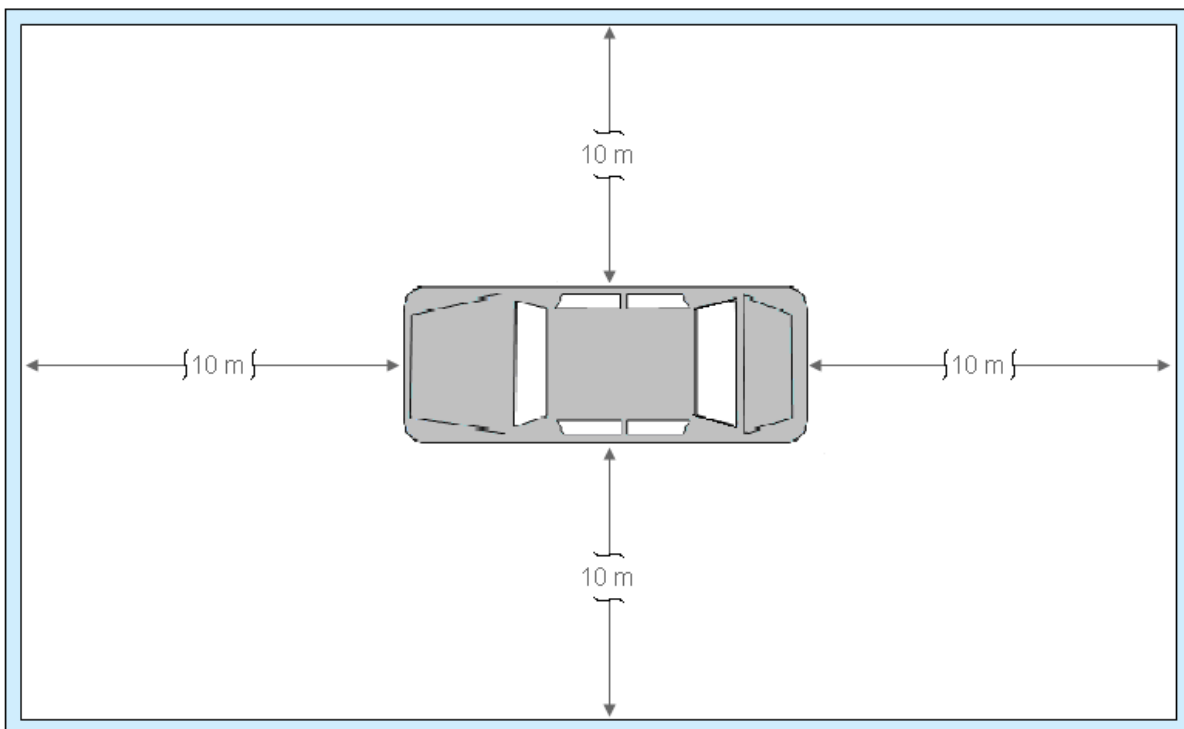
Observing area towards the apparent surface of manoeuvring and courtesy lamps

Zones of observation

This drawing shows the zone from one side, the other zones are from the front, the rear and from the other side of the vehicle



Boundaries of the zones





PART II (B)
COMMON PROVISIONS FOR LIGHTING, LIGHT-SIGNALLING AND RETRO-REFLECTING DEVICES
FOR A TYPE TO BE APPROVED

B1. DEFINITION of Type:

B1.1. "Vehicle type with regard to the installation of lighting and light-signalling devices" means vehicles which do not differ in the **following** essential respects:

- a) the dimension and the external shape of the vehicle;
- b) the number and positioning of the devices;
- c) the headlamp-levelling system;
- d) the suspension system.

Vehicles which differ within the meaning of **the essential respects above**, but not in such a way as to entail a change in the kind, number, positioning and geometric visibility of the lamps and the inclination of the dipped-beam prescribed for the vehicle type in question, and vehicles on which optional lamps are fitted or are absent: **are not considered to be "vehicles of a different type"**.

B1.2. "**Lamps (except retro-reflecting devices and marking plates/devices /materials) of different type**" means lamps, which differ in such essential respects as:

- a) the trade name or mark (lamps bearing the same trade name or mark but produced by different manufacturers shall be considered as being of different types; lamps produced by the same manufacturer differing only
- b) the characteristics of the optical system (levels of intensity, light distribution angles, ~~category of filament lamp, light source module,~~ **inclusion or elimination of components capable of altering the optical effects by reflection, refraction, absorption and/ or deformation during operation**, etc.);
- c) **the category of light source used and/or the LED module specific identification code(s);**

B1.2.1. ~~In addition to~~ For Signalling Lamps, **the following essentials respect, in addition to those listed in paragraph B1.2, shall be considered:**

- d) the category of the lamp, if any;
- e) the variable intensity control, if any.
- f) the sequential activation of light sources, if any.

A change of the colour of the filament lamp or the colour of any filter does not constitute a change of type.

B1.2.2. For headlamps, **the following essentials respect, in addition to those listed in paragraph B1.2, shall be considered:**

-
- d) suitability for right-hand or left-hand traffic or for both traffic systems;
 - e) the kind of beam produced (passing beam, driving beam or both);

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.

B1.2.3. For AFS, **the following essentials respect, in addition to those listed in paragraph B1.2, shall be considered:**

- d) suitability for right-hand or left-hand traffic or for both traffic systems;
- e) the front-lighting function(s), mode(s) and classes produced;
- f) the characteristic(s) of the signal(s), specified for the system;

B1.3. A type of "retro-reflecting device" (as defined in Paragraph **B2.7.**) is defined by the models and descriptive literature submitted with the application for approval.

Retro-reflecting devices can be considered as belonging to the same type if they have one or more "retro-reflecting optical units" which are identical with those of the standard model, or if not identical are symmetrical and suitable for mounting one on the left and one on the right side of the vehicle, and if their other parts differ from those of the standard model only in ways not affecting the properties to which **the pertinent** applies.

B1.4. "**Marking Plates/ Materials of different types**" means **marking plates/devices/materials** which differ in such essential respects as:

- a) **the trade name or mark (marking plates/devices/materials bearing the same trade name or mark but produced by different manufacturers are considered as being of different types; marking plates/devices/materials produced by the same manufacturer differing only by the trade name or mark may be considered to be of the same type);**
- b) the [optical] characteristics of the retro-reflective material [~~or device~~];
- c) the characteristics of the fluorescent material, **if applicable**;
- d) the parts affecting the properties of the retro-reflective **plates/devices/materials**;
- e) the distinctive geometrical and mechanical features of the design (**only for plates/devices to which Regulations 27 or 69 apply**).

For plates/materials to which Regulation 70 or 104 apply, differences in the shape and dimensions of the marking shall not constitute a different type.

B2. DEFINITIONS

B2.1 General definitions

B2.1.1. "*Approval of a vehicle*" means the approval of a vehicle type with regard to the number and mode of installation of the lighting and light-signalling devices.

-
- B2.1.2. References made in UN-Regulation No. 48 to standard (étalon) filament light sources and to UN-Regulation No. 37 shall refer to UN-Regulation No. 37 and its series of amendments in force at the time of application for type approval.
- B2.1.3. References made in UN-Regulation No. 48 to gas-discharge light sources and to UN-Regulation No. 99 shall refer to UN-Regulation No. 99 and its series of amendments in force at the time of application for type approval.
- B2.1.4. References made in UN-Regulation No. 48 to LED light sources and to UN-Regulation No. 128 shall refer to UN-Regulation No. 128 and its series of amendments in force at the time of application for type approval.
- B2.1.5. "*Operating tell-tale*" means a visual or auditory signal (or any equivalent signal) indicating that a device has been switched on and is operating correctly or not.
- B2.1.6. "*Closed-circuit tell-tale*" means a visual (or any equivalent signal) indicating that a device has been switched on, but not indicating whether it is operating correctly or not.
- B2.1.7. "*Gonio(photo)meter system*" (If not otherwise specified in a particular Regulation) means a system used for the photometric measurements specified by the angular coordinates in degrees on a sphere with a vertical polar axis according to CIE publication No. 70, Vienna 1987, i.e. corresponding to a gonio(photo)meter system with a horizontal ("elevation") axis fixed to the ground and a second, moveable ("rotation") axis perpendicular to the fixed horizontal axis (see Annex B14). Note: The above mentioned CIE publication specifies a procedure to correct the angular coordinates in the case where an alternative gonio(photo)meter system is used.

B2.1.8. "*Colour of lights*" means Colour of the light emitted as specified in Annex B4.

B2.2. General definitions and definitions with regard to the installation of lighting and light-signalling devices on vehicles:

- B2.2.1. "*Transverse plane*" means a vertical plane perpendicular to the median longitudinal plane of the vehicle.
- B2.2.2. "*Unladen vehicle*" means a vehicle without driver, crew, passengers and load, but with a full supply of fuel, spare wheel and the tools normally carried.
- B2.2.3. "*Laden vehicle*" means a vehicle loaded to its technically permissible maximum mass, as stated by the manufacturer, who shall also fix the distribution of this mass between the axles in accordance with the method described in Annex A5.
- B2.2.4. "*Ground*" means the surface on which the vehicle stands which should be substantially horizontal.
- B2.2.5. "*Movable components*" of the vehicle mean those body panels or other vehicle parts the position(s) of which can be changed by tilting, rotating or sliding without the use of tools. They do not include tiltable driver cabs of trucks.
- B2.2.6. "*Normal position of use of a movable component*" means the position(s) of a movable component specified by the vehicle manufacturer for the normal condition of use and the park condition of the vehicle.
- B2.2.7. "*Normal condition of use of a vehicle*" means:
For a motor vehicle, when the vehicle is ready to move with its propulsion engine running and its movable components in the normal position(s) as defined in paragraph B2.2.6.;

And for a trailer, when the trailer is connected to a drawing motor vehicle in the conditions as prescribed above and its movable components are in the normal position(s) as defined in paragraph [B2.2.6.](#)

B2.2.8. "*Park condition of a vehicle*" means:

For a motor vehicle, when the vehicle is at standstill and its propulsion engine is not running and its movable components are in the normal position(s) as defined in paragraph [B2.2.6.](#)

And for a trailer, when the trailer is connected to a drawing motor vehicle in the condition as described above and its movable components are in the normal position(s) as defined in paragraph [B2.2.6.](#)

B2.3. General definitions to lighting and light-signalling devices:

B2.3.1. "*Device*" means an element or an assembly of elements used to perform one or more functions.

B2.3.2. "*Lighting function*" means the light emitted by a device to illuminate the road and objects in the direction of vehicle movement.

B2.3.3. "*Light-signalling function*" means the light emitted or reflected by a device to give to other road users visual information on the presence, identification and/or the change of movement of the vehicle.

B2.3.4. "*Lamp*" means a device designed to illuminate the road or to emit a light signal to other road users. Rear registration plate lamps and retro-reflectors are likewise to be regarded as lamps. For the purpose of [UN-Regulation No. 48](#), light-emitting rear registration plates and the service-door-lighting system according to the provisions of [UN-Regulation No. 107](#) on vehicles of categories M₂ and M₃ are not considered as lamps.

B2.3.5. "*Equivalent lamps*" means lamps having the same function and authorized in the country in which the vehicle is registered; such lamps may have different characteristics from those installed on the vehicle when it is approved on condition that they satisfy the requirements of [UN-Regulation No. 48](#).

B2.3.6. "*Independent lamps*" means devices having separate apparent surfaces in the direction of the reference axis (In the case of lighting devices for the rear registration plate and direction-indicators of categories 5 and 6, the "light-emitting surface" shall be used), separate light sources and separate lamp bodies. *(footnote dissolved)*

B2.3.7. "*Axis of reference*" (or "*reference axis*") means the characteristic axis of the lamp determined by the manufacturer (of the lamp) for use as the direction of reference ($H = 0^\circ$, $V = 0^\circ$) for angles of field for photometric measurements and for installing the lamp on the vehicle.

B2.3.8. "*Centre of reference*" means the intersection of the axis of reference with the exterior light-emitting surface; it is specified by the manufacturer of the lamp.

B2.3.9. "*H plane*" means the horizontal plane containing the centre of reference of the lamp.

B2.3.10. "*Sequential activation*" means an electrical connection where the individual light sources of a lamp are wired such that they are activated in a predetermined sequence."

B2.3.11. "*Angles of geometric visibility*" means the angles which determine the field of the minimum solid angle in which the apparent surface of the lamp is visible. That field of the solid angle is determined by the segments of the sphere of which the centre coincides with the centre of reference of the lamp and the equator is parallel with the ground. These segments are

determined in relation to the axis of reference. The horizontal angles β correspond to the longitude and the vertical angles α to the latitude.

B2.3.12. "*Extreme outer edge*" on either side of the vehicle, means the plane parallel to the median longitudinal plane of the vehicle and touching its lateral outer edge, disregarding the projection:

- of tyres near their point of contact with the ground, and of connections for tyre-pressure gauges;

- of any anti-skid devices mounted on the wheels;

- of devices for indirect vision;

- of side direction-indicator lamps, end-outline marker lamps, front and rear position lamps, parking lamps, retro-reflectors and side-marker lamps.

- of customs seals affixed to the vehicle, and of devices for securing and protecting such seals.

- of service-door lighting systems on vehicles of categories M_2 and M_3 as specified in paragraph B2.3.4..

B2.3.13. "*Overall dimensions*" means the distance between the two vertical planes defined in paragraph B2.3.12..

B2.3.14. "*Overall width*" means the distance between the two vertical planes defined in paragraph B2.3.12..

B2.3.15. "*Overall length*" means the distance between the two vertical planes perpendicular to the median longitudinal plane of the vehicle and touching its front and rear outer edge, disregarding the projection:

(a) Of devices for indirect vision;

(b) Of end-outline marker lamps;

(c) Of coupling devices, in the case of motor vehicles.

For trailers in the "overall length" and in any measurement in length the drawbar shall be included, except when specifically excluded.

B2.3.16. "*Lamps marked "D"*" means independent lamps, approved as separate devices in such a way that they are allowed to be used either independently or in an assembly of two lamps to be considered as a "single lamp".

B2.3.17. "*Light emitting surface*" of a "lighting device", "light-signalling device" or a retro-reflector means the surface as declared in the request for approval by the manufacturer of the device on the drawing, see Annex B8 (see e.g. Parts 1, and 4).

This shall be declared according to one of the following conditions:

(a) In the case where the outer lens is textured, the declared light emitting surface shall be all or part of the exterior surface of the outer lens;

(b) In the case where the outer lens is non-textured the outer lens may be disregarded and the light emitting surface shall be as declared on the drawing, see Annex B8 (see e.g. Part 5).

B2.3.18. "*Textured outer lens*" or "*Textured outer lens area*" means all or part of an outer lens, designed to modify or influence the propagation of light from the light source(s), such that the light rays are significantly diverted from their original direction.

B2.3.19. "*Illuminating surface*" see Annex B8.

B2.3.19.1. "*Illuminating surface of a lighting device*" (paragraphs B2.4.1. to B2.4.4. and B2.6.16.) means the orthogonal projection of the full aperture of the reflector, or in the case of headlamps with an ellipsoidal reflector of the "projection lens", on a transverse plane. If the lighting device has no reflector, the definition of paragraph 2.3.19.2. shall be applied. If the light emitting surface of the lamp extends over part only of the full aperture of the reflector, then the projection of that part only is taken into account.

In the case of a dipped-beam headlamp, the illuminating surface is limited by the apparent trace of the cut-off on to the lens. If the reflector and lens are adjustable relative to one another, the mean adjustment should be used.

In the case of AFS being installed: where a lighting function is produced by two or more simultaneously operated lighting units on a given side of the vehicle, the individual illuminating surfaces, taken together, constitute the illuminating surface to be considered (for example, in the figure of paragraph A6.22.4., the individual illuminating surfaces of the lighting units 8, 9 and 11, regarded together and taking into account their respective location, constitute the illuminating surface to be considered for the right hand side of the vehicle).

B2.3.19.2 "*Illuminating surface of a light-signalling device other than a retro-reflector*" (paragraphs B2.6.1 to B2.6.14 and B2.6.5 to 2.6.14 and B2.6.16) means the orthogonal projection of the lamp in a plane perpendicular to its axis of reference and in contact with the exterior light-emitting surface of the lamp, this projection being bounded by the edges of screens situated in this plane, each allowing only 98 per cent of the total luminous intensity of the light to persist in the direction of the axis of reference.

To determine the lower, upper and lateral limits of the illuminating surface only screens with horizontal or vertical edges shall be used to verify the distance to the extreme edges of the vehicle and the height above the ground.

For other applications of the illuminating surface, e.g. distance between two lamps or functions, the shape of the periphery of this illuminating surface shall be used. The screens shall remain parallel, but other orientations are allowed to be used.

In the case of a light-signalling device whose illuminating surface encloses either totally or partially the illuminating surface of another function or encloses a non-lighted surface, the illuminating surface may be considered to be the light emitting surface itself (see e.g. Annex B8, Parts 2, 3, 5 and 6).

B2.3.19.3. "*Illuminating surface of a retro-reflector*" (paragraph B2.7) means, as declared by the applicant during the component approval procedure for the retro-reflectors, the orthogonal projection of a retro-reflector in a plane perpendicular to its axis of reference and delimited by planes contiguous to the declared outermost parts of the retro-reflectors' optical system and parallel to that axis. For the purposes of determining the lower, upper and lateral edges of the device, only horizontal and vertical planes shall be considered.

B2.3.20 The "*apparent surface*" for a defined direction of observation means, at the request of the manufacturer or his duly accredited representative, the orthogonal projection of:

Either the boundary of the illuminating surface projected on the exterior surface of the lens;

Or the light-emitting surface;

Only in the case of a light-signalling device producing variable luminous intensities, its apparent surface that may be variable as specified in paragraph B2.8.12, shall be considered under all conditions permitted by the variable intensity control, if applicable.

In a plane perpendicular to the direction of observation and tangential to the most exterior point of the lens. Different examples of the application of apparent surface can be found in Annex B8.

B2.3.21. "Single and multiple lamps"

B2.3.21.1. "A single lamp" means:

- (a) A device or part of a device having one lighting or light-signalling function, one or more light source(s) and one apparent surface in the direction of the reference axis, which may be a continuous surface or composed of two or more distinct parts; or
- (b) Any assembly of two lamps marked "D", whether identical or not, having the same function; or
- (c) Any assembly of two independent retro-reflectors, whether identical or not, that have been approved separately; or
- (d) Any interdependent lamp system composed of two or three interdependent lamps marked "Y" approved together and providing the same function."

B2.3.21.2. "Two lamps" or "an even number of lamps" in the shape of a band or strip, means two lamps with a single light emitting surface, providing such a band or strip is placed symmetrically in relation to the median longitudinal plane of the vehicle.

B2.3.21.3. "Distance between two lamps" which face in the same direction means the shortest distance between the two apparent surfaces in the direction of the reference axis. Where the distance between the lamps clearly meets the requirements of UN-Regulation No. 48, Part I, the exact edges of apparent surfaces need not be determined.

B2.3.21.4. "Interdependent lamp" means a device operating as part of an interdependent lamp system. Interdependent lamps operate together when activated, have separate apparent surfaces in the direction of the reference axis and separate lamp bodies, and may have separate light source(s). (inserted from R48, 2.7.30.1)

B2.3.21.5. "Interdependent lamp system" means an assembly of two or three interdependent lamps providing the same function.

B2.3.21.6. "Interdependent lamp marked "Y"" means a device operating as part of an interdependent lamp system.

B2.3.21.7. "Grouped lamps" means devices having separate apparent surfaces in the direction of the reference axis (In the case of lighting devices for the rear registration plate and direction-indicators of categories 5 and 6, the "light-emitting surface" shall be used) and separate light sources, but a common lamp body. (footnote dissolved)

B2.3.21.8. "Combined lamps" means devices having separate apparent surfaces in the direction of the reference axis (In the case of lighting devices for the rear registration plate and direction-indicators of categories 5 and 6, the "light-emitting surface" shall be used), but a common light source and a common lamp body. (footnote dissolved)

B2.3.21.9. "Reciprocally incorporated lamps" means devices having separate light sources or a single light source operating under different conditions (for example, optical, mechanical, electrical differences), totally or partially common apparent surfaces in the direction of the reference axis (In the case of lighting devices for the rear registration plate and direction-indicators of categories 5 and 6, the "light-emitting surface" shall be used) and a common

lamp body (Examples to enable a decision regarding reciprocal incorporation of lamps can be found in Annex B8, Part 7). (footnotes dissolved)

- B2.3.21.10. "*Single-function lamp*" means a part of a device which performs a single lighting or light-signalling function.
- B2.3.22. "*Concealable lamp*" means a lamp capable of being partly or completely hidden when not in use. This result may be achieved by means of a movable cover, by displacement of the lamp or by any other suitable means. The term "*retractable*" is used more particularly to describe a concealable lamp the displacement of which enables it to be inserted within the bodywork.
- B2.3.23. "*Optional lamp*" means a lamp, the installation of which is left to the discretion of the manufacturer.
- B2.3.24. "*Pair*" means the set of lamps of the same function on the left- and right-hand side of the vehicle.
- B2.3.24.1. "*Matched pair*" means the set of lamps of the same function on the left- and right-hand side of the vehicle, which, as a pair, complies with the photometric requirements.

B2.4. Definition with regard to lighting devices (e.g. head lamps):

- B2.4.1. "*Driving-beam (main-beam) headlamp*" means the lamp used to illuminate the road over a long distance ahead of the vehicle.
- B2.4.2. "*Passing-beam (dipped-beam) headlamp*" means the lamp used to illuminate the road ahead of the vehicle without causing undue dazzle or discomfort to oncoming drivers and other road-users.
- B2.4.2.1. "*Principal passing-beam (principal dipped-beam)*" means the dipped-beam produced without the contribution of infrared (IR) emitter and/or additional light sources for bend lighting.
- B2.4.3. "*Front fog lamp*" means a lamp used to improve the illumination of the road ahead of the vehicle in case of fog or any similar condition of reduced visibility.
- B2.4.4. "*Cornering lamp*" means a lamp used to provide supplementary illumination of that part of the road which is located near the forward corner of the vehicle at the side towards which the vehicle is going to turn.
- B2.4.5. "*Bend lighting*" means a lighting function to provide enhanced illumination in bends.
- B2.4.6. "*Lens*" means the outermost component of the headlamp (unit) which transmits light through the illuminating surface;
- B2.4.7. "*Coating*" means any product or products applied in one or more layers to the outer face of a lens;

[B2.6.8] Headlamps of different "Classes" (e. g. A or B or ...) mean headlamps identified by particular photometric provisions.

B2.5. Definition with regard to adaptive front lighting systems:

- B2.5.1. "*Adaptive front lighting system*" (or "system") (or "AFS") means a lighting device type-approved according to UN-Regulation No. 123, 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 6.1.1. of UN-Regulation No. 123; 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;

- B2.5.2. "*Lighting unit*" means a light emitting part of the system, which may consist of optical, mechanical and electrical components, designed to provide or contribute to the beam of one or more front-lighting function(s) provided by the AFS;
- B2.5.3. "*Installation unit*" means an indivisible housing (lamp body) which contains one or more lighting unit(s).
- B2.5.4. "*Lighting mode*" or "*mode*" means a state of a front lighting function provided by the AFS, as specified by the manufacturer and intended for adaptation to specific vehicle and ambient conditions.
- B2.5.5. "*System control*" means that part(s) of the AFS receiving the AFS control signals from the vehicle and controlling the operation of the lighting units automatically.
- B2.5.6. "*AFS control signal*" (V, E, W, T) means the input to the AFS in accordance with the paragraph A6.22.7.4.
- B2.5.7. "*Neutral state*" means the state of the AFS when a defined mode of the class C passing-beam ("basic passing-beam") or of the main beam in the maximum condition of activation, if any, is produced, and no AFS control signal applies.
- B2.5.8. "*Adaptive main-beam*" means a main-beam of the AFS that adapts its beam pattern to the presence of oncoming and preceding vehicles in order to improve the long-range visibility for the driver without causing discomfort, distraction or glare to other road users.
- B2.5.9. "*Class*" of a passing beam (C, V, E or W) means the designation of a passing beam, identified by particular provisions according to UN-Regulation No. 48 (For explanation only. The provisions of the passing-beam classes are dedicated to conditions as follows: C for the basic passing-beam, V for use in lit areas such as towns, E for use on roads such as motorways, W for use in adverse conditions such as wet road); (footnote R123 dissolved)
- B2.5.10. "*Mode*" of a front-lighting function provided by a system means a beam within the provisions (see paragraphs A6.2. and A6.3. of UN-Regulation No. 48) 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;
- B2.5.10.1. "*Bending mode*" means the designation of a mode of a front-lighting function with its illumination being laterally moved or modified (to obtain an equivalent effect), designed for bends, curves or intersections of the road, and, identified by particular photometric provisions;
- B2.5.10.2. "*Category 1 bending mode*" means a bending mode with horizontal movement of the kink of the cut-off;
- B2.5.10.4. "*Category 2 bending mode*" means a bending mode without horizontal movement of the kink of the cut-off;
- B2.5.11. "*Right side*" respectively "*left side*" means the combined total of the lighting units intended to be installed to that side of the longitudinal median plane of the vehicle, relative to its forward motion;
- B2.5.12. "*Signal*" means any AFS control signal as defined in Paragraph B2.5.6 or any additional control input to the system or a control output from the system to the vehicle;
- B2.5.13. "*Signal generator*" means a device, reproducing one or more of the signals for system tests;

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- B2.5.14. "*Supply and operating device*" means one or more components of a system providing power to one or more parts of the system, including such as power and/or voltage control(s) for one or more light sources as e.g. electronic light source control gears;
- B2.5.15. "*System reference axis*" means the intersection line of the vehicle's longitudinal median plane with the horizontal plane through the centre of reference of one lighting unit specified in the drawings according to paragraph B2.2.1;
- B2.5.16. "*Aiming*" means the positioning of the beam or part thereof on an aiming screen according to the relevant criteria;
- B2.5.17. "*Adjustment*" means the use of the means provided by the system for vertical and/or horizontal aiming of the beam;
- B2.5.18. "*Traffic-change function*" means any front-lighting function or a mode thereof, or part(s) thereof only, or any combination of these, intended to avoid glare and provide sufficient illumination in case where a vehicle being equipped with a system designed for one traffic direction only is temporarily used in a country with the opposite direction of traffic.
- B2.5.19. "*Substitute function*" means any specified front-lighting and/or front light-signalling, be it a front-lighting and/or a front light-signalling function, or a mode thereof, or part(s) thereof only, or any combination of it, intended to replace a front-lighting function/ mode in case of failure.

B2.6. Definition with regard to Signalling lamps:

- B2.6.1. "*Direction-indicator lamp*" means the lamp used to indicate to other road-users that the driver intends to change direction to the right or to the left.
- A direction-indicator lamp or lamps may also be used according to the provisions of UN-Regulation No. 97.
- B2.6.2. "*Stop lamp*" means a lamp used to indicate to other road users to the rear of the vehicle that the longitudinal movement of the vehicle is intentionally retarded.
- B2.6.3. "*Rear-registration plate illuminating device*" means the device used to illuminate the space reserved for the rear registration plate; such a device may consist of several optical components.
- B2.6.4. "*Rear registration plate lamp*" means the device for the illumination of rear registration plates, hereinafter called "illuminating device", which illuminates the rear registration plate by reflection. For the approval of this device, the illumination of the space to be occupied by the plate is determined. The illuminated areas are grouped into the following categories:"
- B2.6.4.1. Category 1a: illuminated area for use on a vehicle mounted a registration plate, the size of which is 340 x 240 mm or less (tall plate).
- B2.6.4.2. Category 1b: illuminated area for use on a vehicle mounted a registration plate, the size of which is 520 x 120 mm or less (wide plate).
- B2.6.4.3. Category 1c: illuminated area for use on a vehicle mounted a registration plate, the size of which is 255 x 165 mm or less (plate for agricultural or forestry tractors).
- B2.6.4.4. Category 2a: illuminated area for use on a vehicle mounted a registration plate, the size of which is 330 x 165 mm or less.
- B2.6.4.5. Category 2b: illuminated area for use on a vehicle mounted a registration plate, the size of which is 440 x 220 mm or less.
- B2.6.5. "*Front position lamp*" means the lamp used to indicate the presence and the width of the vehicle when viewed from the front.

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- B2.6.6. "*Rear position lamp*" means the lamp used to indicate the presence and width of the vehicle when viewed from the rear.
- B2.6.7. "*Hazard warning signal*" means the simultaneous operation of all of a vehicle's direction-indicator lamps to show that the vehicle temporarily constitutes a special danger to other road-users.
- B2.6.8. "*Rear fog lamp*" means a lamp used to make the vehicle more easily visible from the rear in dense fog.
- B2.6.9. "*Parking lamp*" means a lamp which is used to draw attention to the presence of a stationary vehicle in a built-up area. In such circumstances it replaces the front and rear position lamps.
- B2.6.10. "*End-outline marker lamp*" means the lamp fitted near to the extreme outer edge and as close as possible to the top of the vehicle and intended to indicate clearly the vehicle's overall width. This lamp is intended, for certain vehicles and trailers, to complement the vehicle's front and rear position lamps by drawing particular attention to its bulk.
- B2.6.11. "*Side marker lamp*" means a lamp used to indicate the presence of the vehicle when viewed from the side.
- B2.6.12. "*Daytime running lamp*" means a lamp facing in a forward direction used to make the vehicle more easily visible when driving during daytime.
- B2.6.13. "*Exterior courtesy lamp*" means a lamp used to provide supplementary illumination to assist the entry and exit of the vehicle driver and passenger or in loading operations;
- B2.6.14. "*Manoeuvring lamp*" means a lamp used to provide supplementary illumination to the side of the vehicle to assist during slow manoeuvres.
- B2.6.15. "*Emergency stop signal*" means a signal to indicate to other road users to the rear of the vehicle that a high retardation force has been applied to the vehicle relative to the prevailing road conditions.
- B2.6.16. "*Reversing lamp*" means the lamp used to illuminate the road to the rear of the vehicle and to warn other road-users that the vehicle is reversing or about to reverse.
- B2.6.17. "*Rear-end collision alert signal (RECAS)*" means an automatic signal given by the leading vehicle to the following vehicle. It warns that the following vehicle needs to take emergency action to avoid a collision.

B2.7. Definition with regard to retro-reflectors:

- B2.7.1. "*Retro-reflection*" means the reflection in which radiation is returned in directions close to the direction from which it came, this property being maintained even over wide variations of the direction of the incident radiation:
- B2.7.2. "*Retro-reflector*" means a device used to indicate the presence of a vehicle by the reflection of light emanating from a light source not connected to the vehicle, the observer being situated near the source.

B2.7.2.1. For the purposes of this Regulation the following are not considered as retro-reflectors:

- **Retro-reflecting number plates;**
- **The retro-reflecting signals mentioned in the ADR (European Agreement concerning the international carriage of dangerous goods by road);**

- Other retro-reflective plates and signals which shall be used to comply with national requirements for use as regards certain categories of vehicles or certain methods of operation;

- Retro-Reflecting materials approved as Class D, E or F according to Regulation No. 104 and used for other purposes in compliance with national requirements, e.g. advertising.

B2.7.3. "*Conspicuity marking*" means a device intended to increase the conspicuity of a vehicle, when viewed from the side or rear (or in the case of trailers, additionally from the front), by the reflection of light emanating from a light source not connected to the vehicle, the observer being situated near the source.

B2.7.4. "*Contour marking*" means a conspicuity marking intended to indicate the horizontal and vertical dimensions (length, width and height) of a vehicle.

B2.7.5. "*Full contour marking*" means a contour marking that indicates the outline of the vehicle by a continuous line.

B2.7.6. "*Partial contour marking*" means a contour marking that indicates the horizontal dimension of the vehicle by a continuous line, and the vertical dimension by marking the upper corners.

B2.7.7. "*Line marking*" means a conspicuity marking intended to indicate the horizontal dimensions (length and width) of a vehicle by a continuous line.

B2.7.8. "*Retro-reflecting device*" an assembly ready for use and comprising one or more retro-reflecting optical units;

Retro-reflecting devices are divided into three classes according to their photometric characteristics: Class IA or IB, Class IIIA or IIIB, and Class IVA.

Retro-reflecting devices of Classes IB and IIIB are devices combined with other signal lamps which are not watertight according to Annex 8, paragraph 1.1. of UN-Regulation No. 3, and which are integrated into the body of a vehicle.

B2.7.9. "*Slow moving vehicle (SMV) rear marking plate*" means a triangular plate with truncated corners with a characteristic pattern faced with **retro-reflectors or retro-reflective materials and retro-reflective or fluorescent material.** ~~or devices (class 1); or with retro-reflective materials or devices only (class 2).~~

B2.7.10. "*Rear marking plate*" means a plate faced with retro-reflective and fluorescent material or devices intended to increase the visibility and permit easy identification of heavy and long vehicles.

B2.7.11. "*Retro-reflective marking material*" means a surface or a device from which, when directionally illuminated, a relatively large portion of the incident radiation is retro-reflected.

B2.7.12. "*Sample unit*" means a complete, finished SMV plate ready to be mounted on a vehicle and representative of current production.

B2.7.13. "*Fluorescence*" means when certain substances are brought near to a source of ultraviolet or blue radiations, they emit radiations which are nearly always of longer wave-length than those producing the effect. This phenomenon is called fluorescence. By day and in twilight, fluorescent colours are brighter than normal colours because they reflect part of the light falling upon them, and in addition they emit light. At night they are not brighter than ordinary colours.

B2.8. Definition with regard to light sources:

- B2.8.1. *"Light source"* means one or more elements for visible radiation, which may be assembled with one or more transparent envelopes and with a base for mechanical and electrical connection.
- A light source may also be constituted by the extreme outlet of a light-guide, as part of a distributed lighting or light-signalling system not having a built-in outer lens.
- B2.8.2. *"Replaceable light source"* means a light source which is designed to be inserted in and removed from the holder of its device without tool.
- B2.8.3. *"Non-replaceable light source"* means a light source which can only be replaced by replacement of the device to which this light source is fixed.
- (a) In case of a light source module: a light source which can only be replaced by replacement of the light source module to which this light source is fixed;
- (b) In case of adaptive front-lighting systems (AFS): a light source which can only be replaced by replacement of the lighting unit to which this light source is fixed.
- B2.8.4. *"Light source module"* means an optical part of a device which is specific to that device. It contains one or more non-replaceable light sources and it may optionally contain one or more holders for approved replaceable light sources.
- B2.8.5. *"Filament light source"* (filament lamp) means a light source where the element for visible radiation is one or more heated filaments producing thermal radiation.
- B2.8.6. *"Gas-discharge light source"* means a light source where the element for visible radiation is a discharge arc producing electro-luminescence/fluorescence.
- B2.8.7. *"Light-emitting diode (LED) light source"* means a light source where the element for visible radiation is one or more solid state junctions producing injection-luminescence/fluorescence.
- B2.8.8. *"LED module"* means a light source module containing as light sources only LEDs. However it may optionally contain one or more holders for approved replaceable light sources.
- B2.8.9. *"Electronic light source control gear"* means one or more components between supply and light source, whether or not integrated with the light source or the applied lamp, to control voltage and/ or electrical current of the light source.
- B2.9.10. *"Ballast"* means an electronic light source control gear between supply and light source, whether or not integrated with the light source or applied lamp, to stabilise the electrical current of a gas-discharge light source.
- B2.8.11. *"Ignitor"* means an electronic light source control gear to start the arc of a gas-discharge light source.
- B2.8.12. *"Variable intensity control"* means the device which automatically controls rear light signalling devices producing variable luminous intensities to assure the unvarying perception of their signals. The variable intensity control is part of the lamp, or part of the vehicle, or split between the said lamp and the vehicle.
- B2.8.13. *"Objective luminous flux"* means:
- (a) In the case of a light source:
- The value of the objective luminous flux, not including any tolerances, as indicated in the relevant data sheet of the applicable light source Regulation according to which the light source is approved;

(b) In the case of an LED module:

The value of the objective luminous flux as indicated in the technical specification submitted with the LED module for approval of the lamp of which the LED module is a part;

B3. APPLICATION FOR APPROVAL

B3.1. The application for **type** approval shall be submitted by the holder of the trade name or mark or by his duly accredited representative.

B3.1.1 **In the case of a headlamps, it shall specify:**

- a) whether the headlamp is intended to provide both a passing-beam and a driving-beam or only one of these beams;
- b) if the headlamp is intended to provide a passing-beam, whether it is designed for both left-hand and right-hand traffic or for either left-hand or right-hand traffic only;
- c) if the headlamp is equipped with an adjustable reflector, the mounting position(s) of the headlamp in relation to the ground and the longitudinal median plane of the vehicle;
- d) to which Class (e.g. A or B etc.) the headlamp belongs.

B3.1.2. At the discretion of the applicant, it may specify, in the case of a signalling lamps or of a Classes IA, IB and IVA retro-reflectors, if the device may be installed on the vehicle with different inclinations of the reference axis in respect to the vehicle reference planes and to the ground, or rotate around its reference axis; these different conditions of installation shall be indicated in the communication form.

B3.1.3. The application shall be accompanied by the following documents (in triplicate) and sample(s):

B3.1.3.1. in the case of a vehicle:

B3.1.3.1.1. a description of the vehicle type with regard to the items mentioned in paragraphs **B1.1.**, together with the restrictions on loading, particularly the maximum permissible load in the boot;

B3.1.3.1.2. a list of the devices prescribed by the manufacturer for the lighting and light-signalling assembly. The list may include several types of device for each operation. Each type shall be duly identified (component, type-approval mark, name of manufacturer, etc.), in addition the list may include in respect of each function the additional annotation "or equivalent devices";

B3.1.3.1.3. a layout drawing of the lighting and light-signalling equipment as a whole, showing the position of the various devices on the vehicle;

B3.1.3.1.4. if necessary, in order to verify the conformity to the prescriptions of the present Regulation, the layout drawing(s) for each individual lamp showing:

- a) the illuminating surface as defined in paragraph **B2.3.19.**,

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- b) the light-emitting surface as defined in paragraph B2.3.17.,
 - c) the axis of reference as defined in paragraph B2.3.7., and
 - d) the centre of reference as defined in paragraph B2.3.8.
- of this Regulation.

This is not necessary in the case of the rear registration plate lamp (paragraph B2.6.4. of this Regulation);

- B3.1.3.1.5. a statement of the method used for the definition of the apparent surface (see paragraph B2.3.20)
- B3.1.3.1.6. for vehicles of M and N categories, a description of the electric power supply conditions for the devices indicated in paragraphs B2.4.1., B2.4.2., B2.6.2., B2.6.4. and B2.6.5. of this Regulation above, including, if applicable, information on a special power supply/electronic light source control gear, or variable intensity control;
- B3.1.3.1.7. where an AFS is fitted on the vehicle, a detailed description providing the following information:
 - a) the lighting functions and modes for which the AFS has been approved;
 - b) the related AFS control signals and their technical characteristics as defined according to Annex 10 to Regulation No. 123;
 - c) the provisions being applied to adapt automatically the front lighting functions and modes according to paragraph A6.22.7.4. of this Regulation;
 - d) special instruction, if any, for the inspection of the light sources and the visual observation of the beam;
 - e) the documents according to paragraph A6.22.9.2. of this Regulation;
 - f) the lamps that are grouped or combined with or reciprocally incorporated in the AFS;
 - g) the lighting units which are designed to comply with the requirements of paragraph A6.22.5. of this Regulation.
- B3.1.3.1.8. an unladen vehicle fitted with a complete set of lighting and light-signalling equipment, as prescribed in paragraph A2.2.2. and representative of the vehicle type to be approved.
- B3.1.3.2. in the case of a lamp (except a retro reflecting device):
 - B3.1.3.2.1. drawings, sufficiently detailed to permit identification of the type and, if applicable, of the category of the lamp, showing:
 - a) geometrically in what position(s) it may be mounted on the vehicle;
 - b) the axis of observation to be taken as the axis of reference in the tests (horizontal angle $H = 0^\circ$, vertical angle $V = 0^\circ$); and the point to be taken as the centre of reference during the tests;
 - c) the limit of the apparent surface of the function(s);
 - d) the position intended for the approval number and the additional symbols in relation to the circle of the approval mark;

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- e) in case of LED module(s) also the space reserved for the specific identification code(s) of the module(s);
 - f) in the case of an interdependent lamp system, the interdependent lamp or the combination of interdependent lamps;
 - g) **in addition**, in the case of a headlamp a frontal view, with details of lens ribbing if any, and the cross section;
- B3.1.3.2.2.** A brief technical description stating in particular, with the exception of lamps with non-replaceable light sources:
- a) the category or categories of filament lamp(s) prescribed; this filament lamp category shall be one of those contained in Regulation No. 37;
 - b) the category or categories of gas-discharge light source(s) ,prescribed; this gas-discharge light source category shall be one of those contained in Regulation No. 99;
 - c) the category or categories of LED lamp(s) prescribed; this LED lamp category shall be one of those contained in Regulation No. 128;
 - d) the light source module specific identification code;
- B3.1.3.2.3.** **In the case of a signalling lamp** with variable intensity, a concise description of the variable intensity control. For a double-intensity lamp, an arrangement diagram and a specification of the characteristics of the system ensuring the two levels of intensity;
- B3.1.3.2.4.** **If applicable in the relevant Regulation and in the case of a non-replaceable filament lamp(s) or light source module(s) equipped with non-replaceable filament lamp(s), the documents according to paragraph B6.5..**
- B3.1.3.2.5.** **If not otherwise specified in the relevant Regulation**, two complete samples of the device.
- If application is made for the approval **of signalling lamps** which are not identical but are symmetrical and suitable for mounting one on the left and one on the right side of the vehicle, the two samples submitted may be identical and be suitable for mounting only on the right or only on the left side of the vehicle.
- For a variable-intensity **signalling** lamp, **a sample of the** variable intensity control or a generator providing the same signal(s).
- In the case of headlamps [**or front-fog lamps**], one sample intended for the installation on the left side of the vehicle and one sample intended for the installation of the right side of the vehicle.
- In the case of headlamps [or front-fog lamps], for the samples necessary to test the** plastic material of which the lenses are made see Annex 11 **to Part II of this Regulation.**
- B3.1.3.3.** **in the case of retro-reflecting devices:**
- B3.1.3.3.1.** **drawings**, in sufficient detail to permit identification of the type, showing:
- a) geometrically the position(s) in which the retro-reflecting device may be fitted to the vehicle;
 - b) in case of class IB or IIIB-retro-reflectors details of installation;

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- c) the position intended for the approval number and class indicator in relation to the circle of the approval mark;

- B3.1.3.3.2.** a brief description giving the technical specifications of the materials of which the retro-reflecting optical unit is made;
- B3.1.3.3.3.** **ten** samples of the retro-reflecting device of a colour specified by the manufacturer and, if necessary, the means of fixation **If** necessary, two samples in other colour(s) for simultaneous or subsequent extension of the approval to devices in other colour(s);
- B3.1.3.3.4.** in the case of devices of Class IVA: **ten** samples of the retro-reflecting device and, if necessary, the means of fixation.
- B3.1.3.4.** **In the case of a type of lamp differing only by the trade name or mark from a type that has already been approved it is sufficient that the application is accompanied by:**
- B3.1.3.4.1.** **a declaration by the lamp manufacturer that the type submitted is identical (except in the trade name or mark) with and has been produced by the same manufacturer as the type already approved, the latter being identified by its approval code;**
- B3.1.3.4.2.** **two samples bearing the new trade name or mark or equivalent documentation.**
- B3.1.4.** **The "Communication concerning approval" provided in Annex to each Regulation shall be attached to the relevant type-approval documentation.**

B4. APPROVAL

- B4.1. If the devices or the vehicle(s) submitted for approval in pursuance of paragraph B3.1. meet the requirements of the pertinent Regulation approval shall be granted.
- B4.2. An approval number shall be assigned to each type approved and shall be marked on the vehicle or device following the requirements of Paragraph 5. The same Contracting Party shall not assign the same number:
- to another vehicle type or to the same vehicle type submitted with equipment not specified in the list referred to in paragraph A3.2.2., subject to the provisions of paragraph B10.;
 - to another type of device covered by the same device Regulation.
- B4.3. Notice of approval or of extension or refusal or withdrawal of approval of a type of a device pursuant to the Regulation, under which the device has been approved, shall be communicated to the Parties to the 1958 Agreement which apply the pertinent Regulation, by means of a form conforming to the model in **Annex 1** to the Regulation under which the device has been approved.

B5. MARKINGS

Every vehicle or device belonging to an approved type shall comprise a space of sufficient size for the approval mark prescribed in paragraph B5.1. or B5.2. and the additional symbols prescribed in paragraph B5.3.

The space for the approval mark shall be shown in the drawings mentioned in paragraph B3.2.1.;

-
- B5.1. In the case of a vehicle
- B5.1.1. the approval mark shall be affixed, conspicuously and in a readily accessible place specified on the approval form, close to or on the vehicle data plate affixed by the manufacturer;
- B5.1.2. if the vehicle conforms to a vehicle type approved in the same Contracting Party, under one or more Regulations annexed to the Agreement, the symbol prescribed in paragraph B5.3.1. need not to be repeated and the approval numbers and the additional symbols of all the Regulations under which approval has been granted in the same Contracting Party shall be placed in vertical columns to the right of the symbol prescribed in paragraph B5.3.1..
- B5.2. In the case of a lamp:
- B5.2.1. the approval mark, included the additional symbols prescribed in paragraph B5.3., shall be clearly legible and indelible. It may be placed on an inner or outer part (transparent or not) of the device which cannot be separated from the transparent part of the device emitting the light. In any case the marking shall be visible when the device is fitted on the vehicle or when a movable part such as the hood or boot lid or a door is opened.
- B5.2.2. in the case of grouped, combined or reciprocally incorporated lamps a single approval mark may be applied, provided that all the grouped, combined or reciprocally incorporated lamps satisfy any one of the pertinent Regulations and that the following requirements are also fulfilled:
- (a) requirements of paragraph B5.2.1. apply;
 - (b) no part of the grouped, combined or reciprocally incorporated lamps that transmits light can be removed without at the same time removing the approval mark;
 - (c) the symbols for each lamp, prescribed in paragraphs B5.3.2 and B5.3.3. to B5.3.3.4.,-appropriate to each Regulation under which approval has been granted, shall be marked:
 - either on the appropriate light-emitting surface;
 - or in a group, in such a way that each lamp of the grouped, combined or reciprocally incorporated lamps may be clearly identified,
 - (d) the size of the components of a single approval mark shall not be less than the minimum size required for the smallest of the individual marks by the pertinent Regulation -
- B5.2.3. in the case of different types of lamps complying with the requirements of several Regulations, which use the same outer lens having the same or different colour, a single approval mark may be provided that:
- (a) the symbols for each lamp, prescribed in paragraphs B5.3.2 and B5.3.3. to B5.3.3.4.,-appropriate to each Regulation under which approval has been granted, are marked in conformity to paragraph B5.2.1.;
 - (b) the main body of the lamp shall bear the approval mark of the actual function(s);
 - (c) the size of the components of a single approval mark shall not be less than the minimum size required for the smallest of the individual marks by the pertinent Regulation.
- [B5.2.4. In the case of lamps grouped, combined or reciprocally incorporated with other lamps the lens of which may also be used for other types of lamps both the provisions of paragraphs B5.2.2 and B 5.2.3. apply.]
- B5.3 Composition of the approval mark
- The approval mark shall consist of:
- B5.3.1 a circle surrounding the letter “E” followed by the distinguishing number of the **Contracting Party**

which has granted approval;¹

B5.3.2 the number of the pertinent Regulation, followed by the letter "R", a dash and the approval number prescribed in paragraph 4.2.,. The first two digits of the approval number indicate the series of amendments in force at the time of issue of the approval;

B5.3.3. in the case of a lamp, also of the following symbols:

B5.3.3.1. symbols identifying the lighting or light signalling function for which type approval has been granted:

| Lighting or light signalling function (lamp) | Identification symbol |
|--|-----------------------|
| Driving (Main) beam headlamp | R |
| Passing (Dipped) beam headlamp | C |
| Front fog lamp Class B | B |
| Front fog lamp Class F3 | F3 |
| Adaptive Frontlighting System (AFS): basic passing beam | XC ² |
| Adaptive Frontlighting System (AFS): highway passing beam | XCE ² |
| Adaptive Frontlighting System (AFS): town passing beam | XCV ² |
| Adaptive Frontlighting System (AFS): adverse weather passing beam | XCW ² |
| Adaptive Frontlighting System (AFS): driving beam | XR ² |
| Reversing lamp | AR |
| Front direction indicator lamp to be installed more than 40 mm from dipped beam headlamp or front fog lamp | 1 |
| Front direction indicator lamp to be installed between 40 mm and 20 mm from dipped beam headlamp or front fog lamp | 1a |
| Front direction indicator lamp to be installed less than 20 mm from dipped beam headlamp or front fog lamp | 1b |
| Front direction indicator lamp to be installed on vehicles of category L | 11 |
| Rear direction indicator lamp (steady luminous intensity) | 2a |

¹ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.2/Amend.3 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

² In the case of a single installation unit the symbol "XC" is marked only once. In the case of more installation units each providing one or more AFS function(s) each unit is marked with the symbol "X" followed by the identification symbol(s) of the specific AFS function(s) provided.

| | |
|---|----------------------|
| Rear direction indicator lamp (variable luminous intensity) | 2b |
| Rear direction indicator lamp to be installed on vehicles of category L | 12 |
| Side direction indicator lamp for vehicles M1 and vehicles N1, M2 and M3 up to 6000 mm in length | 5 |
| Side direction indicator lamp for vehicles N2 and N3 and vehicles N1, M2 and M3 more than 6000 mm in length | 6 |
| Rear registration plate illuminating device | L |
| Front position lamp | A |
| Rear position lamp (steady luminous intensity) | R or R1 ³ |
| Rear position lamp (variable luminous intensity) | R2 ³ |
| Stop lamp (steady luminous intensity) | S1 ³ |
| Stop lamp (variable luminous intensity) | S2 ³ |
| Stop lamp (central high mounted) (steady luminous intensity) | S3 |
| Stop lamp (central high mounted) (variable luminous intensity) | S4 |
| Rear fog lamp (steady luminous intensity) | F1 |
| Rear fog lamp (variable luminous intensity) | F2 |
| Front end-outline marker lamp | AM |
| Rear end-outline marker lamp (steady luminous intensity) | RM1 |
| Rear end-outline marker lamp (variable luminous intensity) | RM2 |
| Side marker lamp for M1 vehicles | SM2 |
| Side marker lamp for all vehicle categories | SM1 |
| Cornering lamp | K |
| Daytime running lamp | RL |
| Manoeuvring lamp | ML |
| Parking lamp | None |

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On devices comprising both a rear position lamp and a stop-lamp, the letters "R" or "R1" or "R2" and "S1" or "S2" as the case may be, shall be separated by a horizontal dash.

| | |
|---|------|
| Retro reflector for motor vehicles (independent) | IA |
| Rear retro reflector for motor vehicles (combined with other signal lamps which are not watertight) | IB |
| Retro reflector for trailers (independent) | IIIA |
| Rear retro reflector for trailers (combined with other signal lamps which are not watertight) | IIIB |
| Rear wide angle retro reflector | IVA |
| Conspicuity marking (material for contour/strip marking) | C |
| Conspicuity marking (material for distinctive markings/graphics intended for a limited area) | D |
| Conspicuity marking (material for distinctive markings/graphics intended for an extended area) | E |

| | |
|---|-----|
| Conspicuity marking (materials for distinctive markings or graphics as base or background in printing process for fully coloured logos and markings of class "E" in use which fulfil the requirements of class "D" materials) | D/E |
| Retro reflecting marking for long or heavy vehicles (retro-reflective and fluorescent materials) | RF |
| Retro reflecting marking for long or heavy vehicles (retro-reflective only materials) | RR |
| Marking for slow moving vehicles (retro-reflective and fluorescent materials) | RF |
| Marking for slow moving vehicles (retro-reflective only materials) | RR |

B5.3.3.2. additional symbols for headlamps and AFS:

B5.3.3.2.1. In the case of headlamps/AFS installation unit meeting left-hand traffic requirements only, a horizontal arrow pointing to the right of an observer facing the headlamp, i.e. to the side of the road on which the traffic moves;

B5.3.3.2.2. In the case of headlamps/AFS installation unit designed to meet the requirements of both traffic systems by means of an appropriate adjustment of the setting of the optical unit or the filament lamp or LED module(s), a horizontal arrow with a head on each end, the heads pointing respectively to the left and to the right;

B5.3.3.2.3. In the case of headlamps/AFS installation unit incorporating a lens of plastic material, the group of letters "PL" to be affixed near the symbols identifying the lighting function prescribed in paragraphs B5.3.3.1.;

B5.3.3.2.4. In the case of headlamps/AFS installation unit meeting the requirements of the driving-beam, an indication, placed near the circle surrounding the letter "E", of the maximum luminous intensity expressed by a reference mark (I'_M), as defined as follows:

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

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

In the case of grouped or reciprocally incorporated driving-beam headlamps/AFS lighting unit, indication of the maximum luminous intensity of the driving-beams as a whole shall be expressed as above.

B5.3.3.2.5 in the case of headlamps/AFS installation unit so designed that the filament light source(s) or LED module(s) producing the principal passing-beam shall not be lit simultaneously with that of any other lighting function with which it may be reciprocally incorporated: an oblique stroke (/) shall be placed behind the symbol indicating the headlamp producing

vehicle indiscriminately:

- a horizontal arrow directed towards the front of the vehicle shall be added on side direction indicator lamps of category 5 and 6 and on parking lamps emitting light of amber colour towards the front and rear;
- an indication "R" or "L", indicating the right or left side of the vehicle, shall be added on side direction indicator lamps of category 6;

B5.3.3.3.2. in the case of devices with reduced light distribution a vertical arrow starting from a horizontal segment and directed downwards shall be added;

B5.3.3.3.3. in the case of devices which may be used as part of an assembly of two lamps, the additional letter "D" shall be added to the right of the symbol identifying the lighting function prescribed mentioned in paragraph B5.3.3.1.;

B5.3.3.3.4. in the case of interdependent lamps, which may be used as part of an interdependent lamp system, the letter "Y" shall be added to the right of the symbol identifying the lighting function prescribed in paragraph-B5.3.3.1. on each device.

B5.4. Other markings

Lighting and light signaling devices or systems shall bear, in indelible and clearly legible manner, the following markings:

B5.4.1. in the case of devices including a passing-beam designed to satisfy the requirements both of right-hand and of left-hand traffic, markings indicating the two settings of the optical unit on the vehicle or of the light source on the reflector; these markings shall consist of the letters "R/D" for the position for right-hand traffic and the letters "L/G" for the position for left-hand traffic;

B5.4.2. with the exception of devices with non-replaceable light sources, marking indicating:

- (a) the category or categories **of light source(s)** prescribed; and/or
- (b) the light source module specific identification code;

B5.4.3. in the case of lamps with:

- (a) an electronic light source control gear; or
- (b) a variable intensity control; and/or
- (c) a secondary operating mode; and/or
- (d) non-replaceable light sources; and/or
- (e) light source module(s);

marking of the rated voltage or range of voltage and rated maximum wattage;

B5.4.4. in the case of lamps with light source module(s), that shall be marked in accordance with the said Regulation, on the light source module(s) shall bear marking of:

- (a) the trade name or mark of the applicant;

(b) the specific identification code of the module;- This specific identification code shall comprise the starting letters "MD" for "MODULE" followed by the approval mark without the circle as prescribed in paragraph B5.3.1.; this identification code shall be shown in the drawings mentioned in paragraph 3.2.1. The approval mark does not have to be the same as the one on the lamp in which the module is used, but both marks shall be from the same applicant;

(c) the rated voltage or range of voltage **and rated maximum wattage**.

B5.4.5. on the electronic light source control gear or a variable intensity control being part of the lamp but not included into the lamp body, marking of the name of the manufacturer and its identification number.

B5.5. The approval number and the symbols prescribed in paragraphs B5.3.3. to B5.3.3.4. shall be placed close to the circle prescribed in paragraph B5.3.1. and either above or below the letter "E", or to the right or left of that letter. The digits of the approval number shall be on the same side of the letter "E" and face the same direction. The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

B5.6. Examples of the arrangement of vehicle and devices marks are shown in Annex 1 to [Pat II of] this Regulation.

B6. GENERAL REQUIREMENTS

B6.1 Each device supplied shall conform to the REQuIREMENTS set forth in the Regulation pertained to this device.

B6.2 The devices must be so designed and constructed that under 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 **Part II to this Regulation** and the Regulation under which they have been approved.

B6.3. In the case of replaceable **light source**:

B6.3.1. Any category or categories of **light source(s)** approved according to Regulation **No. 37, No. 99 or No. 128** may be used, provided that no restriction on the use is made **in the pertinent Regulation and in the relevant Regulation No. 37, No. 99 or No. 128** and its series of amendments in force at the time of application for type approval.

B6.3.2. The design of the device shall be such that the **light source(s)** can be fixed in no other position but the correct one.

B6.3.3. 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.

Version as approved by GRE 69 see Documents ECE/TRANS/WP.29/GRE/2013/17, and ECE/TRANS/WP.29/2013/69 and paragraph 19 to the report ECE/TRANS/WP.29/GRE/69 and as amended in the discussion in GRE71

"B6.4. In the case of non-replaceable filament lamp(s) or light source module(s) equipped with non-replaceable filament lamp(s), the applicant shall annex to the type approval documentation a report, acceptable to the Authority responsible for type approval, that demonstrates compliance of these non-replaceable filament lamp(s) with lifetime requirements and, in the case of colour coated filament lamps, also with colour endurance requirements as specified in paragraph 2.11 of IEC 60809, Edition 3."

B6.5. For a device equipped with a light source module:

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- B6.5.1 The design of the light source module(s) shall be such that even in darkness the light source module(s) can be fitted in no position but the correct one;
- B6.5.2 The light source module(s) shall be
- tamperproof.
 - 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
 - So designed that regardless of the use of tool(s), it is not mechanically interchangeable with any replaceable approved light source.
- B6.5.3. A LED module does not need to be replaceable, if so stated in the communication sheet of the component type approval.

B6.6. COLOUR OF LIGHT EMITTED

The colour of the light emitted by any lamp **or the reflected-light of the device** shall fulfil the requirements of Annex B4.

In the case of light signalling lamps these requirements shall apply to the light emitted inside the field of the light distribution grid specified in each Regulation; outside this field, no sharp variation of colour shall be observed.

These requirements shall also apply within the range of variable luminous intensity produced by variable intensity lamps.

In the case of retro-reflectors or retro-reflecting devices these requirements shall apply to the measuring procedures as specified in the pertinent Regulation.

In the case of head lamps these requirements shall apply to the light emitted inside the field of the light distribution specified in each Regulation; outside this field, no sharp variation of colour shall be observed.

B7. GENERAL REQUIREMENTS WITH REGARD TO SIGNALLING LAMPS

See reg 7 new proposal!!!

- B7.1 The limits of the apparent surface in the direction of the reference axis of a light-signalling device shall be determined.
- B7.2. Devices, which are reciprocally incorporated with another function, using a common light source, and designed to operate permanently with an electronic light source control gear to regulate the intensity of the light emitted, are permitted.
- B7.3. Grouped, combined or reciprocally incorporated or single lamps
- B7.3..1. Lamps may be grouped, combined or reciprocally incorporated with one another provided that all requirements regarding colour, position, orientation, geometric visibility, electrical connections and other requirements, if any, are fulfilled.
- B7.3..1.1. The photometric and colorimetric requirements of a lamp shall be fulfilled when all other functions with which this lamp is grouped, combined or reciprocally incorporated are switched OFF.
- However, when a front or rear position lamp is reciprocally incorporated with one or more other function(s) which can be activated together with them, the requirements regarding colour of each of these other functions shall be fulfilled when the reciprocally incorporated function(s) and the front or rear position lamps are switched ON.

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- B7.3..1.2. Stop lamps and direction-indicator lamps are not permitted to be reciprocally incorporated.
- B7.3..1.3. Where stop lamps and direction-indicator lamps are grouped, the following conditions shall be met:
- B7.3..1.3.1. Any horizontal or vertical straight line passing through the projections of the apparent surfaces of these functions on a plane perpendicular to the reference axis, shall not intersect more than two borderlines separating adjacent areas of different colour;
- B7.3..1.3.2. Their apparent surfaces in the direction of the reference axis, based upon the areas bounded by the outline of their light emitting surfaces, do not overlap.
- B7.3..2. Single lamps:
- B7.3..2.1. Single lamps as defined in paragraph **B2.5.16.1. (a)**, composed of two or more distinct parts, shall be installed in such a way that:
- (a) Either the total area of the projection of the distinct parts on a plane tangent to the exterior surface of the outer lens and perpendicular to the reference axis shall occupy not less than 60 per cent of the smallest quadrilateral circumscribing the said projection; or
 - (b) The minimum distance between the facing edges of two adjacent/tangential distinct parts shall not exceed 75 mm when measured perpendicularly to the reference axis.

These requirements shall not apply to a single retro-reflector."

- B7.3.2.2. Single lamps as defined in paragraph **B2.5.16.1. (b) or (c)**, composed of two lamps marked "D" or two independent retro reflectors, shall be installed in such a way that:
- (a) Either the projection of the apparent surfaces in the direction of the reference axis of the two lamps or retro reflectors occupies not less than 60 per cent of the smallest quadrilateral circumscribing the projections of the said apparent surfaces in the direction of the reference axis; or
 - (b) The minimum distance between the facing edges of the apparent surfaces in the direction of the reference axis of two lamps or two independent retro reflectors does not exceed 75 mm when measured perpendicularly to the reference axis."
- B7.3.2.3. Single lamps as defined in paragraph **B2.3.21.1. (d)** shall fulfil the requirements of paragraph B7.3.2.1.."

Where two or more lamps and/or two or more separate apparent surfaces are included into the same lamp body and/or have a common outer lens these shall not be considered as an interdependent lamp system.

However, a lamp in the shape of a band or strip may be part of an interdependent lamp system."

- B7.3.2.4. Two lamps or an even number of lamps in the shape of a band or strip shall be placed symmetrically in relation to the median longitudinal plane of the vehicle, extending on both sides to within at least 0.4 m of the extreme outer edge of the vehicle, and are not less than 0.8 m long; the illumination of such a surface shall be provided by not less than two light sources placed as close as possible to the ends; the light-emitting surface may be constituted by a number of juxtaposed elements on condition that these individual light-emitting surfaces, when projected on a transverse plane fulfil the requirements of paragraph B7.3.2.1.."

B7.3.2.5. An interdependent lamp system shall meet the requirements when all its interdependent lamps are operated together.

However, if the interdependent lamp system providing a rear function is partly mounted on the fixed component and partly mounted on a movable component, the interdependent lamp(s) specified by the Applicant shall meet the geometric visibility, colorimetric and photometric requirement, at all fixed positions of the movable component(s). This does not apply to interdependent lamp(s) intended for fitting on vehicle(s) where, to fulfil or complete the geometric visibility angle, additional lamps are activated when the movable component is in any fixed open position, provided that these additional lamps satisfy all the position, photometric and colorimetric requirements applicable to the lamps installed on the movable component.

B7.4. However, if a front or rear position lamp is reciprocally incorporated with a direction-indicator the electrical connection of the front position lamp on the relevant side of the vehicle or the reciprocally incorporated part of it may be such that it is switched off during the entire period (both ON and OFF cycle) of activation of the direction-indicator lamp.

B7.5. In the absence of specific instructions, the photometric characteristics (e.g. intensity, colour, apparent surface, etc.) of a lamp shall not be intentionally varied during the period of activation of the lamp.

B7.5.1. Direction-indicator lamps, the vehicle-hazard warning signal, amber side-marker lamps complying with paragraph A6.18.7. and the emergency stop signal shall be flashing lamps.

B7.5.2. The photometric characteristics of any lamp may vary:

- (a) In relation to the ambient light;
- (b) As a consequence of the activation of other lamps; or
- (c) When the lamps is being used to provide another lighting function;

provided that any variation in the photometric characteristics is in compliance with the technical provisions for the lamp concerned.

B7.5.3. The photometric characteristics of a direction indicator lamp of categories 1, 1a, 1b, 2a or 2b may be varied during a flash by sequential activation of light sources as specified in paragraph 5.6. of Regulation No. 6.

This provision shall not apply when direction indicator lamps of categories 2a and 2b are operated as emergency stop signal according to paragraph A6.23.1..

B7.6. In all cases, the distance between the rear fog-lamp and each stop-lamp shall be greater than 100 mm.

B7.7. The test procedures for Signalling lamps are described in Annex B5.

B7.8. In the case of signalling lamps, the heat resistance test, if applicable in the individual Regulation, shall be carried out **in accordance to part A in Annex B10.**

B8. GENERAL REQUIREMENTS WITH REGARD TO HEAD LAMPS

- B8.1. Each sample shall conform to the **requirements** set forth in paragraphs 6. to 8. **of the pertinent Regulation.**
- B8.2. Headlamps 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.
- B8.2.1. Headlamps shall be fitted with a device enabling them to be so adjusted on the vehicles as to comply with the rules applicable to them. Such a device need not be fitted on units in which the reflector and the diffusing lens cannot be separated, provided the use of such units is confined to vehicles on which the headlamp setting can be adjusted by other means.
- B8.2.2** Where a headlamp providing a principal passing-beam and a headlamp providing a driving-beam, each equipped with its own **light source** 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 headlamp assemblies whose reflectors are indivisible.-
- B8.3. The headlamp shall be equipped with **a light source(s) according to paragraph B6.3.**
- B8.3.1. And/or LED module(s) **according to paragraph B6.4.:**
- B8.3.1.1. Electronic light source control gear(s), if applicable, shall be considered to be part of the headlamp; they may be part of the LED module(s);
- B8.3.1.2. The headlamp, if equipped with LED modules, and the LED module(s) themselves shall comply with the relevant requirements specified in Annex B13. The compliance with the requirements shall be tested.
- B8.3.1.3. The total objective luminous flux of all LED modules producing the principal passing-beam and measured as described in paragraph 5. of Annex shall be equal or greater than 1,000 lumens.
- B8.3.1.4. In the case of a replaceable LED module the removal and replacement of this LED module, as described in Annex B13, paragraph 1.4.1. shall be demonstrated to the satisfaction of the Technical Service.
- B8.4. Headlamps **with asymmetrical beam patterns only** designed to satisfy the requirements both of right hand and of left hand traffic may be adapted for traffic on a given side of the road either by an appropriate initial setting when fitted on the vehicle or by selective setting by the user. Such initial or selective setting may consist, for example, of fixing either the optical unit at a given angle on the vehicle or the filament lamp or LED module(s) producing the principal passing-beam at a given angle/position in relation to the optical unit. In all cases, only two different and clearly distinct settings, one for right hand and one for left-hand traffic, shall be possible, and the design shall preclude inadvertent shifting from one setting to the other or setting in an intermediate position. Where two different setting positions are provided for the filament lamp or LED module(s) producing the principal passing-beam, the components for attaching the filament lamp or LED module(s) producing the principal passing-beam to the reflector must be so designed and made that, in each of its two settings, this filament lamp or LED module(s) will be

held in position with the precision required for headlamps designed for traffic on only one side of the road. Conformity with the requirements of this paragraph shall be verified by visual inspection and, where necessary, by a test fitting.

- B8.5. Complementary tests shall be done according to the requirements of Annex B10 to ensure that in use there is no excessive change in photometric performance.
- B8.6. Light transmitting components made of plastic material shall be tested according to the requirements of Annex B11.
- B8.7. On headlamps 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 for these purposes shall be so constructed that:
- B8.7.1. 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.
- B8.7.2. 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 6.2.; of the pertinent Regulation** 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).
- 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.
- B8.7.3. Either the principal passing-beam or the driving-beam shall always be obtained without any possibility of the mechanism stopping in between two positions;
- B8.7.4. The user cannot, with ordinary tools, change the shape or position of the moving parts.
- B8.8. Illumination configuration **of headlamps with asymmetrical beam patterns only** for different traffic conditions
- B8.8.1. In the case of headlamps designed to meet the requirements of traffic moving on one side of the road (either right or left) only, appropriate measures shall be taken to prevent discomfort to road-users in a country where traffic moves on the side of the road opposite to that of the country for which the headlamp was designed⁴. Such measures may be:

⁴ Instructions on the installation of lamps fitted with the measures are given in Regulation No. 48.

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- (a) Occulting a part of the outer headlamp lens area;
 - (b) Downward movement of the beam. Horizontal movement is allowed;
 - (c) Any other measure to remove or reduce the asymmetrical part of the beam.
- B8.8.2. Following the application of this (these) measure(s) the following requirements regarding the luminous intensity of the headlamp shall be met with the adjustment left unchanged compared to that for the original traffic direction:
- B8.8.2.1. Passing-beam designed for right-hand traffic and adapted to left-hand traffic:
at 0.86D-1.72L at least 2,500 cd;
at 0.57U-3.43R not more than 880 cd.
- B8.8.2.2. Passing-beam designed for left-hand traffic and adapted to right-hand traffic:
at 0.86D-1.72R at least 2,500 cd;
at 0.57U-3.43L not more than 880 cd.
- B8.9. In case of a passing-beam headlamp incorporating a light source or LED module(s) producing the principal passing-beam and having a total objective luminous flux which exceeds 2,000 lumens, a reference shall be made in item 9. of the communication form in Annex 1 **of the pertinent Regulation**. The objective luminous flux of LED modules shall be measured as described in paragraph 5. of Annex B13 to this Regulation.
- B8.10. The definitions in **paragraphs B2.8.4. and B2.8.8.** allow the use of LED modules, which may contain holders for other light sources. Notwithstanding this provision a mixture of LED(s) and other light sources for the principal dipped beam or the contributor to the bend lighting or each driving-beam, as specified by this Regulation is not allowed.
- B8.11. 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.

B9. GENERAL REQUIREMENTS WITH REGARD TO RETRO – REFLECTING DEVICES

- B9.1. Retro-reflecting devices or retro-reflective marking materials must be so constructed that they function satisfactorily and will continue to do so in normal use. In addition, they must not have any defect in design or manufacture that is detrimental to their efficient operation or to their maintenance in good condition.
- B9.2. The components of retro-reflecting devices or retro-reflective marking materials or parts thereof shall not be capable of being easily dismantled.
- B9.3. The means of attachment of the marking materials shall be durable and stable.
- B9.4.. The outer surface of retro-reflecting devices or retro-reflective marking materials shall be easy to clean. The surface shall therefore not be rough and any protuberances they may exhibit shall not prevent easy cleaning.
- B9.5. There shall be no access to the inner surface of the retro-reflectors when in normal use.
- B9.6. The test procedures for retro - reflecting devices or retro – reflecting marking materials are described in **Annex B7**.

B10. MODIFICATIONS OF A TYPE OF LAMP FOR MOTOR VEHICLES AND THEIR TRAILERS AND EXTENSION OF APPROVAL

- B10.1 **Every modification of the vehicle type, or of the installation of its lighting or light-signalling devices, or of the list referred to in paragraph A3.2.2. or every modification of a type of lamp shall be notified to the administrative department which approved the type. The department may then either:**
- B10.1.1 Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the device still complies with the requirements; or
- B10.1.2 Require a further test report from the technical service responsible for conducting the tests.
- B10.2 Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph B4.3. , to the Parties to the Agreement applying individual device Regulations.
- B10.3 The Competent Authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying the Regulation under which the approval has been granted by means of a communication form conforming to the model in **Annex 1** to each pertinent Regulation.

B11. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

- B11.1** The approval granted in respect of
- **vehicle pursuant to this Regulation may be withdrawn if the requirements are not complied with or if a vehicle bearing the approval mark does not conform to the type approved;** or
 - a device pursuant to a Regulation may be withdrawn if the foregoing requirements are not met;
- B11.2 If a Contracting Party to the Agreement which applies a Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying individual device Regulations, by means of a communication form conforming to the model in **Annex 1** to each Regulation.

B12. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture

-
- a type of vehicle approved in accordance with the Regulation for the installation of its lighting or light-signalling devices or
 - a device approved in accordance with the pertinent Regulations,

he shall so inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the 1958 Agreement applying pertinent Regulations by means of a communication form conforming to the model in **Annex 1** to each pertinent Regulation.

B13. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF ADMINISTRATIVE DEPARTMENTS

The Parties to the 1958 Agreement which apply a Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Administrative Departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, or the definitive discontinuation of production issued in other countries, are to be sent.

Annex B1

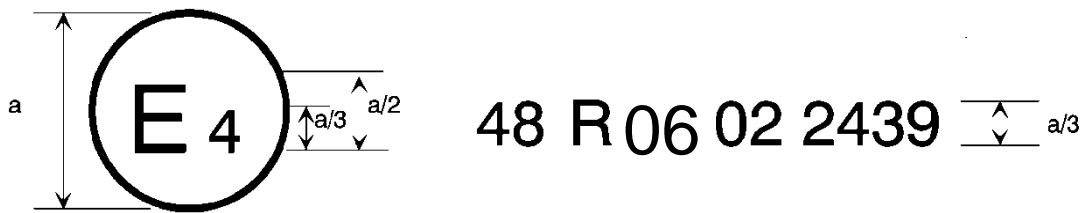
ARRANGEMENT OF APPROVAL MARKS

The following approval marks arrangements are given merely as examples and any other different arrangement made in accordance to the pertinent paragraphs of **section 5 in** [is acceptable] [shall be accepted].

1. Vehicle mark

Model **A1**

(See paragraph **B5.1.1.**)

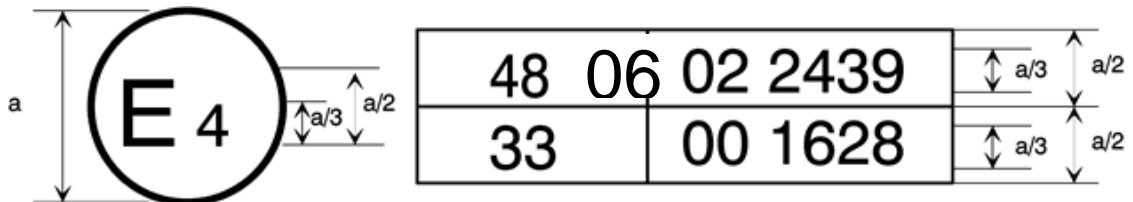


$a = 8 \text{ mm min.}$

The above approval mark affixed to a vehicle shows that the vehicle type concerned has, with regard to the installation of lighting and light-signalling devices, been approved in the Netherlands (E4) pursuant to Regulation No. 48 as amended by the 06 series of amendments. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No. 48 as amended by the 06 series of amendments.

Model **A2**

(See paragraph **4.5. B5.1.2.**)



$a = 8 \text{ mm min.}$

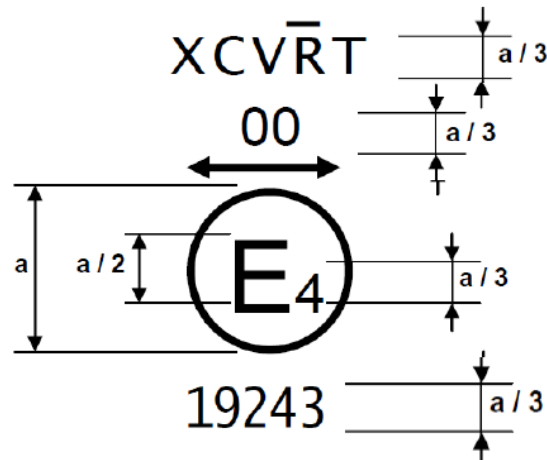
The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in the Netherlands (E4) pursuant to Regulation No. 48 as amended by the 06 series of amendments and Regulation No. 33⁵¹. The approval number indicates that, at the dates when the respective approvals were given, Regulation No. 48 was amended by the 06 series of amendments and Regulation No. 33 was still in its original form.

¹ The second number is given merely as an example.

2. Lamps mark

2.1. Approval mark of independent lamps (See paragraph B5.2.1.

Model B1 - Lighting devices



a = 8 mm min. on glass

a = 5 mm min. on plastic material

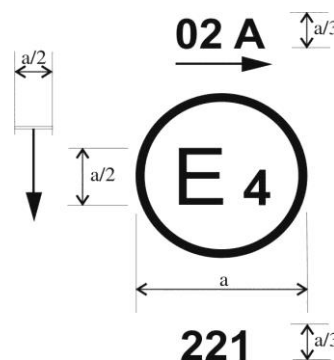
The device bearing the above approval mark is an installation unit of an AFS approved in the Netherlands (E 4) under approval number 12493 pursuant to Regulation No. 123.

The number mentioned below the functions identification symbols indicates that approval was granted in accordance with the requirements of Regulation No. 123 in its original form (00).

The functions identification symbols show that the approval was granted in respect of the driving-beam (R) and the Class C and Class V passing-beam. The double pointed arrow show that the passing beam is suitable for both traffic systems by means of an appropriate adjustment of the setting of the optical element or the light source on the vehicle. Class C passing-beam, Class V passing-beam and driving-beam comply to bending lighting provisions, as indicated by the letter "T". The score above the letter "R" indicates that the driving-beam function is provided by more than one installation unit on that side of the system.

Number 30 indicates that the maximum luminous intensity of the driving-beam is between 123,625 and 145,125 candelas.

Model B2 - Light signalling devices



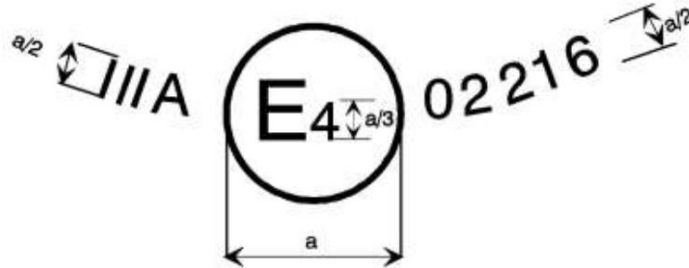
a = 5 mm min.

The device bearing the approval mark shown above is a front position lamp (A) approved in the Netherlands (E4), under approval number 221 pursuant to Regulation No. 7.

The number (02) mentioned close to the symbol "A" indicates that approval was granted in accordance with the requirements of Regulation No. 7 as amended by the 02 series of amendments. The horizontal

arrow indicates the outwards of the vehicle The vertical arrow starting from a horizontal segment and directed downwards indicates a devices with reduced light distribution (vertically downwards and/or horizontally below the H plane as defined in paragraph **B2.3.9.**)

Model B3 - Retro reflecting devices [and materials]




a = 4 mm min.

The device bearing the approval mark shown above is a retro-reflecting device of class III A approved in the Netherlands (E 4) under approval number 02216. The first two digits of the approval number (02) indicates that approval was granted in accordance with the requirements of Regulation No. 3 as amended by the 02 series of amendments.


2.1. Single approval mark of grouped, combined or reciprocally incorporated lamps (See paragraph **B5.2.2.**)

Note: The vertical and horizontal lines schematize the shape of the light-signalling device. These are not part of the approval mark.

Model C1

| | | | |
|--|---|---------------|---------------|
| | 3333 IA 02  | 2b → 01 | R2 → 02 |
| | F2 00 | AR 00 | S2 02 |


Model C2

| | | | |
|--|---|---------------|---------------|
| | 3333 IA 02  | 2b → 01 | R2 → 02 |
| | F2 00 | AR 00 | S2 02 |



| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

Model C3

| | | | |
|--|--|--|--|
| IA 2b R2 02 → → 01 02 F2 AR S2 00 00 02 3333  | | | |
| | | | |


÷

These three examples of approval marks (models C1, C2 and C3) represent three possible variables for the marking of a light signalling device when two or more lamps are part of the same assembly of grouped, combined or reciprocally incorporated lamps.

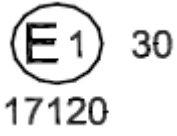
They indicate that the device was approved in the Netherlands (E4) under approval number 3333 and comprises:

- (a) A retro-reflector of class 1A approved in accordance with the 02 series of amendments to Regulation No. 3;
- (b) A rear direction indicator lamp with variable luminous intensity (category 2b) approved in accordance with the 01 series of amendments to Regulation No. 6;
- (c) A rear position lamp with variable luminous intensity (R2) approved in accordance with the 02 series of amendments to Regulation No. 7;
- (d) A rear fog lamp with variable luminous intensity (F2) approved in accordance with Regulation No. 38 in its original version;
- (e) A reversing lamp (AR) approved in accordance with Regulation No. 23 in its original version;
- (f) A stop-lamp with variable luminous intensity (S2) approved in accordance with the 02 series of amendments to Regulation No. 7.

Model D1

| | | | | |
|--|---|--------------|-------|-------|
| |  30 17120 02 A 02 HCR → ←→ | 02 B 00 K | 00 RL | 01 1a |
|--|---|--------------|-------|-------|

Model D2

| | | | | |
|--|---|--|--|--|
| | 02 A 02 HCR 02 B 00 K 00 RL 01 1a → ↔ | | | |
| |  | | | |

Model **D3**


| | | | | | | |
|---|--------------|-------|-------|--|--|--|
| 02 A → 02 HCR ↔ | 02 B 00 K | 00 RL | 01 1a | | | |
|  | | | | | | |

These three examples of approval marks above, models D, E and F, correspond to a lighting device approved in Germany (E1) under approval number 17120, and incorporating:

- (a) A front position lamp (A) approved in accordance with the 02 series of amendments to Regulation No. 7;
- (b) A headlamp (HCR) with a passing beam designed for right-hand and left-hand traffic and a driving beam with a maximum intensity comprised between 86,250 and 101,250 candelas (indicated by the figure 30), approved in accordance with the 02 series of amendments to Regulation No. 20;
- (c) A front direction indicator lamp (of category 1a) approved in accordance with the 01 series of amendments to Regulation No. 6;
- (d) Daytime running lights (RL) approved in accordance with the 00 series of amendments to Regulation No. 87;
- (e) A front fog lamp (B) approved in accordance with the 02 series of amendments to Regulation No. 19 in models D and E;
- (f) A cornering lamp (K) approved in accordance with the 00 series of amendments to Regulation No. 119 in model F.

3. Approval mark of a device the lens of which is intended to be used in different types of lamps (See paragraph B5.2.3.)

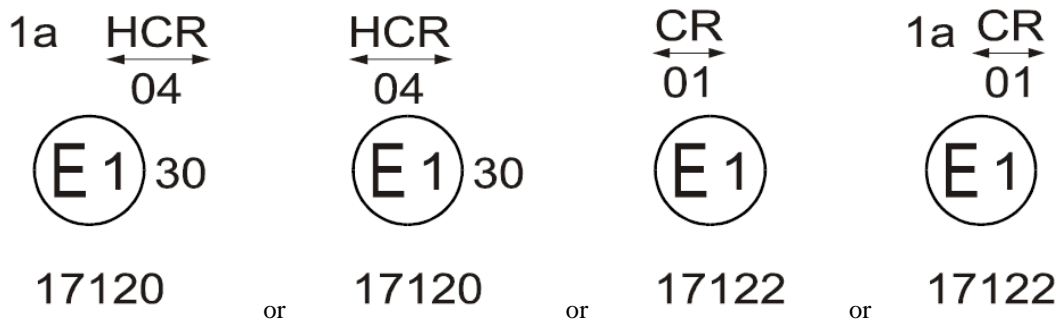
Model E1

30 
 1a HCR CR
 01 ← 04 → 01
 17120
 17122

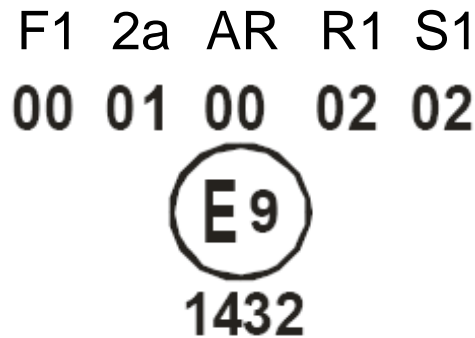
The above example corresponds to the marking of a lens intended to be used in different types of headlamps, namely either:

- (a) A headlamp with a passing beam designed for right-hand and left-hand traffic and a driving beam with a maximum intensity comprised between 86,250 and 101,250 candelas (indicated by the number 30), approved in Germany (E1) in accordance with the requirements of Regulation No. 8 as amended by the 04 series of amendments; which is reciprocally incorporated with a front direction indicator (category 1a) approved in accordance with the 01 series of amendments to Regulation No. 6; or
- (b) A headlamp with a passing beam designed for right-hand and left-hand traffic and a driving beam, approved in Germany (E1) in accordance with the requirements of Regulation No. 1 as amended by the 01 series of amendments, which is reciprocally incorporated with the same front direction indicator as above; or even
- (c) Either of the above-mentioned headlamps approved as a single lamp.

The main body of the headlamp shall bear the only valid approval mark, for instance:



Model E2



The above example corresponds to the marking of a lens intended to be used in different types of light signalling lamps. The approval marks indicate that the device was approved in Spain (E9) under approval number 1432 and comprises:

- (a) A rear fog lamp (F) of category F1 (steady luminous intensity) approved in accordance with Regulation No. 38 in its original version;
- (b) A rear direction indicator lamp of category 2a (steady luminous intensity) approved in accordance with the 01 series of amendments to Regulation No. 6;
- (c) A reversing lamp (AR) approved in accordance with Regulation No. 23 in its original version;
- (d) A rear position lamp of category R1 (steady luminous intensity) approved in accordance with the 02 series of amendments to Regulation No. 7;
- (e) A stop-lamp of category S1 (steady luminous intensity) approved in accordance with the 02 series of amendments to Regulation No. 7.

The main body of the device shall bear the only valid approval mark.

Identification code of light source modules (See paragraph B5.4.4.)

MD E3 17325

The light source module bearing the identification code shown above has been approved together with a lamp approved in Italy (E3) under approval number 17325.

Annex B2

MINIMUM REQUIREMENTS FOR CONFORMITY OF PRODUCTION CONTROL PROCEDURES

1. GENERAL

- 1.1 The conformity requirements shall be considered satisfied from a mechanical and geometric standpoint, if the differences do not exceed inevitable manufacturing deviations within the requirements of this Horizontal Reference Document and the Regulation under which the lamp has been approved.
- 1.2 With respect to photometric performances, the conformity of mass-produced lamps shall not be contested if, when testing photometric performances of any lamp chosen at random according to **paragraph 7 of the pertinent Regulation**.
- 1.2.1 If, in the case of a lamp equipped with a replaceable light source and if results of the test described above do not meet the requirements, tests on lamps shall be repeated using another standard filament lamp.
- 1.3 The chromaticity coordinates shall be complied with when tested under conditions of paragraph 8 of this Horizontal Reference Document.

Version as approved by GRE 69 see Documents ECE/TRANS/WP.29/GRE/2013/17, and ECE/TRANS/WP.29/2013/69 and paragraph 19 to the report ECE/TRANS/WP.29/GRE/69 and as amended in the discussion in GRE71

"1.4. In the case of non-replaceable filament lamp(s) or light source module(s) equipped with non-replaceable filament lamps, at any conformity of production check:

1.4.1. the holder of the approval mark shall demonstrate the use in normal production and show the identification of the non-replaceable filament lamp(s) as indicated in the type approval documentation;

1.4.2. in the case where doubt exists in respect to compliance of the non-replaceable filament lamp(s) with lifetime requirements and/or, in the case of colour coated filament lamps, with colour endurance requirements, as specified in paragraph 2.11 of IEC 60809, Edition 3, conformity shall be checked as specified in paragraph 2.11 of IEC 60809, Edition 3."

2. MINIMUM REQUIREMENTS FOR VERIFICATION OF CONFORMITY BY THE MANUFACTURER

For each type of lamp the holder of the approval mark shall carry out at least the following tests, at appropriate intervals. The tests shall be carried out in accordance with the provisions of this Horizontal Reference Document and the Regulation under which the lamp has been approved.

If any sampling shows non-conformity with regard to the type of test concerned, further samples shall be taken and tested. The manufacturer shall take steps to ensure the conformity of the production concerned.

2.1 Nature of tests

Tests of conformity in this Horizontal Reference Document shall cover the photometric and colorimetric characteristics.

2.2 Methods used in tests

2.2.1 Tests shall generally be carried out in accordance with the methods set out in this Horizontal Reference Document and in Regulation pertaining to the specific device.

2.2.2 In any test of conformity carried out by the manufacturer, equivalent methods may be used with the consent of the competent authority responsible for approval tests. The manufacturer is responsible for

proving that the applied methods are equivalent to those laid down in this Horizontal Reference Document.

2.2.3 The application of paragraphs 2.2.1 and 2.2.2 requires regular calibration of test apparatus and its correlation with measurements made by a competent authority.

2.2.4 In all cases the reference methods shall be those of this Horizontal Reference Document and in Regulation pertaining to the specific device, particularly for the purpose of administrative verification and sampling.

2.3 Nature of sampling

Samples of lamps shall be selected at random from the production of a uniform batch. A uniform batch means a set of lamps of the same type, defined according to the production methods of the manufacturer.

The assessment shall in general cover series production from individual factories. However, a manufacturer may group together records concerning the same type from several factories, provided these operate under the same quality system and quality management.

2.4 Measured and recorded photometric characteristics

The sampled lamp shall be subjected to photometric **and colorimetric** measurements ~~for the minimum~~ values at the points listed in **Paragraph 10.1.2. of the pertinent Regulation** under which it has been approved.

2.5 Criteria governing acceptability

The manufacturer is responsible for carrying out a statistical study of the test results and for defining, in agreement with the competent authority, criteria governing the acceptability of his products in order to meet the requirements laid down for verification of conformity of products in **paragraph 10.1 of the pertinent Regulation**.

The criteria governing the acceptability shall be such that, with a confidence level of 95%, the minimum probability of passing a spot check in accordance with **Annex B3**. (first sampling) would be 0.95.

Annex B3

MINIMUM REQUIREMENTS FOR SAMPLING BY AN INSPECTOR

Current Version:

1. GENERAL

- 1.1 The conformity requirements shall be considered satisfied from a mechanical and a geometric standpoint, in accordance with the requirements of this Horizontal Reference Document and the Regulation under which the lamp has been approved, if any, if the differences do not exceed inevitable manufacturing deviations.
- 1.2 With respect to photometric performances, the conformity of mass-produced lamps shall not be contested if, when testing photometric performances of any lamp chosen at random according to paragraph 8 of this Horizontal Reference Document:
- 1.2.1 No measured value deviates unfavourably by more than 20% from the values prescribed in the Regulation under which it has been approved;
- 1.2.2 If, in the case of a lamp equipped with a replaceable light source and if results of the test described above do not meet the requirements, tests on lamps shall be repeated using another standard filament lamp;
- 1.2.3 Lamps with apparent defects are disregarded.
- 1.3 The chromaticity coordinates shall be complied with when tested under conditions of paragraph 8 of this Horizontal Reference Document.

2. FIRST SAMPLING

In the first sampling four lamps are selected at random. The first sample of two (the first and third lamps) is marked A, the second sample of two (the second and fourth lamps) is marked B.

2.1 The conformity is not contested

- 2.1.1 Following the sampling procedure shown in Figure 1 of this annex the conformity of mass-produced lamps shall not be contested if the deviations of the measured values of the lamps in the unfavourable directions are:

2.1.1.1 Sample A

| | |
|----------------------------------|-----|
| A1: one lamp | 0% |
| for the other lamp not more than | 20% |
| A2: both lamps more than | 0% |
| but not more than | 20% |
| go to sample B | |

2.1.1.2 Sample B

B1: both lamps 0%

2.1.2 or if the conditions of paragraph 1.2.2 for sample A are fulfilled.

2.2 The conformity is contested

2.2.1 Following the sampling procedure shown in Figure 1 of this annex the conformity of mass-produced lamps shall be contested and the manufacturer requested to make his production meet the requirements (alignment) if the deviations of the measured values of the lamps are:

2.2.1.1 Sample A

A3: one lamp not more than 20%
the other lamp more than 20%
but not more than 30%

2.2.1.2 Sample B

B2: in the case of A2
one lamp more than 0%
but not more than 20%
the other lamp not more than 20%

B3: in the case of A2
one lamp 0%
the other lamp more than 20%
but not more than 30%

2.2.2 or if the conditions of paragraph 1.2.2 for sample A are not fulfilled.

2.3 Approval withdrawn

Conformity shall be contested and point 11 applied if, following the sampling procedure in Figure 1 of this annex, the deviations of the measured values of the lamps are:

2.3.1 Sample A

A4: one lamp not more than 20%
the other lamp more than 30%

A5: both lamps more than 20%

2.3.2 Sample B

| | | | |
|-----|--------------------------|-----|--|
| B4: | in the case of A2 | | |
| | one lamp more than | 0% | |
| | but not more than | 20% | |
| | the other lamp more than | 20% | |
| B5: | in the case of A2 | | |
| | both lamps more than | 20% | |
| B6: | in the case of A2 | | |
| | one lamp | 0% | |
| | the other lamp more than | 30% | |

2.3.3 or if the conditions of paragraph 1.2.2 for samples A and B are not fulfilled.

3. REPEATED SAMPLING

In the cases of A3, B2, B3 a repeated sampling, third sample C of two lamps and fourth sample D of two lamps, selected from stock manufactured after alignment, is necessary within two months' time after the notification.

3.1 The conformity is not contested

3.1.1 Following the sampling procedure shown in Figure 1 of this annex the conformity of mass-produced lamps shall not be contested if the deviations of the measured values of the lamps are:

3.1.1.1 Sample C

| | | | |
|-----|------------------------------|-----|--|
| C1: | one lamp | 0% | |
| | the other lamp not more than | 20% | |
| C2: | both lamps more than | 0% | |
| | but not more than | 20% | |
| | go to sample D | | |

3.1.1.2 Sample D

| | | | |
|-----|-------------------|----|--|
| D1: | in the case of C2 | | |
| | both lamps | 0% | |

3.1.2 or if the conditions of paragraph 1.2.2 for sample C are fulfilled.

3.2 The conformity is contested

3.2.1 Following the sampling procedure shown in Figure 1 of this annex the conformity of mass-produced lamps shall be contested and the manufacturer requested to make his production meet the requirements (alignment) if the deviations of the measured values of the lamps are:

3.2.1.1 Sample D

| | | |
|-----|------------------------------|-----|
| D2: | in the case of C2 | |
| | for both lamps | 0% |
| | but not more than | 20% |
| | the other lamp not more than | 20% |

3.2.1.2 or if the conditions of paragraph 1.2.2 for sample C are not fulfilled.

3.3 Approval withdrawn

Conformity shall be contested and point 12 applied if, following the sampling procedure in Figure 1 of this annex, the deviations of the measured values of the lamps are:

3.3.1 Sample C

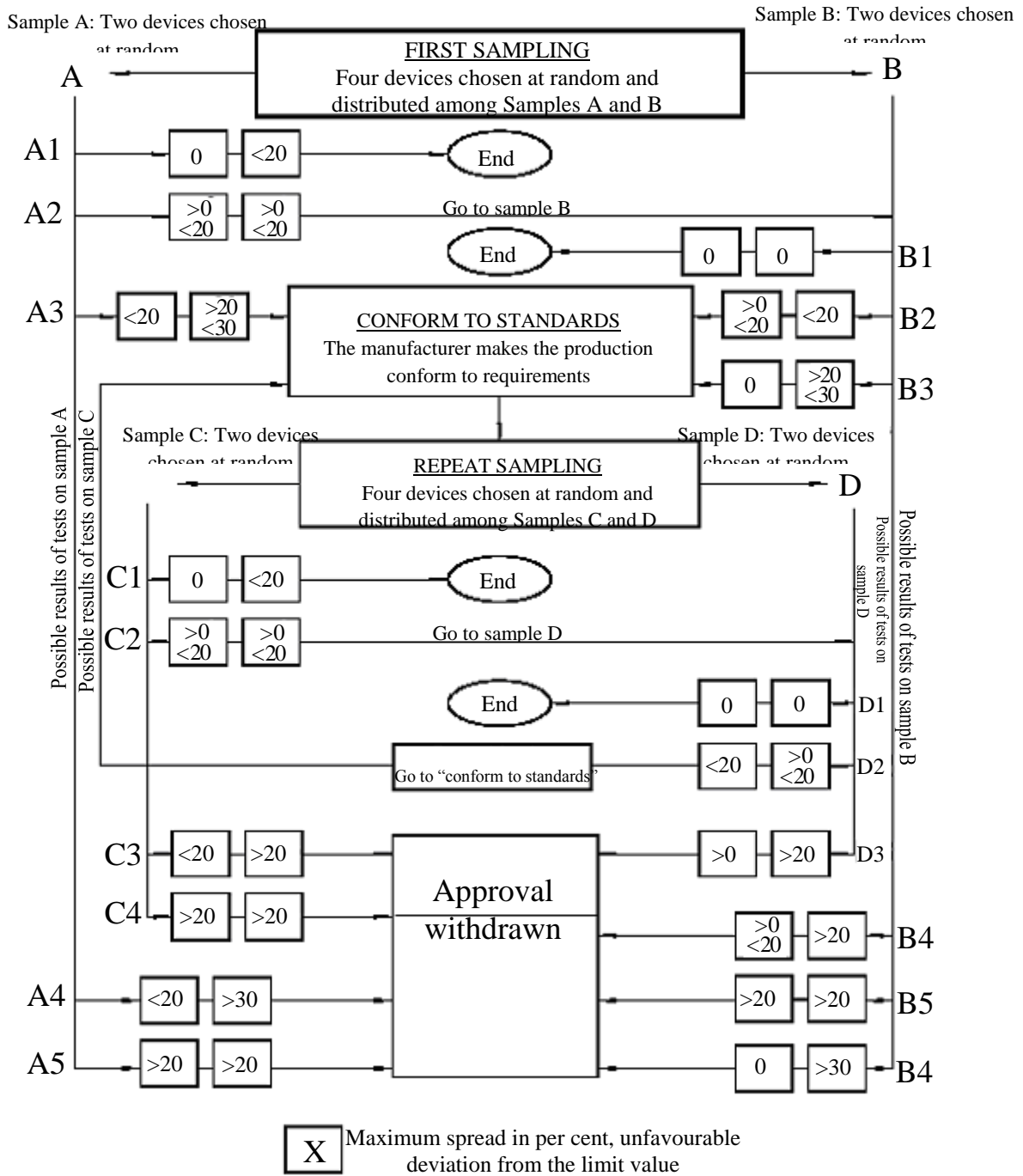
| | | |
|-----|--------------------------|-----|
| C3: | one lamp not more than | 20% |
| | the other lamp more than | 20% |
| C4: | both lamps more than | 20% |

3.3.2 Sample D

| | | |
|-----|----------------------------|-----|
| D3: | in the case of C2 | |
| | one lamp 0 %, or more than | 0% |
| | the other lamp more than | 20% |

3.3.3 or if the conditions of paragraph 1.2.2 for samples C and D are not fulfilled.

Figure 1



Version as approved by GRE 69 see Documents ECE/TRANS/WP.29/GRE/2013/21, to ECE/TRANS/WP.29/GRE/2013/37 and paragraph 20 to the report ECE/TRANS/WP.29/GRE/69.

1. GENERAL

1.1. The conformity requirements shall be considered satisfied from a mechanical and a geometric standpoint, in accordance with the requirements of this Regulation, if any, if the differences do not exceed inevitable manufacturing deviations.

1.2. With respect to photometric performance, the conformity of mass-produced lamps shall not be contested if, when testing the photometric performances **as set forth in Paragraph 11 of the pertinent Regulation** of any lamp chosen at random:

1.2.1. no measured value deviates ~~unfavourably by more than 20%~~ from the values prescribed in **Paragraph 10.1.1. of the pertinent** Regulation under which the lamp has been approved..

1.2.2. If, in the case of a lamp equipped with a replaceable light source and if results of the test described above do not meet the requirements, tests on lamps shall be repeated using another standard filament lamp.

1.2.3. Lamps with apparent defects are disregarded.

1.3. The chromaticity coordinates shall be complied when tested under conditions of paragraph 7. of **of the pertinent Regulation.**

2. First sampling

In the first sampling four lamps are selected at random. The first sample of two is marked A, the second sample of two is marked B.

2.1. The conformity **of mass-produced lamps** ~~is~~ shall not be contested **if the deviation of** any specimen of samples A and B (all four lamps) is not more than 20 per cent.

In the case, that the deviation of both lamps of sample A is not more than 0 per cent the measurement can be closed.

2.2. **The conformity of mass-produced lamps** ~~is~~ shall be contested **if the deviation of at least one specimen of samples A or B is more than 20 per cent.**

The manufacturer shall be requested to bring his production in line with the requirements (alignment) and a repeated sampling according to paragraph 3. shall be carried out within two months' time after the notification The samples A and B shall be retained by the Technical Service until the entire COP process is finished.

3. FIRST REPEATED SAMPLING

A sample of four lamps, is selected at random from stock manufactured after alignment. The first sample of two is marked C, the second sample of two is marked D.

3.1. The conformity of mass-produced lamps ~~is~~ shall not be contested if the deviation of any specimen of samples C and D (all four lamps) is not more than 20 per cent.

In the case, that the deviation of both lamps of sample C is not more than the measurement can be closed. 0 per cent

3.2. The conformity of mass-produced lamps ~~is~~ shall be contested if the deviation of at least

3.2.1 one specimen of samples C or D is more than 20 per cent but the deviation of all specimen of these samples is not more than 30 per cent.

The manufacturer shall be requested again to bring his production in line with the requirements (alignment).

A second repeated sampling according to paragraph 4. shall be carried out within two months' time after the notification shall. The samples C and D shall be retained by the Technical Service until the entire COP process is finished.

3.2.2 one specimen of samples C or D is more than 30 per cent.

In this case the approval shall be withdrawn and paragraph 5 shall be applied.

4. SECOND REPEATED SAMPLING

A sample of four lamps, is selected at random from stock manufactured after alignment. The first sample of two is marked E, the second sample of two is marked F.

4.1. The conformity of mass-produced lamps ~~is~~ shall not be contested if the deviation of any specimen of samples E and F (all four lamps) is not more than 20 per cent.

In the case, that the deviation of both lamps of sample E is not more than the measurement can be closed. 0 per cent

4.2. The conformity of mass-produced lamps shall be contested if the deviation of at least one specimen of samples E or F is more than 20 per cent.

In this case the approval shall be withdrawn and paragraph 5 shall be applied.

5. Approval withdrawn

Approval shall be withdrawn according to paragraph B10..

Annex B4

COLOUR OF LIGHTS

1. Colour of the light

The colour of the light produced by the lamps, as defined by the colorimetric characteristics prescribed in the paragraphs from 2.1 to 5.1, shall be:

| | |
|--|---|
| Main-beam headlamp: | White |
| Dipped-beam headlamp: | White |
| Front fog lamp: | White or selective yellow |
| Reversing lamp: | White |
| Direction-indicator lamp: | Amber |
| Hazard warning signal: | Amber |
| Stop lamp: | Red |
| Emergency stop signal : | Amber or red |
| Rear-end collision alert signal: | Amber |
| Rear registration plate lamp: | White |
| Front position lamp: | White |
| Rear position lamp: | Red |
| Front fog lamp | White or selective yellow |
| Rear fog lamp: | Red |
| Parking lamp: | White in front, red at the rear, amber if reciprocally incorporated in the side direction-indicator lamps or in the side-marker lamps. |
| Side-marker lamp: | Amber; however the rearmost side- marker lamp can be red if it is grouped or combined or reciprocally incorporated with the rear position lamp, the rear end-outline marker lamp, the rear fog lamp, the stop lamp or is grouped or has part of the light emitting surface in common with the rear retro-reflector. |
| End-outline marker lamp: | White in front, red at the rear |
| Daytime running lamp: | White |
| Rear retro-reflector, non- triangular: | Red |
| Rear retro-reflector, triangular: | Red |
| Front retro-reflector, non- triangular: | Identical to incident light ^{1/} |

^{1/} Also known as white or colourless retro-reflector.

| | |
|--|--|
| Side retro-reflector, non- triangular: | Amber; however the rearmost side retro-reflector can be red if it is grouped or has part of the light emitting surface in common with the rear position lamp, the rear end outline marker lamp, the rear fog lamp, the stop-lamp, the red rearmost side-marker lamp or the rear retro-reflector, non-triangular. |
| Cornering lamp: | White |
| Conspicuity marking: | White to the front; White or yellow to the side; Red or yellow to the rear ^{2/} . |
| Adaptive front-lighting systems (AFS): | White |
| Exterior courtesy lamp: | White |
| Manoeuvring lamp: | White |

2 Definition of the colours of the light emitted

For checking the following colorimetric characteristics, the test procedure described in paragraph 8.1 of this Regulation apply.

However, for lamps equipped with any non-replaceable light source, the colorimetric characteristics should be verified with the light sources present in the lamp, in accordance with the relevant subparagraph of paragraph B8.1..

2.1 "White" means the chromaticity coordinates (x,y) ^{3/} of the light emitted that lie inside the chromaticity areas defined by the boundaries:

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

With intersection points:

| | x | y |
|------------------|-------|-------|
| W ₁ : | 0.310 | 0.348 |
| W ₂ : | 0.453 | 0.440 |
| W ₃ : | 0.500 | 0.440 |

^{2/} Nothing in this Regulation shall preclude the Contracting Parties applying this Regulation from allowing the use of white conspicuity markings to the rear in their territories.

^{3/} CIE Publication 15.2, 1986, Colorimetry, the CIE 1931 standard colorimetric observer.

| | | |
|------------------|-------|-------|
| W ₄ : | 0.500 | 0.382 |
| W ₅ : | 0.443 | 0.382 |
| W ₆ : | 0.310 | 0.283 |

2.2. "Selective-yellow" means the chromaticity coordinates (x,y) ^{3/} of the light emitted that lie inside the chromaticity areas defined by the boundaries:

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

With intersection points:

| | x | y |
|-------------------|-------|-------|
| SY ₁ : | 0.454 | 0.486 |
| SY ₂ : | 0.480 | 0.519 |
| SY ₃ : | 0.545 | 0.454 |
| SY ₄ : | 0.521 | 0.440 |
| SY ₅ : | 0.500 | 0.440 |

2.3. "Amber" means the chromaticity coordinates (x,y) ^{3/} of the light emitted that lie inside the chromaticity areas defined by the boundaries:

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

With intersection points:

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

2.4. "Red" means the chromaticity coordinates (x,y) ^{3/} of the light emitted that lie inside the chromaticity areas defined by the boundaries:

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

With intersection points:

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

3. Definition of the night-time colour of the light retro-reflected from a device (excepted retro-reflective tires according to Regulation No. 88)

3.1. "White" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|------------------|-----------------------|
| W ₁₂ | blue boundary: | $y = 0.843 - 1.182 x$ |
| W ₂₃ | violet boundary: | $y = 0.489 x + 0.146$ |
| W ₃₄ | yellow boundary: | $y = 0.968 - 1.010 x$ |
| W ₄₁ | green boundary: | $y = 1.442 x - 0.136$ |

With intersection points:

| | x | y |
|----------------|-------|-------|
| W ₁ | 0.373 | 0.402 |
| W ₂ | 0.417 | 0.350 |
| W ₃ | 0.548 | 0.414 |
| W ₄ | 0.450 | 0.513 |

3.2. "Yellow" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|--------------------|-----------------------|
| Y ₁₂ | green boundary: | $y = x - 0.040$ |
| Y ₂₃ | the spectral locus | |
| Y ₃₄ | red boundary: | $y = 0.200 x + 0.268$ |
| Y ₄₁ | white boundary: | $y = 0.970 - x$ |

With intersection points:

| | x | y |
|----------------|-------|-------|
| Y ₁ | 0.505 | 0.465 |
| Y ₂ | 0.520 | 0.480 |
| Y ₃ | 0.610 | 0.390 |
| Y ₄ | 0.585 | 0.385 |

3.3. "Amber" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|--------------------|-----------------------|
| A ₁₂ | green boundary: | $y = 1.417 x - 0.347$ |
| A ₂₃ | the spectral locus | |
| A ₃₄ | red boundary: | $y = 0.390$ |
| A ₄₁ | white boundary: | $y = 0.790 - 0.670 x$ |

With intersection points:

| | x | y |
|----------------|-------|-------|
| A ₁ | 0.545 | 0.425 |
| A ₂ | 0.557 | 0.442 |
| A ₃ | 0.609 | 0.390 |
| A ₄ | 0.597 | 0.390 |

3.4. "Red" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|--------------------|-----------------|
| R ₁₂ | yellow boundary: | $y = 0.335$ |
| R ₂₃ | the spectral locus | |
| R ₃₄ | the purple line | |
| R ₄₁ | purple boundary: | $y = 0.978 - x$ |

With intersection points:

| | x | y |
|----------------|-------|-------|
| R ₁ | 0.643 | 0.335 |
| R ₂ | 0.665 | 0.335 |
| R ₃ | 0.735 | 0.265 |
| R ₄ | 0.720 | 0.258 |

4. Definition of day-time colour of the light reflected from a device

4.1. "White" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|-----------------|-----------------|
| W ₁₂ | violet boundary | $y = x - 0.030$ |
| W ₂₃ | yellow boundary | $y = 0.740 - x$ |
| W ₃₄ | green boundary | $y = x + 0,050$ |
| W ₄₁ | blue boundary | $y = 0.570 - x$ |

With intersection points:

| | x | y |
|----------------|-------|-------|
| W ₁ | 0.300 | 0.270 |
| W ₂ | 0.385 | 0.355 |
| W ₃ | 0.345 | 0.395 |
| W ₄ | 0.260 | 0.310 |

- 4.2. "Yellow" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|--------------------|-----------------------|
| Y ₁₂ | red boundary | $y = 0.534 x + 0.163$ |
| Y ₂₃ | white boundary | $y = 0.910 - x$ |
| Y ₃₄ | green boundary | $y = 1.342 x - 0.090$ |
| Y ₄₁ | the spectral locus | |

With intersection points:

| | x | y |
|----------------|-------|-------|
| Y ₁ | 0.545 | 0.454 |
| Y ₂ | 0.487 | 0.423 |
| Y ₃ | 0.427 | 0.483 |
| Y ₄ | 0.465 | 0.534 |

- 4.3. "Red" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|-----------------|--------------------|-----------------------|
| R ₁₂ | red boundary | $y = 0.346 - 0.053 x$ |
| R ₂₃ | purple boundary | $y = 0.910 - x$ |
| R ₃₄ | yellow boundary | $y = 0.350$ |
| R ₄₁ | the spectral locus | |

With intersection points:

| | x | y |
|----------------|-------|-------|
| R ₁ | 0.690 | 0.310 |
| R ₂ | 0.595 | 0.315 |
| R ₃ | 0.560 | 0.350 |
| R ₄ | 0.650 | 0.350 |

5. Definition of day-time colour produced by a fluorescent a device

- 5.1. "Red" means the chromaticity coordinates (x,y) ^{3/} of the light reflected that lie inside the chromaticity areas defined by the boundaries:

| | | |
|------------------|--------------------|-----------------------|
| FR ₁₂ | red boundary | $y = 0.346 - 0.053 x$ |
| FR ₂₃ | purple boundary | $y = 0.910 - x$ |
| FR ₃₄ | yellow boundary | $y = 0.315 + 0.047 x$ |
| FR ₄₁ | the spectral locus | |

With intersection points:

| | x | y |
|-----------------|-------|-------|
| FR ₁ | 0,690 | 0,310 |
| FR ₂ | 0,595 | 0,315 |
| FR ₃ | 0,569 | 0,341 |
| FR ₄ | 0,655 | 0,345 |

Annex B5

PHOTOMETRIC MEASUREMENTS of signalling lamps

1. MEASUREMENT METHODS

- 1.1 During photometric measurements, stray reflections shall be avoided by appropriate masking.
- 1.2 In case the results of measurements should be challenged, measurements shall be carried out in such a way as to meet the following requirements:
 - 1.2.1 The distance of measurement shall be such that the law of the inverse of the square of the distance is applicable;
 - 1.2.2 The measuring equipment shall be such that the angular aperture of the receiver viewed from the reference centre of the light is comprised between 10' and 1 degree;
 - 1.2.3 The intensity requirement for a particular direction of observation shall be deemed to be satisfied if that requirement is met in a direction deviating by not more than one-quarter of a degree from the direction of observation.
- 1.3 In the case where the device may be installed on the vehicle in more than one or in a field of different positions the photometric measurements shall be repeated for each position or for the extreme positions of the field of the reference axes specified by the manufacturer.

2. PHOTOMETRIC MEASUREMENT OF LAMPS

- 2.1 For any lamp except those equipped with filament lamp(s) **and if not otherwise specified in the individual Regulation**, the luminous intensities measured after one minute and after 30 minutes of operation:

- (a) In flashing mode ($f = 1.5$ Hz, duty factor 50%) for direction indicator lamps;
- (b) In steady mode for other lamps;

shall comply with the minimum and maximum requirements. The luminous intensity distribution after one minute of operation can be calculated by applying at each test point the ratio of luminous intensity measured in HV after one minute and after 30 minutes of operation, as described above.

- 2.2. In the case of a lamp with replaceable light source, if not supplied by an electronic light source control gear or a variable intensity control,
 - with a colourless or coloured standard filament lamp of the category prescribed for the device, supplied with the voltage necessary to produce the reference luminous flux required for that category of filament lamp;
- 2.3 The photometric performance of lamps incorporating several light sources shall be checked:
 - 2.3.1 For lamps equipped with non-replaceable light sources (filament lamps and other):
 - with the light sources present in the lamp, in accordance with the **paragraph B6.5.**;
 - 2.3.2 For lamps equipped with replaceable filament lamps:
 - with lamps supplied with 6.75 V, 13.5 V or 28.0 V.

The luminous intensity values produced shall then be corrected. The correction factor is the ratio between the reference luminous flux and the mean value of the luminous flux found at the voltage applied (6.75 V, 13.5 V or 28.0 V). The actual luminous fluxes of each filament lamp used shall not deviate more than $\pm 5\%$ from the mean value. Alternatively a standard filament lamp may be used in turn, in each of the

individual positions, operated at its reference flux, the individual measurements in each position being added together.

- 2.3 In any event, all light sources connected in series shall be considered as a single light source.
- 2.4 In the case of a system that uses an electronic light source control gear or a variable intensity control, being part of the lamp⁶ applying at the input terminals of the lamp the voltage declared by the manufacturer or, if not indicated, 6.75 V, 13.5 V or 28.0 V, respectively;
- 2.5 In the case of a system that uses an electronic light source control gear or a variable intensity control, not being part of the lamp with the voltage declared by the manufacturer applied to the input terminals of the lamp.
- 2.6 However, in the case of a lamp operated by a variable intensity control to obtain variable luminous intensity, photometric measurements shall be performed according to the applicant's description.
- 2.7 The test laboratory shall require from the manufacturer the light source control gear or a variable intensity control needed to supply the light source and the applicable functions.
- 2.8 The voltage to be applied to the lamp shall be noted in the communication form in **Annex 1** of the pertinent Regulation under which the device has been approved.
- 2.9 When an assembly of two independent lamps to be type approved as "D" lamps having the same function is deemed to be a single lamp, it shall comply with the requirements for:
- (a) Maximum intensity if all lamps together are lit;
 - (b) Minimum intensity if either lamp has failed.
- 2.10 In case of failure of a single lamp containing more than one light source the following provisions shall apply:
- 2.10.1 A group of light sources, wired so that the failure of any one of them causes all of them to stop emitting light, shall be considered to be one light source.
- 2.10.2 The lamp shall comply with the minimum intensity required in the table of standard light distribution in space as shown in Annex 4 **of the pertinent Regulation** when any one light source has failed. However, for lamps designed for only two light sources, 50 per cent of the minimum intensity in the axis of reference of the lamp shall be considered sufficient, provided that a note in the communication form states that the lamp is only for use on a vehicle fitted with an operating tell-tale which indicates when any one of these two light sources has failed.

Version as approved by GRE 69 see Documents ECE/TRANS/WP.29/GRE/2013/17, and ECE/TRANS/WP.29/2013/69 and paragraph 19 to the report ECE/TRANS/WP.29/GRE/69 and as amended in the discussion in GRE71

- 2.11 In the case of a non-replaceable light source operating directly under vehicle voltage system conditions:
- 2.11.1 All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.3 V, 13.2 V or 28.0 V, or at a voltage as specified by the applicant with respect to any other vehicle voltage system.
- 2.11.2 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 voltage as specified in paragraph 2.3. shall be applied to the input terminals of that system/power supply. The test

⁶ For the purpose of this Regulation "being part of the lamp" means to be physically included in the lamp body or to be external, separated or not, but supplied by the lamp manufacturer as part of the lamp system.

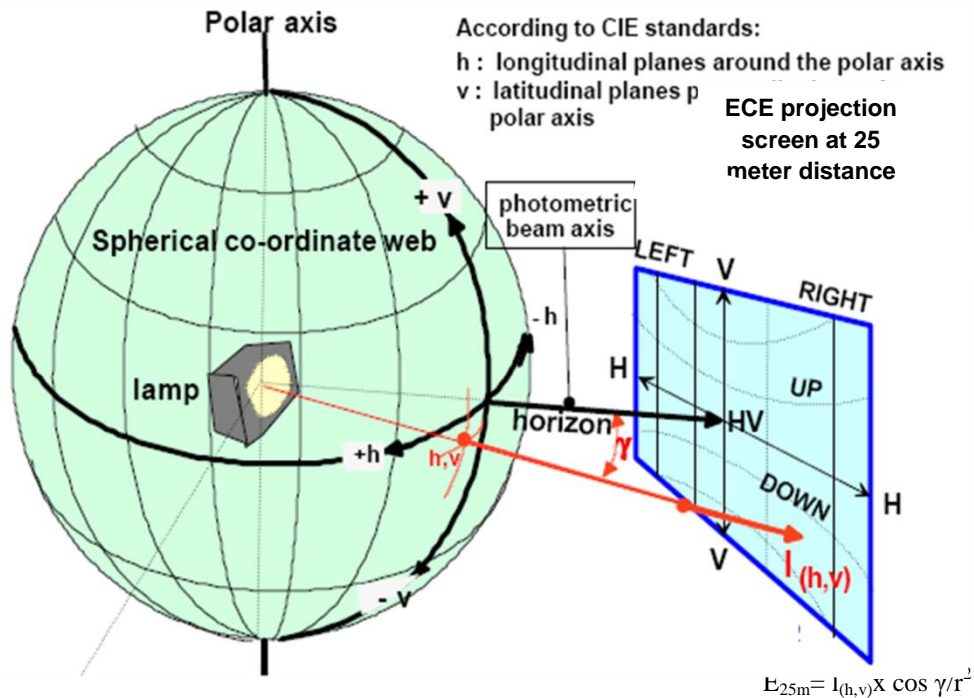
laboratory may require from the manufacturer this special power supply needed to supply the light sources.

Annex B6

PHOTOMETRIC MEASUREMENTS of head lamps

Spherical coordinate measuring system and test point locations

Figure A
Spherical coordinate measuring system



Photometric measurement provisions

1. General provisions
 - 1.1. Headlamps 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 or one or more LED module(s) being part of the passing-beam headlamp.
 - 1.2. The **headlamp** or system or part(s) thereof shall be mounted on a goniometer with a fixed horizontal axis and moveable axis perpendicular to the fixed horizontal axis.
 - 1.2.1. The luminous intensity values shall be determined by means of a photoreceptor contained within a square of 65 m side and 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. **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 A).**

- 1.2.2. The angular co-ordinates are specified in deg on a sphere with a vertical polar axis according to the gonio-photometer as defined in paragraph B2.1.7 (see Figure A).
 - 1.2.3. During photometric measurements, stray reflections should be avoided by appropriate masking.
 - 1.3. Any equivalent photometric method is acceptable, if the accordingly applicable correlation is observed.
 - 1.4. An aiming screen shall be used and may be located at a shorter distance than that of the photoreceptor.
 - 1.5. The **headlamps** or 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 of Annex 3** to the **pertinent** Regulation. 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.
2. Measurement conditions with respect to light sources
 - 2.1. In the case of replaceable filament lamps operated directly under vehicle voltage system conditions:

The system or parts thereof shall be checked by means of an uncoloured standard (étalon) 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 13.2 volts as indicated at the relevant data sheet of Regulation No. 37.

- 2.1.2. During the checking of the headlamp, the voltage at the terminals of the filament lamp shall be regulated as to obtain the reference luminous flux at 13.2 V as indicated for each filament lamp at the relevant data sheet of Regulation No. 37.

However, if a filament lamp 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 Regulation No. 37 and a reference stating which voltage was chosen for type approval shall be made in item 9 in the communication form of Annex 1.

- 2.1.3. In order to protect the standard (étalon) filament lamp 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 (étalon) filament lamp in order to verify the compliance with the photometric requirements where:

$$F_{\text{lamp}} = \Phi_{\text{reference}} / \Phi_{\text{test}}$$

$\Phi_{\text{reference}}$ is the reference luminous flux at 13,2 V as specified in the relevant data sheet of Regulation No. 37

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.

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

The voltage applied to the terminals of the ballast(s) is 13.2 V +/- 0.1 for 12 V systems.

The **headlamp or** system or parts thereof using a replaceable gas-discharge light source shall comply with the photometric requirements set out in the relevant paragraphs of this Regulation with at least one standard (étalon) light source, which has been aged during at least 15 cycles, as specified in Regulation No. 99. The luminous flux of this gas-discharge light source may differ from the objective luminous flux specified in Regulation No. 99.

In this case, the measured photometric values shall be corrected accordingly.

2.3. The **headlamp or** system or parts thereof shall be considered acceptable if the requirements of **paragraph 6. of the pertinent Regulation** are met with at least one standard (étalon), **light source** which may be submitted with the system.

2.4. LED module(s) shall be measured at 6.3 V, 13.2 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.

2.5.

Annex B7

PHOTOMETRIC MEASUREMENTS of Retro – reflectors and retro – reflecting devices

For the purpose of this Annex:

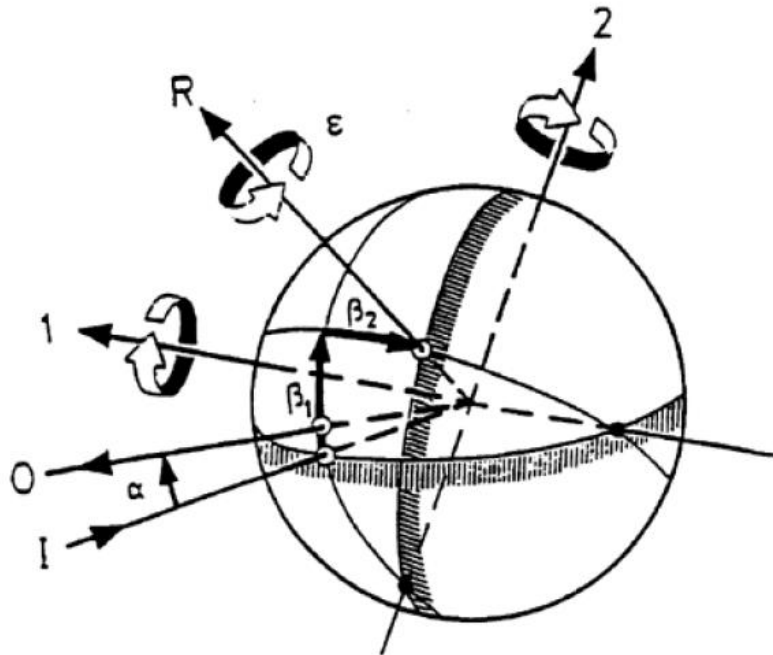
1. "Retro-reflection" means the reflection in which light is reflected in directions close to the direction from which it came. This property is maintained over wide variations of the illumination angle.
 - 1.1. "Retro-reflecting optical unit" means a combination of optical components producing retro-reflection.
 - 1.2. "Retro-reflecting device" 1/ means an assembly ready for use and comprising one or more retro-reflecting optical units.
 - 1.3. "Angle of divergence" means the angle between the straight lines connecting the centre of reference to the centre of the receiver and to the centre of the source of illumination.
 - 1.4. "Illumination angle" means the angle between the axis of reference and the straight line connecting the centre of reference to the centre of the source of illumination.
 - 1.5. "Angle of rotation" means the angle through which the retro-reflecting device is rotated about its axis of reference starting from one given position.
 - 1.6. "Angular diameter of the retro-reflecting device" means the angle subtended by the greatest dimension of the visible area of the illuminating surface, either at the centre of the source of illumination or at the centre of the receiver.
 - 1.7. "Illumination of the retro-reflecting device" is the abbreviated expression used conventionally to designate the illumination measured in a plane perpendicular to the incident rays and passing through the centre of reference.
 - 1.8. "Coefficient of luminous intensity (CIL)" means the quotient of the luminous intensity reflected in the direction considered, divided by the illumination of the retro-reflecting device for given angles of illumination, divergence and rotation.
- 2.0. Geometric definitions (see Annex 1, figure 1)
 - 2.0.1. "Reference centre" means a point on or near a retro-reflective area which is designated to be the centre of the device for the purpose of specifying its performance;
 - 2.0.2. "Illumination axis (symbol I)" means a line segment from the reference centre to the light source.
 - 2.0.3. "Observation axis (symbol O)" means a line segment from the reference centre to the photometer head;
 - 2.0.4. "Observation angle (symbol α)" means the angle between the illumination axis and the observation axis. The observation angle is always positive and, in the case of retro-reflection, is restricted to small angles;
 - 2.0.5. "Observation on half-plane" means the half-plane which originates on the illumination axis and which contains the observation axis;

-
- 2.0.6. "Reference axis (symbol R)" means a designated line segment originating on the reference centre which is used to describe the angular position of the retro-reflective device;
- 2.0.7. "Entrance angle (symbol β)" means the angle from the illumination axis to the reference axis. The entrance angle is usually not larger than 90° but, for completeness, its full range is defined as $0^\circ < \beta < 180^\circ$. In order to specify the orientation in full, this angle is characterised by two components, β_1 and β_2 ;
- 2.0.8. "Rotation angle (symbol ε)" means the angle indicating the orientation of the retro-reflecting material by an appropriate symbol with respect to rotation about the reference axis. If retro-reflective materials or devices have a marking (e.g. TOP), this marking governs the starting position. The angle of rotation ε lies in the range $-180^\circ < \varepsilon < +180^\circ$.
- 2.0.9. "First axis (symbol 1)" means an axis through the reference centre and perpendicular to the observation half-plane;
- 2.0.10. "First component of the entrance angle (symbol β_1)" means the angle from the illumination axis to the plane containing the reference axis and the first axis; range: $-180^\circ < \beta_1 < 180^\circ$;
- 2.0.11. "Second component of the entrance angle (symbol β_2)" means the angle from the plane containing the observation half-plane to the reference axis; range $-90^\circ < \beta_2 < 90^\circ$;
- 2.0.12. "Second axis (symbol 2)" means an axis through the reference centre and perpendicular to both the first axis and the reference axis. The positive direction of the second axis lies in the observation half-plane when $-90^\circ < \beta_1 < 90^\circ$ as shown in Annex 1, figure 1.
- 2.1. Definition of photometric terms
- 2.1.1. "Coefficient of retro-reflection (symbol R')" means the quotient of the coefficient of luminous intensity R of a plane retro-reflecting surface and its area A
- $$\left(R' = \frac{R}{A} \right) \quad \text{The coefficient of retro-reflection R' is expressed in candelas per m}^2 \text{ per lx (cd.m}^{-2} \cdot \text{lx}^{-1})$$
- $$\left(R' = \frac{I}{E_{\perp} \cdot A} \right) \quad \text{(Luminance / Illumination);}$$
- 2.1.2. "Angular diameter of the retro-reflector sample (symbol η_1)" means the angle subtended by the greatest dimension of the retro-reflective sample, either at the centre of the source of illumination or at the centre of the receiver ($\beta_1 = \beta_2 = 0^\circ$);
- 2.1.3. "Angular diameter of the receiver (symbol η_2)" means the angle subtended by the greatest dimension of the receiver as seen from the reference centre ($\beta_1 = \beta_2 = 0^\circ$);
- 2.1.4. "Luminance factor (symbol β)" means the ratio of the luminance of the body to the luminance of a perfect diffuser under identical conditions of illumination and observation;
- 2.1.5. "Colour of the reflected light of the device" The definitions of the colour of the reflected light are given in [Annex B4](#).
- 2.2. Description of Goniometer

A goniometer as defined in paragraph B2.1.7., which can be used in making retro-reflection measurements in the CIE geometry is illustrated in Annex 1, figure 2. In this illustration, the photometer head (O) is arbitrarily shown to be vertically above the source (I). The first axis is shown to be fixed and horizontal and is situated perpendicular to the observation half-plane. Any arrangement of the components which is equivalent to the one shown can be used.

Figure 1

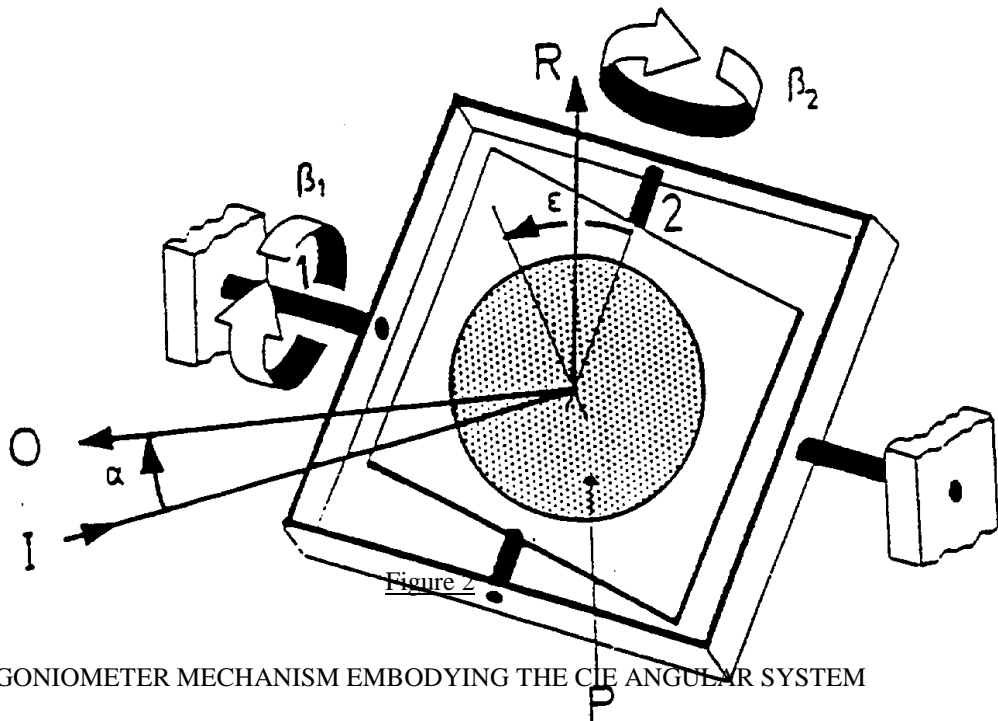
THE CIE CO-ORDINATE SYSTEM



- | | | |
|----------------|----------------------|--------------------------------------|
| 1: First Axis | I: Illumination Axis | α : Observation angle |
| 2: Second Axis | O: Observation Axis | β_1, β_2 : Entrance angles |
| | R: Reference Axis | ϵ : Rotation angle |

The CIE angular system for specifying and measuring retro-reflective marking materials. The first axis is perpendicular to the plane containing the observation axis and the illumination axis. The second axis is perpendicular both to the first axis and to the reference axis. All axes, angles, and directions of rotation are shown positive.

- Notes:
- (a) The principle fixed axis is the illumination axis.
 - (b) The first axis is fixed perpendicular to the plane containing the observation and illumination axis.
 - (c) The reference axis is fixed in the retro-reflective material and moveable with β_1 and β_2 .



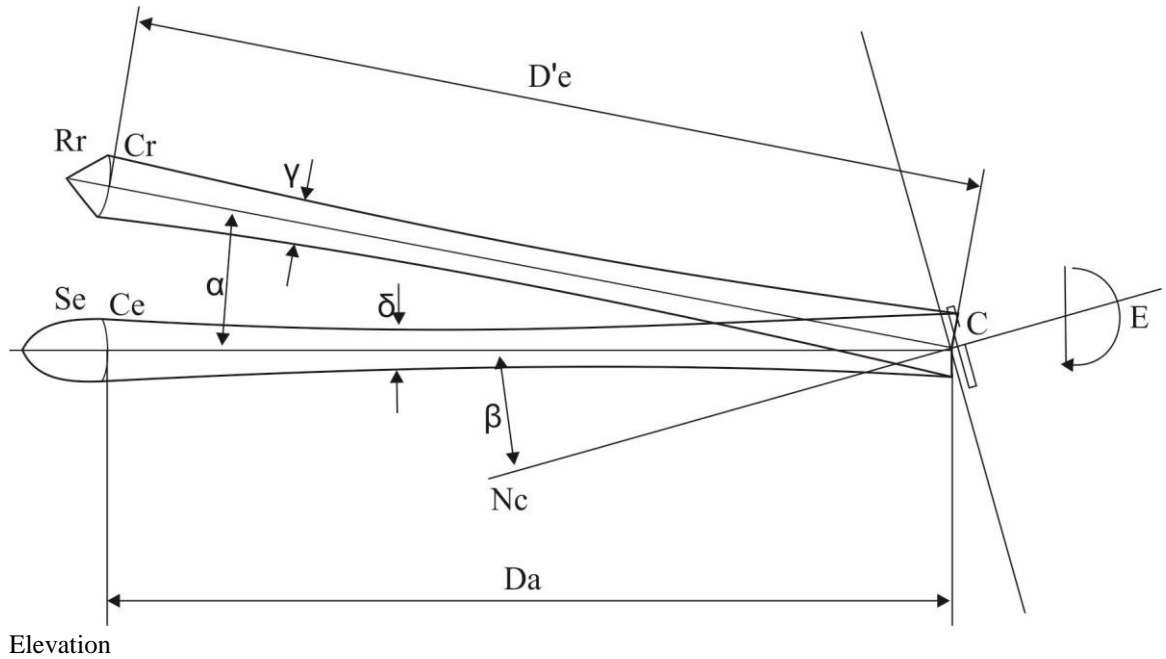
GONIOMETER MECHANISM EMBODYING THE CIE ANGULAR SYSTEM

- | | | |
|----------------|------------------------------|--------------------------------------|
| 1: First Axis | I: Illumination Axis | α : Observation angle |
| 2: Second Axis | O: Observation Axis | β_1, β_2 : Entrance angles |
| | R: Reference Axis | ϵ : Rotation angle |
| | P: Retro-reflective material | |

Representation of a Goniometer mechanism embodying the CIE angular system for specifying and measuring retro-reflective materials. All angles and directions of rotation are shown positive.

Arrangement of the test equipment for retro-reflecting devices and retro-reflectors:

Symbols



Symbols and units

- A = Area of the illuminating surface of the retro-reflecting device (cm²)
- C = Centre of reference
- NC = Axis of reference
- Rr = Receiver, observer or measuring device
- Cr = Centre of receiver
- Ør = Diameter of receiver Rr if circular (cm)
- Se = Source of illumination
- Cs = Centre of source of illumination
- Øs = Diameter of source of illumination (cm)
- De = Distance from centre Cs to centre C (m)
- D'e = Distance from centre Cr to centre C (m)

Note: In general, De and D'e are very nearly the same and under normal conditions of observation it may be assumed that De = D'e.

| | | |
|------------|---|---|
| D | = | Observation distance from and from beyond which the illuminating surface appears to be continuous |
| α | = | Angle of divergence |
| β | = | Illumination angle. With respect to the line CsC which is always considered to be horizontal, this angle is prefixed by the signs - (left), + (right), + (up) or - (down), according to the position of the source Se in relation to the axis NC, as seen when looking towards the retro-reflecting device. For any direction defined by two angles, vertical and horizontal, the vertical angle is always given first. |
| γ | = | Angular diameter of the measuring device Rr as seen from point C |
| δ | = | Angular diameter of the source Se as seen from point C |
| ϵ | = | Angle of rotation. This angle is positive when the rotation is clockwise as seen when looking towards the illuminating surface. If the retro-reflecting device is marked "TOP", the position thus indicated is taken as the origin. |
| E | = | Illumination of the retro-reflecting device (lux) |
| CIL | = | Coefficient of luminous intensity (millicandelas/lux) Angles are expressed in degrees and minutes. |

Annex B8

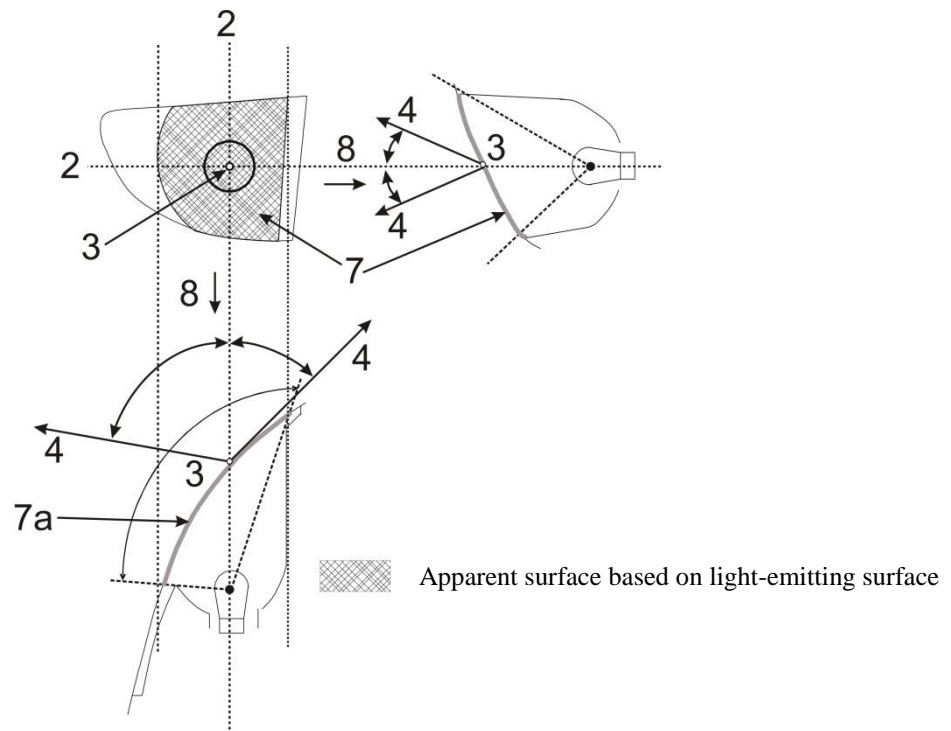
Examples of lamp surfaces, axes, centres of reference, and angles of geometric visibility

These examples show some arrangements to aid the understanding of the provisions and are not intended to be design restrictive.

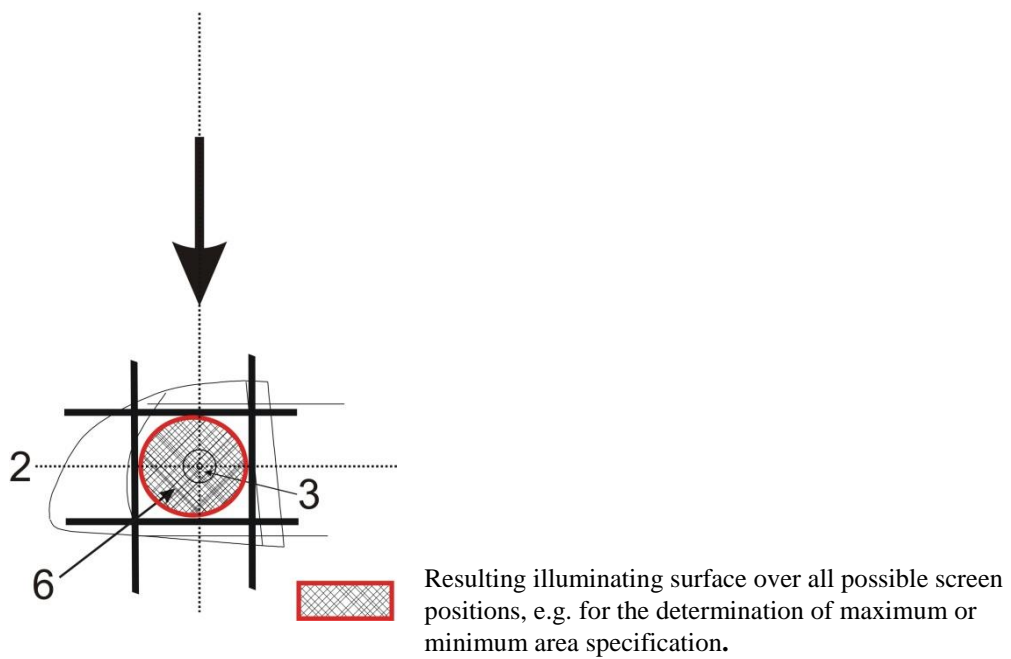
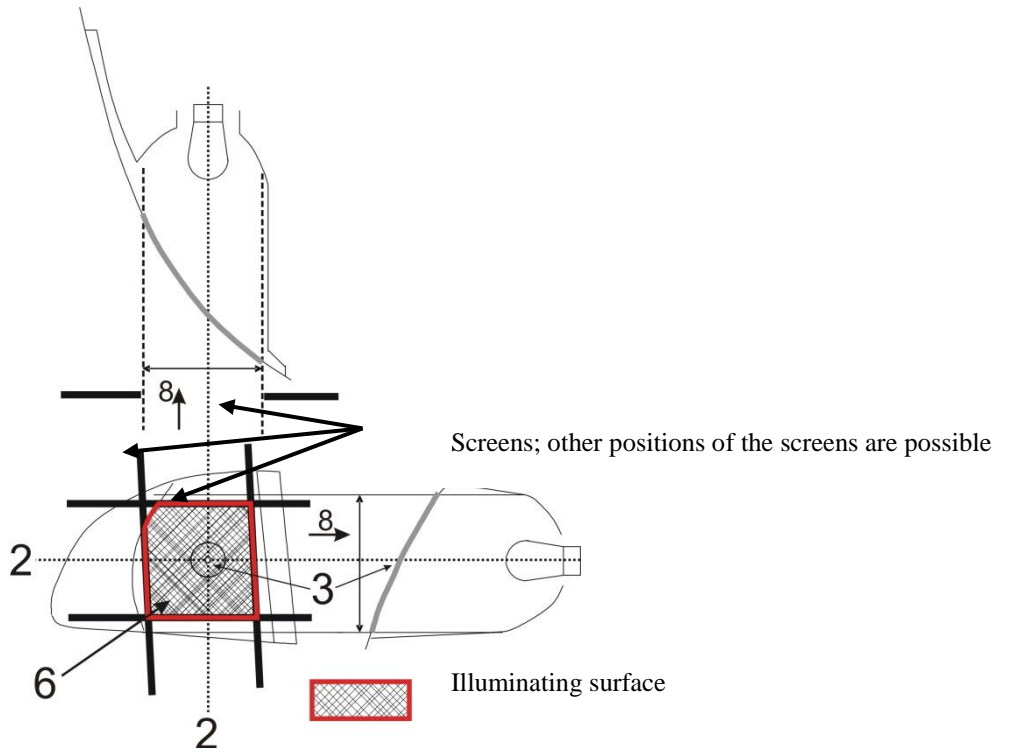
KEY for all examples in this Annex:

| | |
|--|--|
| <ol style="list-style-type: none"> 1. Illuminating surface 2. Axis of reference 3. Centre of reference 4. Angle of geometric visibility 5. Light-emitting surface 6. Apparent surface based on the illuminating surface 7a. Apparent surface based on the light-emitting surface according to paragraph 2.8. a) (with outer lens) 7b. Apparent surface based on the light-emitting surface according to paragraph 2.8. b) (without outer lens) 8. Direction of visibility | <p>IO Inner optical part LG Light guide L Outer lens R Reflector S Light source X Not part of this function F1 Function one F2 Function two</p> |
|--|--|

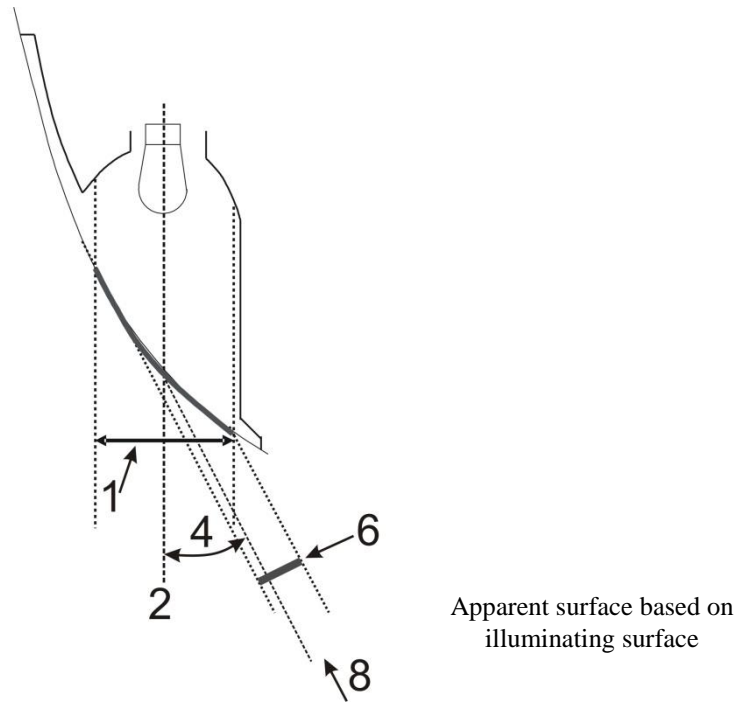
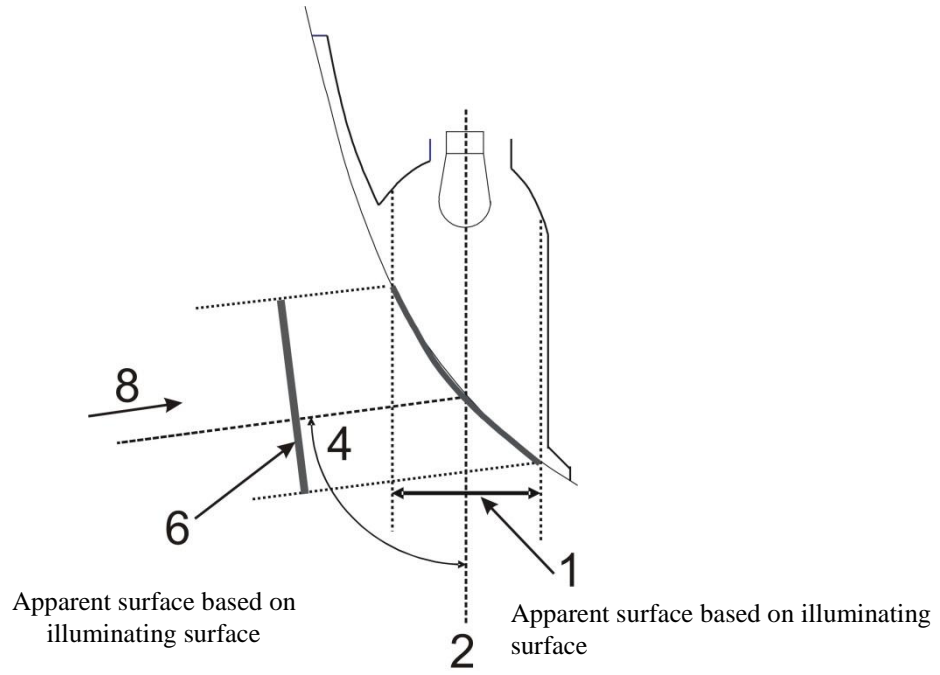
Part 1 – Light emitting surface of a light-signalling device other than a retro-reflector



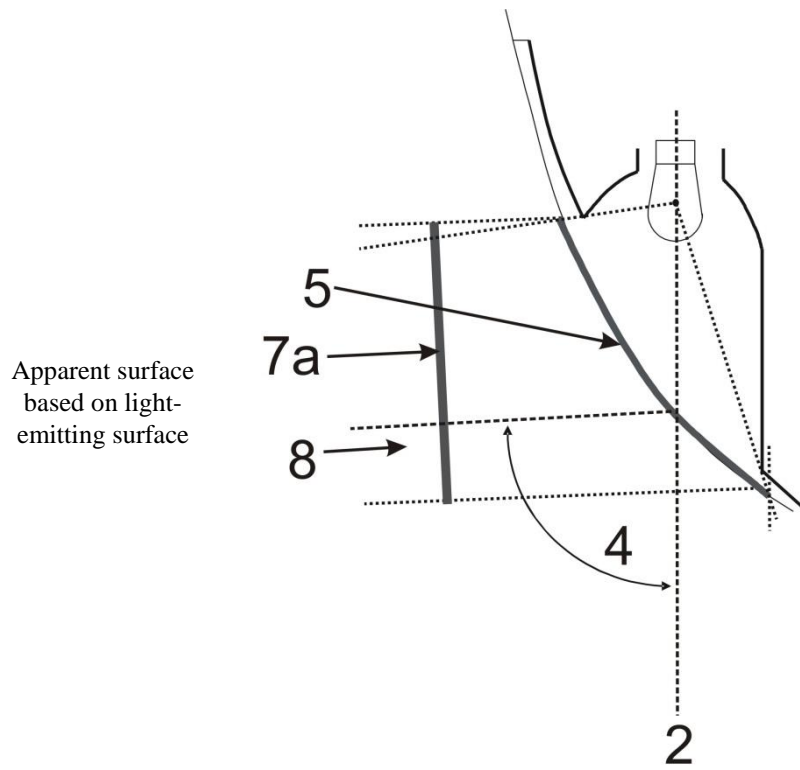
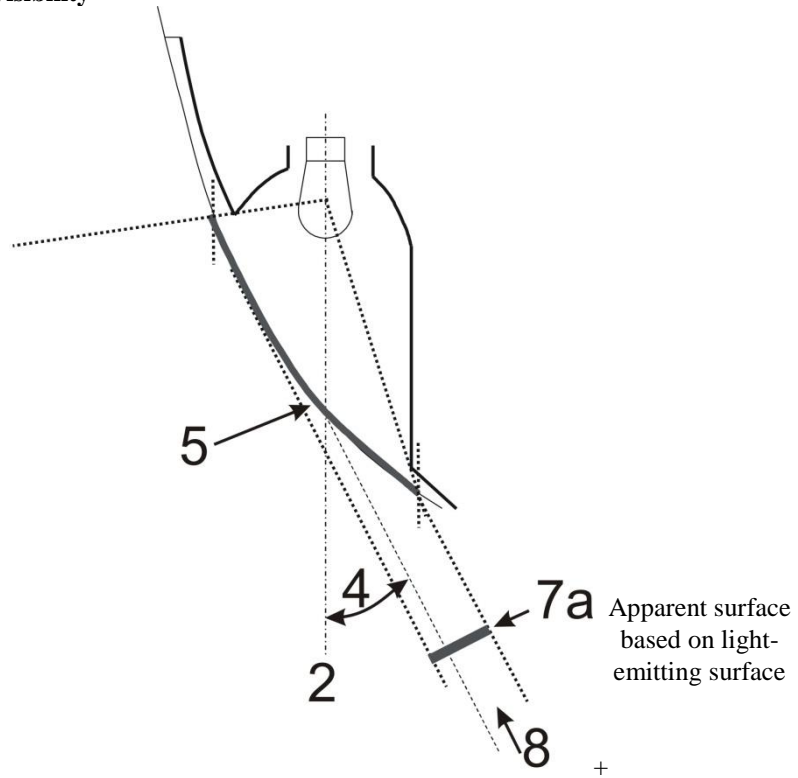
Part 2 – Illuminating surface of a light-signalling device other than a retro-reflector



Part 3 – Examples of apparent surface based on illuminating surface in different directions of geometric visibility



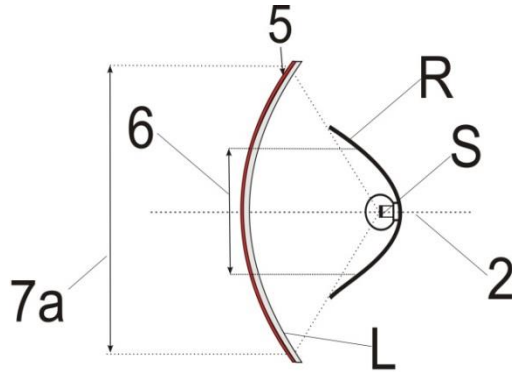
Part 4 – Examples of apparent surface based on light emitting surface in different directions of geometric visibility



Part 5 – Example of illuminating surface in comparison with light-emitting surface in the case of a "single function lamp" (see paragraph B2.3.21.)

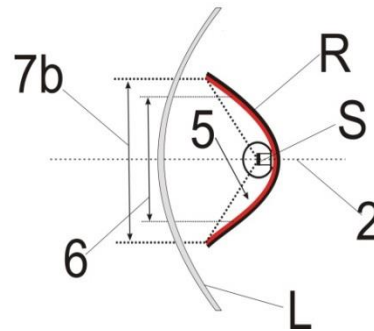
Examples of a light source with a reflector optic behind an outer lens:

Example 1



(Including the outer lens)

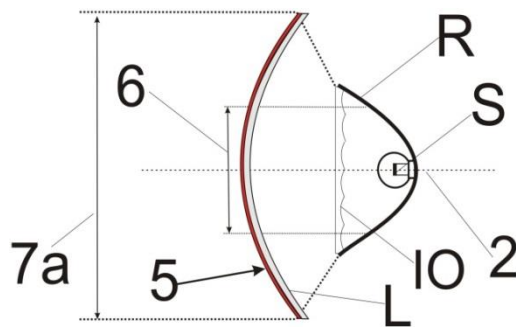
Example 2



(Excluding the non-textured outer lens)

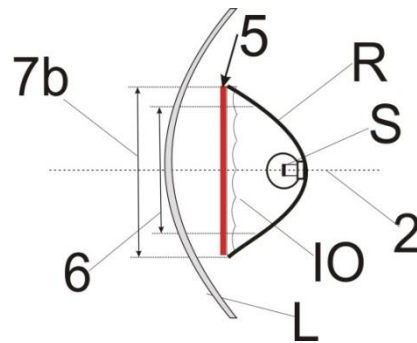
Examples of a light source with a reflector optic with a inner lens behind an outer lens:

Example 3



(Including the outer lens)

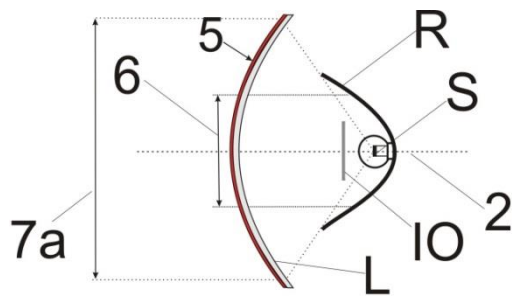
Example 4



(Excluding the non-textured outer lens)

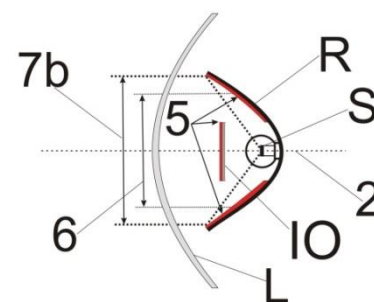
Examples of a light source with a reflector optic with a partial inner lens behind an outer lens:

Example 5



(Including the outer lens)

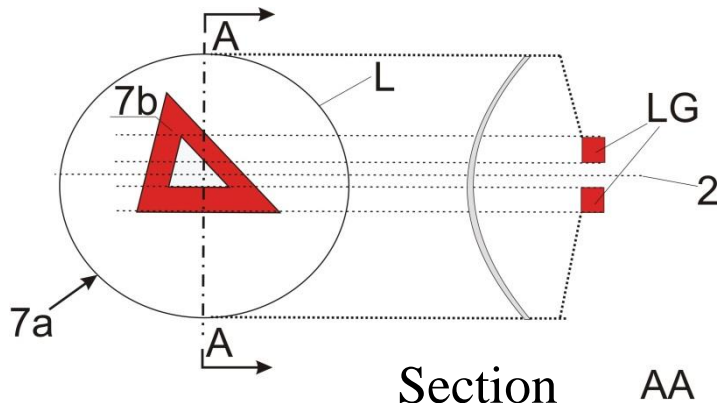
Example 6



(Excluding the non-textured outer lens)

Example of a light guide optic behind an outer lens:

Example 7

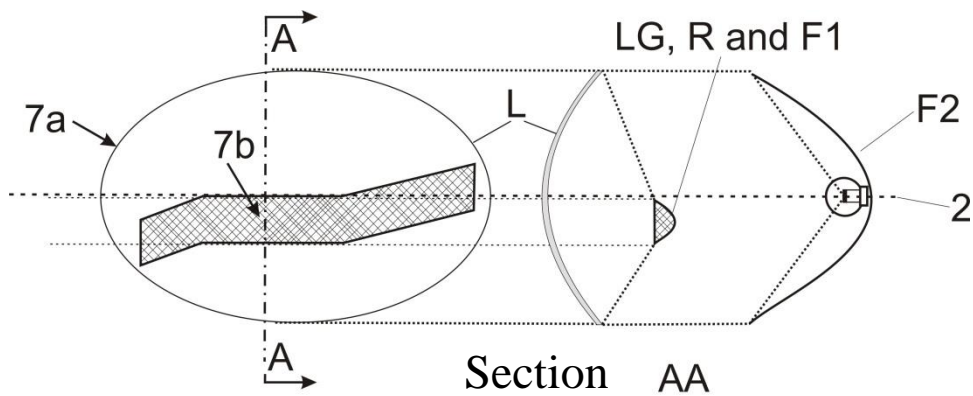


In the case where the non-textured outer lens is excluded, "7b" is the apparent surface according to paragraph [B2.3.17.b](#)

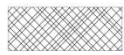


Example of a light guide optic or a reflector optic behind an outer lens:

Example 8

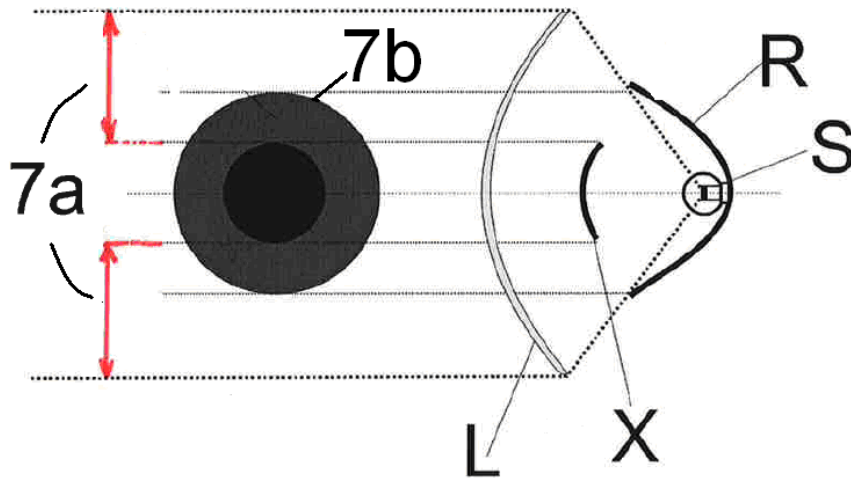


In the case where the non textured outer lens is excluded, "7b" is the apparent surface according to paragraph [B2.3.17. b](#)), and F1 shall not transparent to F2



Example of a light source with a reflector optic in combination with an area which is not part of this function, behind an outer lens:

Example 9

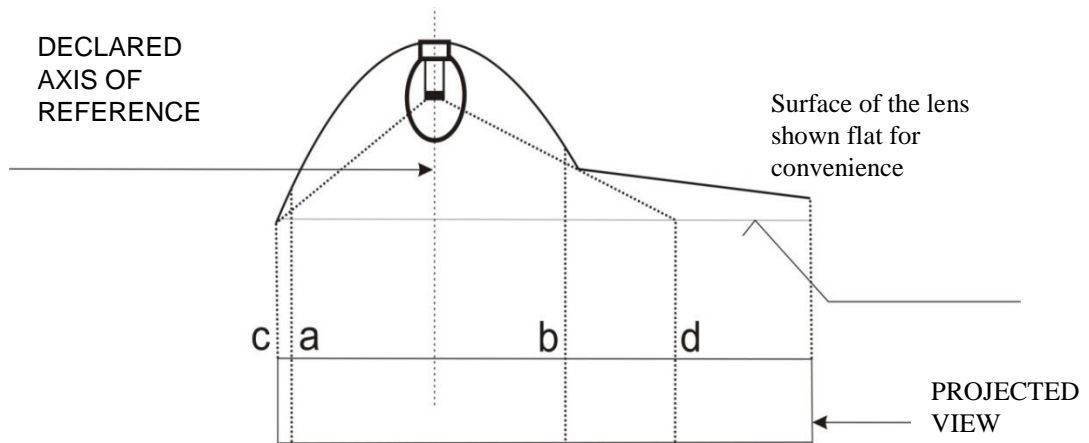


In the case where the non textured outer lens is excluded, "7b" is the apparent surface according to paragraph 2.8. b).

Part 6 – Examples showing the determination of the light-emitting surface in comparison with illuminating surface (See paragraphs [B2.3.17.](#) and [B2.3.19.](#))

Note: Reflected light could / may contribute to the determination of the light emitting surface

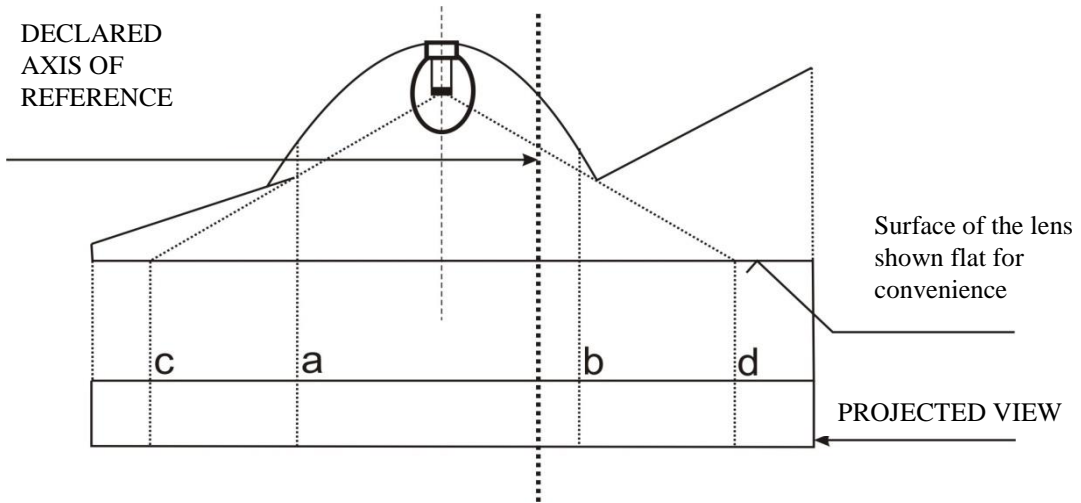
Example A



| | <i>Illuminating surface</i> | <i>Declared light-emitting surface according to B2.3.17.. a)</i> |
|-----------|-----------------------------|--|
| Edges are | a and b | c and d |

Example B

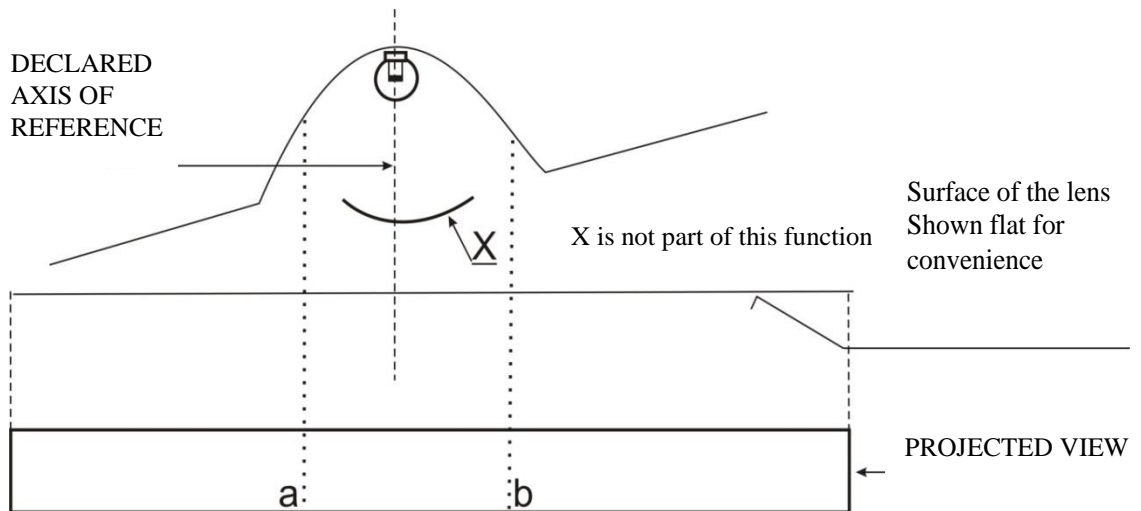
DECLARED
AXIS OF
REFERENCE



| | <i>Illuminating surface</i> | <i>Declared Light-emitting surface according to B2.3.17. a)</i> |
|-----------|-----------------------------|---|
| Edges are | a and b | c and d |

Example C

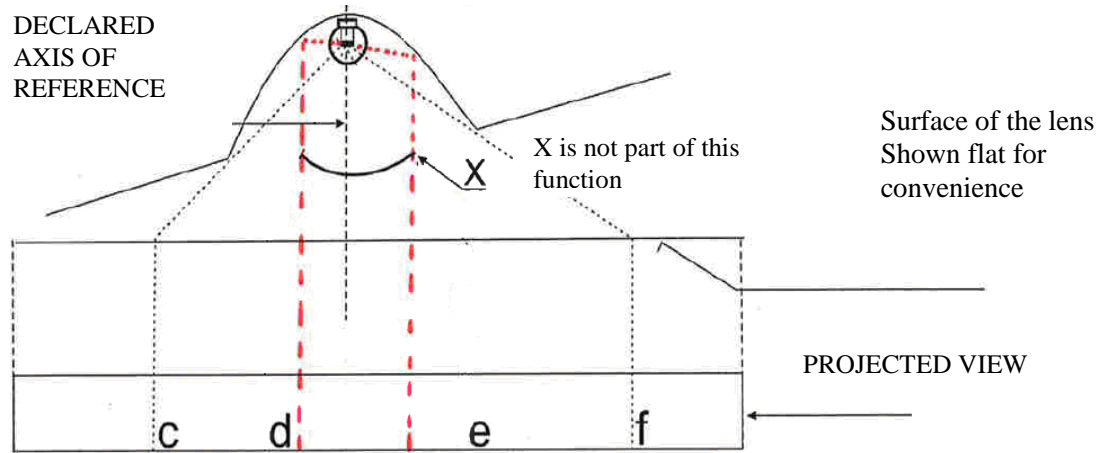
Example to determine the illuminating surface in combination with an area which is not part of the function:



| | <i>Illuminating surface</i> |
|-----------|-----------------------------|
| Edges are | a and b |

Example D

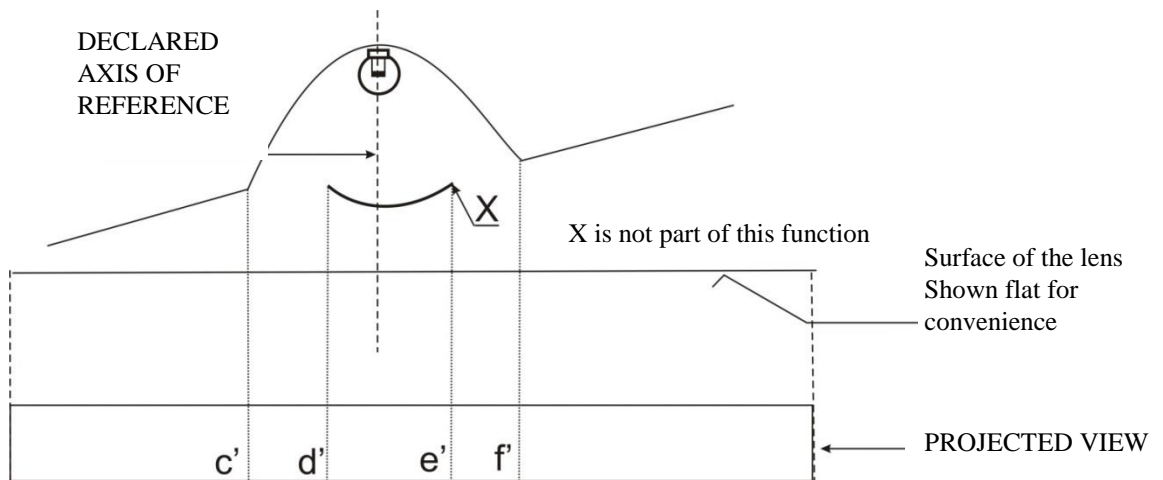
Example to determine a light emitting surface according to B2.3.17. a) in combination with an area which is not part of the function:



| | |
|-----------|---|
| | <i>Declared Light-emitting surface according to B2.3.17. a)</i> |
| Edges are | c-d and e-f |

Example E

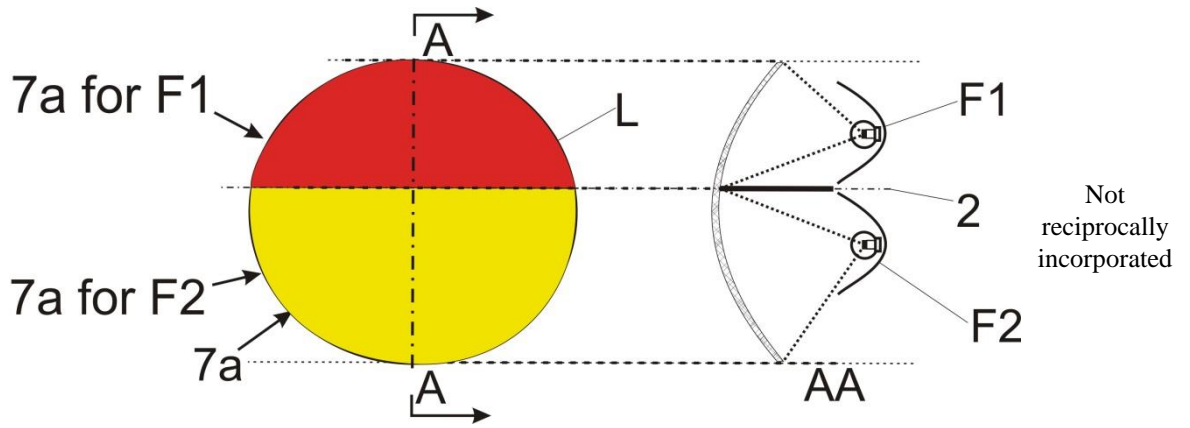
Example to determine the apparent surface in combination with an area which is not part of the function and a non-textured outer lens (according to B2.3.17. b):



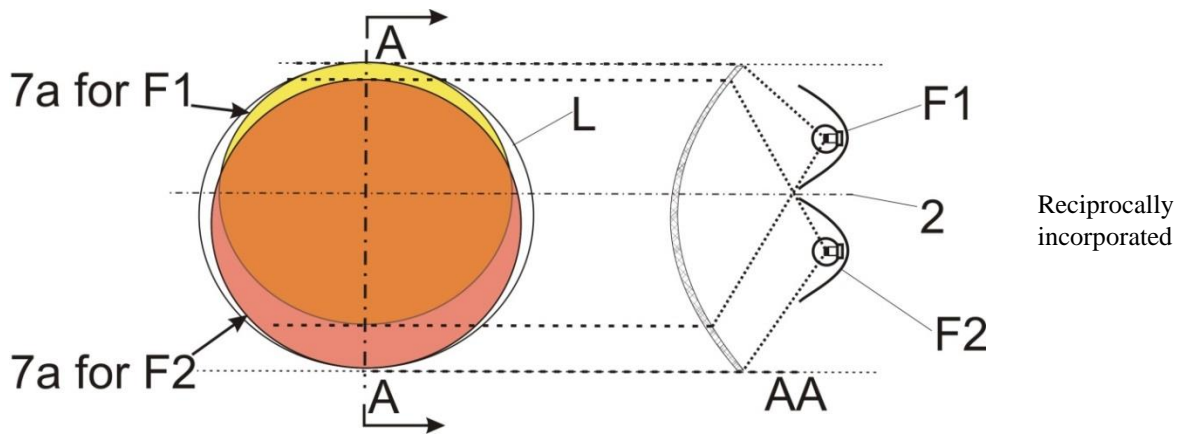
| | |
|-----------|---|
| | <i>Declared Light emitting surface according to B2.3.17. b) for example</i> |
| Edges are | c'-d' and e'-f' |

Part 7 – Examples to enable a decision regarding the reciprocal incorporation of two functions

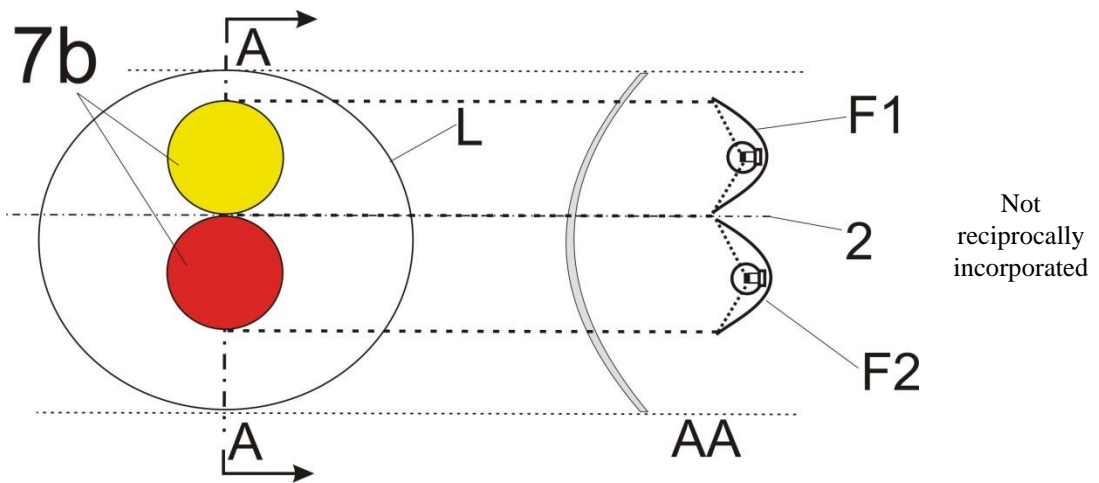
In the case with a textured outer lens and a wall in between:



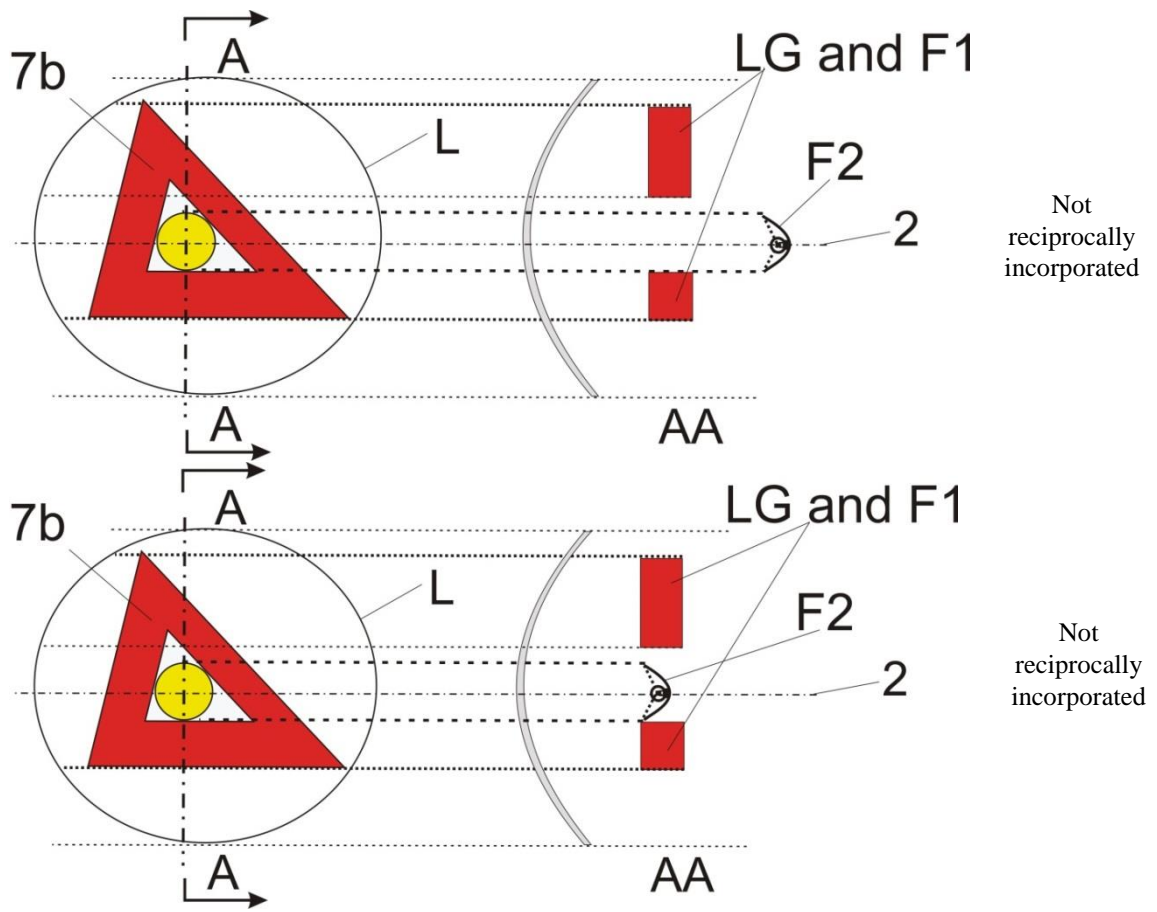
In the case with a textured outer lens:



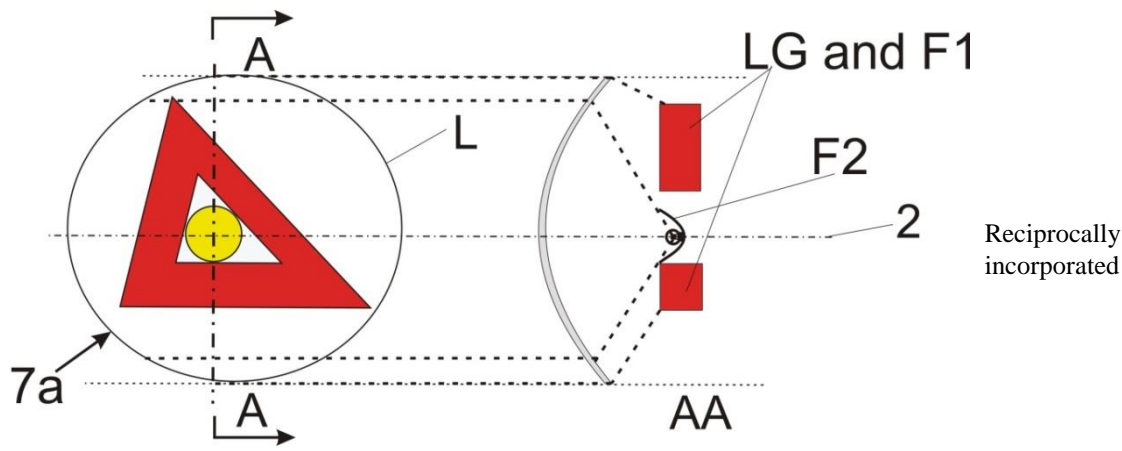
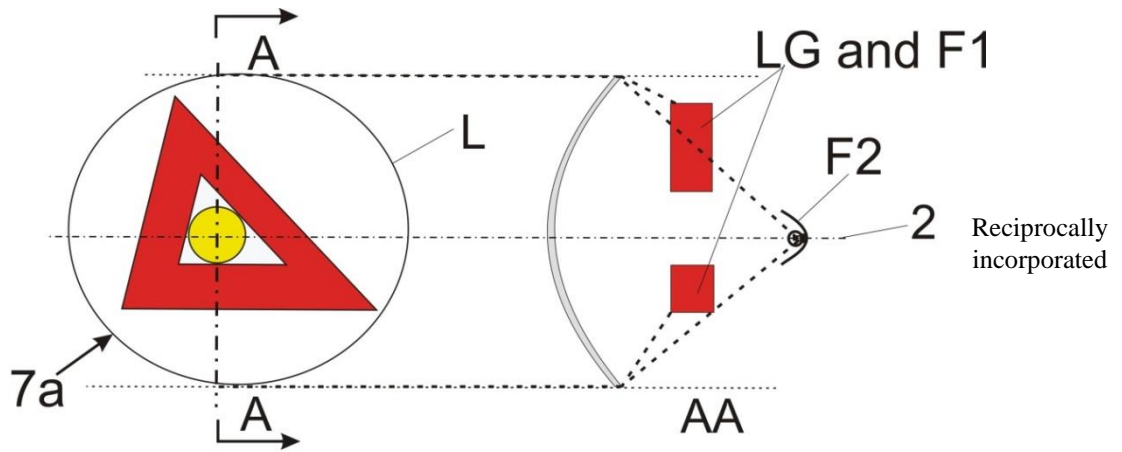
In the case where the non-textured outer lens is excluded:



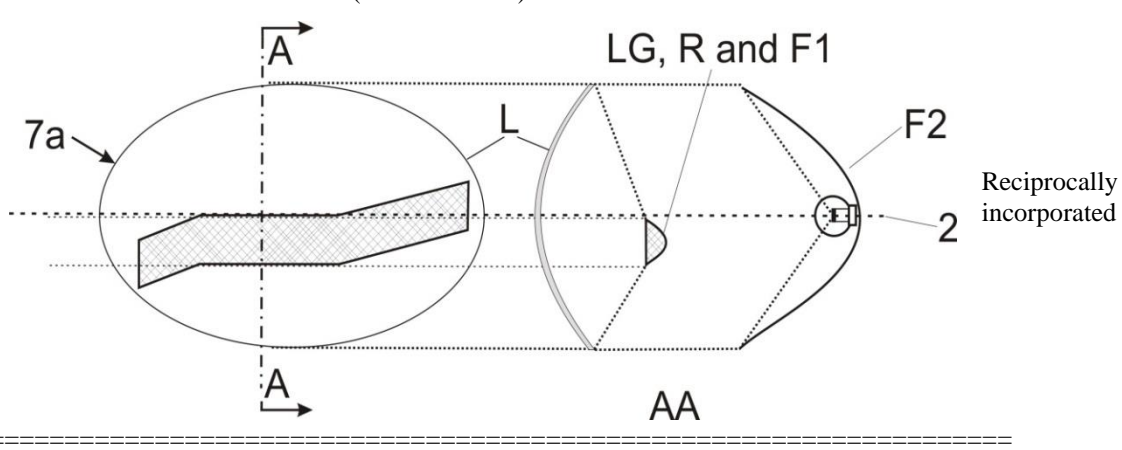
In the case where the non-textured outer lens is excluded:



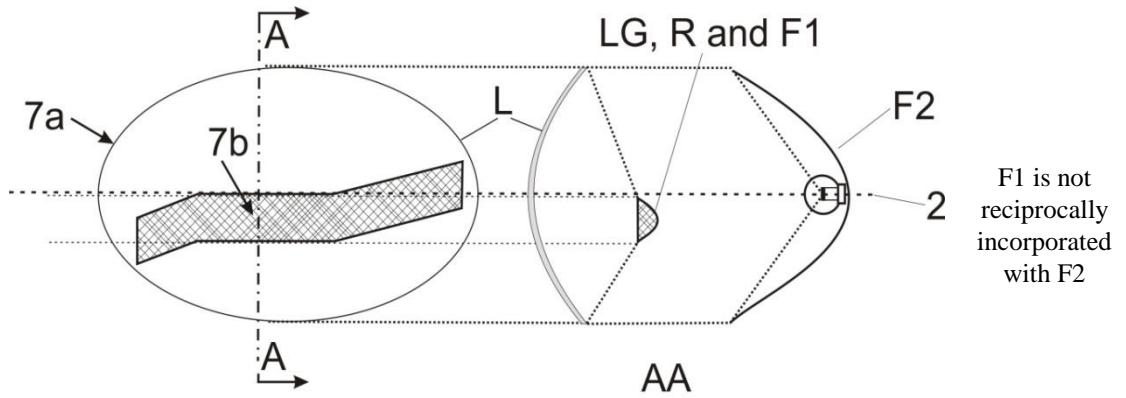
In the case where the outer lens (textured or not) is included:



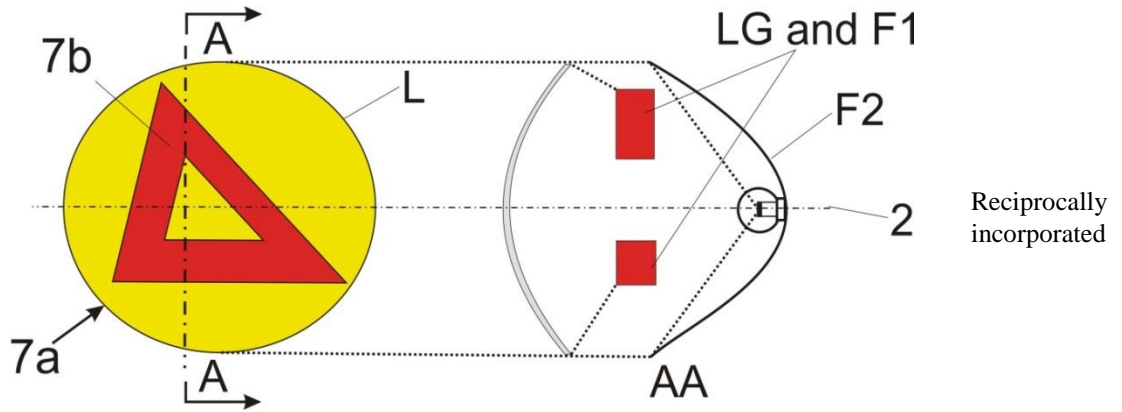
In the case where the outer lens (textured or not) is included:



In the case where the non-textured outer lens is excluded, "7b" is the apparent surface according to paragraph B2.3.17, and F1 shall not be transparent to F2:



In the case where the non-textured outer lens is excluded or not:

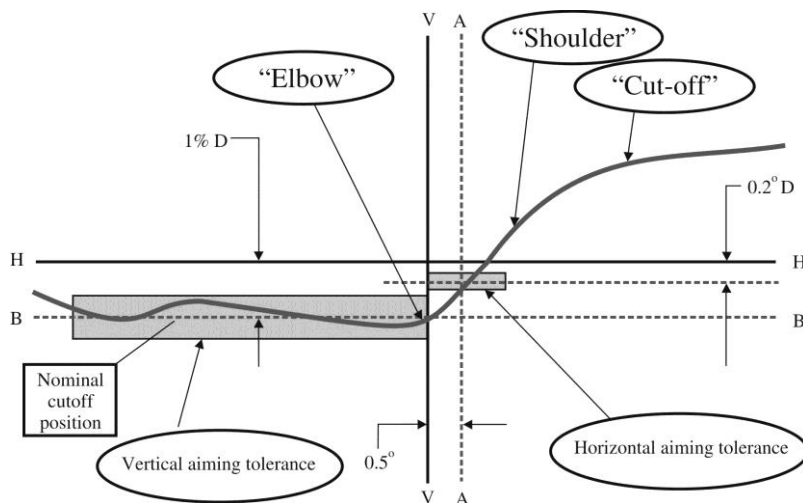


Annex B9A

DEFINITION AND SHARPNESS OF THE "CUT-OFF" LINE OF ASYMMETRICAL BEAM PATTERNS

- 1.0 Provisions concerning passing-beams
- 1.1. The luminous intensity distribution of the principal passing-beam headlamp shall incorporate a "cut-off" (see Figure 1), 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) For right hand traffic beams:
 - (i) A straight "horizontal part" towards the left;
 - (ii) A raised "elbow – shoulder" part towards the right.
 - (b) For left hand traffic beams:
 - (i) A straight "horizontal part" towards the right;
 - (ii) A raised "elbow - shoulder" part towards the left.
- In each case the "elbow-shoulder" part shall have a sharp edge.
- 1.2. The headlamp shall be visually aimed by means of the "cut-off" (see Figure 1) as follows. The aiming shall be carried out using a flat vertical screen set up at a distance of 10 m or 25 m (as indicated in item 9 of Annex 1) forward of the headlamp and at right angles to the H-V axis as shown in Annex B6. The screen shall be sufficiently wide to allow examination and adjustment of the "cut-off" of the passing-beam over at least 5° on either side of the V-V line.
- 1.3. 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;

Figure 1



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

- 1.4. 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° D its "shoulder" shall not exceed the line A to the left;
- (b) The line 0.2° 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;

or

For left hand traffic from left to right and shall be horizontally positioned after its movement so that:

- (a) Above the line 0.2 D its "shoulder" shall not exceed the line A to the right;
- (b) On the line 0.2° or below its "shoulder" cross the line A; and
- (c) The kink of the "elbow" should be primarily on the V-V line;

1.5. Where a headlamp so aimed does not meet the requirements set out in paragraphs 6.2.4. to 6.2.6. and 6.3. of the pertinent Regulation. its alignment may be changed, provided that the axis of the beam is not displaced:

Horizontally from line A by more than:

- (a) 0.5° to the left or 0.75° to the right, for right hand traffic; or
- (b) 0.5° to the right or 0.75° to the left, for left hand traffic; and

Vertically not more than 0.25° up or down from line B.

1.6. If, however, vertical adjustment cannot be performed repeatedly to the required position within the tolerances described in paragraph 1.5. above, the instrumental method the paragraphs 2. and 3. 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.

2.0 Instrumental verification of the "cut-off" for asymmetric passing-beam headlamps

2.1. General

In the case where paragraph 1.6. above applies, the quality of the "cut-off" shall be tested according to the requirements set out in paragraph 2. and the instrumental vertical and horizontal adjustment of the beam shall be performed according to the requirements set out in paragraph 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 1.3. and 1.4 above is required.

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° at either a measurement distance of:

- (a) 10 m with a detector having a diameter of approximately 10 mm or
- (b) 25 m with a detector having a diameter of approximately 30 mm.

The measuring distance at which the test was carried out shall be recorded in item 9. of the communication form (see Annex 1 of the pertinent Regulation).

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° 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 2.1. to 2.3. comply with at least one set of measurements.

2.2.1. Not more than one "cut-off" shall be visible¹.

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° from the V-V where:

$$G = (\log E_\beta - \log E_{(\beta+0.1^\circ)}) \text{ where } \beta = \text{the vertical position in degrees.}$$

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

2.2.3. Linearity

The part of the horizontal "cut-off" that serves for vertical adjustment shall be horizontal between 1.5° and 3.5° from the V-V line (see Figure 1).

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

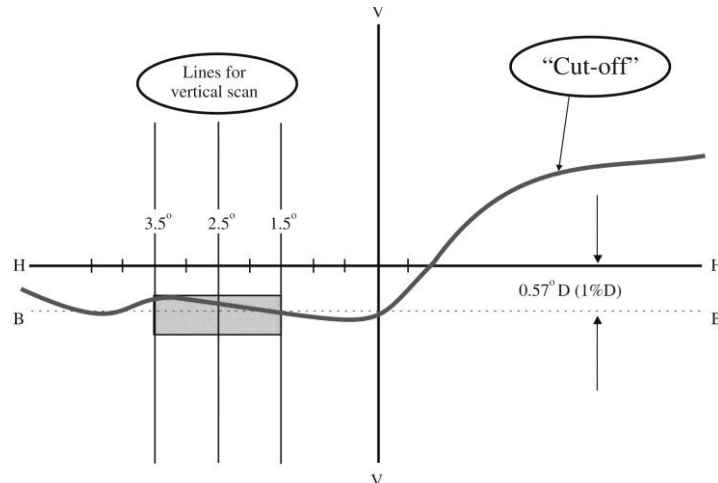
The maximum vertical distance between the inflection points determined shall not exceed 0.2° .

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

2.3. Vertical and horizontal adjustment

If the "cut-off" complies with the quality requirements of paragraph 2. of this annex, the beam adjustment may be performed instrumentally.

Figure 1
Measurement of "cut-off" quality



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

2.3.1. Vertical adjustment

¹ This paragraph should be amended when an objective test method is available.

Moving upward from below the line B (see Figure 2), a vertical scan is carried out through the horizontal part of the "cut-off" at 2.5° from V-V. The inflection point (where $d^2(\log E) / dv^2 = 0$) is determined and positioned on the line B situated one per cent below H-H.

2.3.2. Horizontal adjustment

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

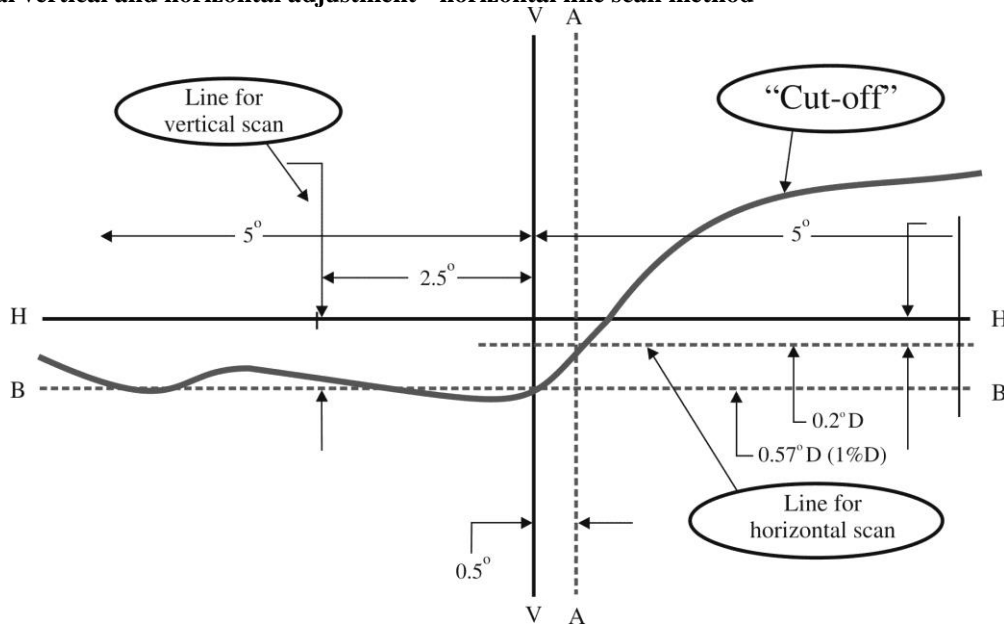
- (a) The "0.2 D line" method (see Figure 2).

A single horizontal line at 0.2° D shall be scanned from 5° left to 5° right after the lamp has been aimed vertically. The maximum gradient "G" determined using the formula $G = (\log E_\beta - \log E_{(\beta + 0.1^\circ)})$ where β 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.

Figure 2

Instrumental vertical and horizontal adjustment - horizontal line scan method



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

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

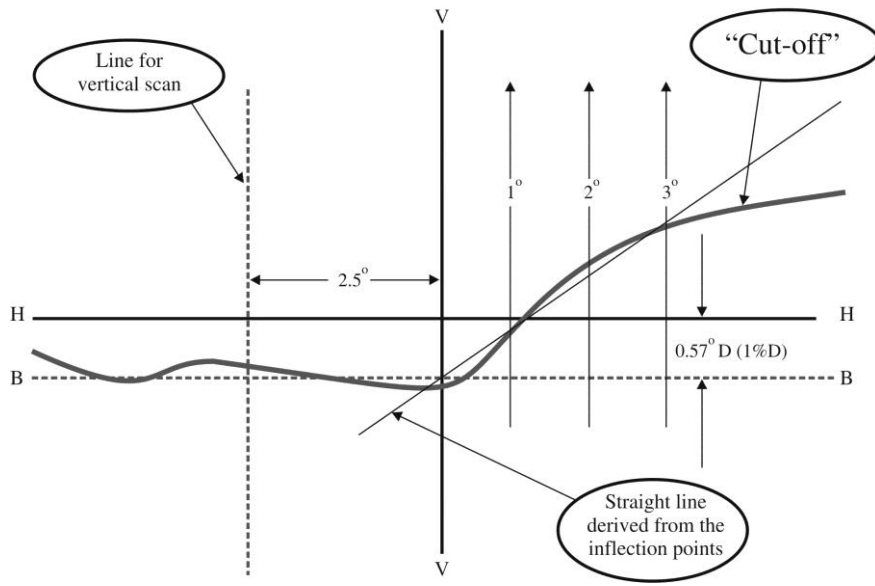
Three vertical lines shall be scanned from 2° D to 2° U at 1°R, 2°R, and 3°R after the lamp has been aimed vertically. The respective maximum gradients "G" determined using the formula:

$$G = (\log E_\beta - \log E_{(\beta + 0.1^\circ)})$$

where β 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.

Figure 3

Instrumental vertical and horizontal adjustment - Three line scan method



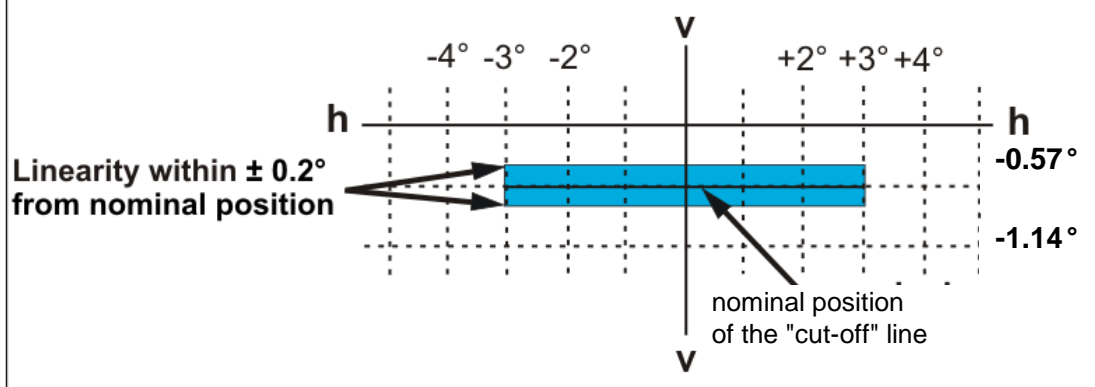
Note: The scales are different for vertical and horizontal lines.

Annex B9 B

DEFINITION AND SHARPNESS OF THE "CUT-OFF" LINE FOR SYMMETRICAL PASSING BEAM HEADLAMPS AND AIMING PROCEDURE BY MEANS OF THIS "CUT-OFF" LINE

1. General
 - 1.1. For a correct aiming the principal passing beam shall produce a sufficiently sharp "cut-off" to permit a satisfactory visual adjustment with its aid as indicated in paragraph 1.2 below. 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° 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° L to 3° R. In case the visual aim leads to problems or ambiguous positions, the instrumental method as specified in paragraphs 2. and 4., shall be applied and the quality or rather the sharpness of the "cut-off" and the linearity shall be checked on performance.
 - 1.2. The principal passing beam shall be aimed so that:
 - 1.2.1. For horizontal adjustment: The beam is as symmetrical as possible with reference to line V-V;
 - 1.2.2. For vertical adjustment: the horizontal part of the "cut-off" line is adjusted to its nominal position (0.57 degrees) below the H-H line. If, however, vertical adjustment cannot be performed repeatedly to the required position within the allowed tolerances, the instrumental method of paragraphs 4. and 5. shall be applied to test compliance with the required minimum quality of the "cut-off" line and to perform the beam vertical adjustment.
 - 1.3. The luminous intensity distribution of the symmetrical passing-beam headlamps shall incorporate a "cut-off" line which enables the symmetrical passing-beam headlamp 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 2. to 4.:
2. Shape of the "cut-off" line
 - 2.1. For visual adjustment of the symmetrical passing-beam headlamp the "cut-off" line shall provide a horizontal line for vertical adjustment of the symmetrical passing-beam headlamp extending to either side of the V-V line (see Figure 1) as specified in paragraph 1.1. above.

Figure 1: Shape and position of the "cut-off" line



3. Adjustment of the symmetrical passing-beam headlamp
 - 3.1. Horizontal adjustment: the beam with the "cut-off" line shall be so positioned that the projected beam pattern appears approximately symmetrical to the V-V line.
 - 3.2. Vertical adjustment: after horizontal adjustment of the symmetrical passing-beam headlamp according to paragraph 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 line at 1 per cent below the h-h line.

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° left to 3° right of the V-V line at 0.2° for Class B and 0.3° for Classes A, C, D and E headlamps above and below the nominal position of the "cut-off" (see Figure 1).

- 3.3. When the vertical adjustments of three different individuals differs by more than 0.2° for Class B and 0.3° for Classes A, C, D and E head lamps, 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.
4. Measurement of the quality of "cut-off"
 - 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°:
 - (a) At either a measurement distance of 10 m and a detector with a diameter of approximately 10 mm;
 - (b) Or 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 4.1.2. of this annex shall comply with at least one measurement at 10 m or 25 m.

The measuring distance at which the test was determined shall be noted down in paragraph 9., Annex 1 "Communication form" of the pertinent Regulation.

The scanning is performed from its lower position upwards through the "cut-off" line along the vertical lines at -3° to -1.5° and +1.5° to +3° from the V-V line. When so measured, the quality of the "cut-off" line shall meet the following requirements:

-
- 4.1.1. Not more than one "cut-off" line shall be visible¹.
- 4.1.2. Sharpness of "cut-off": if scanned vertically through the horizontal part of the "cut-off" line along the $\pm 2.5^\circ$ -lines, the maximum value measured for:
- $$G = (\log E_V - \log E_{(V+0.1^\circ)})$$
- is called the sharpness factor G of the "cut-off" line. The value of G shall not be less than 0.13 for Class B and 0.08 for Classes A, C, D and E.
- 4.1.3. Linearity: the part of the "cut-off" line which serves for vertical adjustment shall be horizontal from 3°L to 3°R of the V-V line. This requirement is deemed to be met if the vertical positions of the inflection points according to paragraph 3.2. at 3° left and right of the V-V line do not differ by more than 0.2° for Class B and 0.3° for Classes A, C, D and E headlamps from the nominal position at the V-V line.
5. Instrumental vertical adjustment
- 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-h-line. The movement for measuring and adjusting the "cut-off" line shall be upwards from below the nominal position.

Annex B10

TESTS FOR STABILITY OF PHOTOMETRIC PERFORMANCE OF SIGNALLING LAMPS AND HEAD LAMPS IN OPERATION

A Heat resistance test for rear fog lamps and daytime running lamps

- 1.1. The lamp shall be subjected to a one-hour test of continuous operation following a warm-up period of 20 minutes. The ambient temperature shall be $23^\circ\text{C} \pm 5^\circ\text{C}$. The light source used shall be a light source of the category specified for the lamp, and shall be supplied with a current at a voltage such that it gives the specified average power at the corresponding test voltage. However, for lamps equipped with non-replaceable light sources (filament lamps and other), the test shall be made with the light sources present in the lamp, in accordance with **Annex B5**.
- 1.2. Where only the maximum power is specified, the test shall be carried out by regulating the voltage to obtain a power equal to 90 per cent of the specified power. The specified average or maximum power referred to above shall in all cases be chosen from the voltage range of 6, 12 or 24 V at which it reaches the highest value; for lamps equipped with non-replaceable light sources (filament lamps and other) the test conditions set in **Annex B5** shall be applied.
- 1.3. After the lamp has been stabilized at the ambient temperature, no distortion, deformation, cracking or colour modification shall be perceptible. In case of doubt the intensity of light

¹ This paragraph will be amended, if an objective test method is available.

according to the specific paragraph “ Intensity of Light” in the pertinent Regulation shall be measured. At that measurement the values shall reach at least 90 per cent of the values obtained before the heat resistance test on the same device.

B Heat resistance test for head lamps and front fog lamps

Tests on complete headlamps

Once the photometric values have been measured according to the prescriptions in the pertinent Regulation, in the point for I_{\max} for driving-beam and in points HV, 50 R, B 50 L for passing-beam (or HV, 50 L, B 50 R for headlamps designed for left-hand traffic) a complete headlamp sample shall be tested for stability of photometric performance in operation. "Complete headlamp" shall be understood to mean the complete lamp itself including those surrounding body parts and lamps which could influence its thermal dissipation.

The tests shall be carried out:

- (a) In a dry and still atmosphere at an ambient temperature of $23\text{ °C} \pm 5\text{ °C}$, 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 modules which have been aged for at least 48 hours and cooled down to ambient temperature before starting the tests as specified in the pertinent Regulation. The LED modules supplied by the applicant shall be used.

The measuring equipment shall be equivalent to that used during headlamp type approval tests.

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.

1. Test for stability of photometric performance

1.1. Clean headlamp

The headlamp shall be operated for 12 hours as described in paragraph 1.1.1. and checked as prescribed in paragraph 1.1.2.

1.1.1. Test procedure²

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

- 1.1.1.1. (a) In the case where only one lighting function (driving or passing-beam or front fog lamp) is to be approved, the corresponding filament and/or LED module(s) is (are) lit for the prescribed time³;

² For the test schedule see Annex 8 to this Regulation.

³ When the tested headlamp includes signalling lamps, the latter shall be lit for the duration of the test,

-
- (b) In the case of a headlamp with 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 headlamp shall be subjected to the following cycle until the time specified is reached:
- 15 minutes, principal passing-beam filament or principal passing-beam LED module(s) lit;
- 5 minutes, all filaments and/or LED module(s) 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) lit⁴ at a time, the test shall be carried out in accordance with this condition, activating² successively the passing-beam half of the time and the driving-beam(s) (simultaneously) for half the time specified in paragraph 1.1..
- (c) 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 filaments and/or all LED modules 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) lit³ at a time, the test shall be carried out in accordance with this condition, activating² successively the front fog lamp half of the time and the driving-beam(s) (simultaneously) for half the time specified in paragraph 1.1..
- (d) 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 filament or principal passing-beam LED module(s) lit;
- 5 minutes, all filaments and/or all LED modules lit.

except for a daytime running lamp. In the case of a direction indicator lamp, it shall be lit in flashing mode with an on/ off time of approximately one to one.

⁴ Should two or more lamp filaments and/or LED module(s) be simultaneously lit when headlamp flashing is used, this shall not be considered as being normal use of the filaments and/or LED module(s).

- (ii) If the applicant declares that the headlamp is to be used with only the passing-beam lit or only the driving-beam(s)³ lit at a time, the test shall be carried out in accordance with this condition, activating² successively the principal passing-beam half of the time and the driving-beam(s) for half the time specified in paragraph 1.1., 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 passing-beam lit or only the front fog lamp³ lit at a time, the test shall be carried out in accordance with this condition, activating² successively the principal passing-beam half of the time and the front fog lamp for half of the time specified in paragraph 1.1., 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 passing-beam lit or only the driving-beam(s)³ lit or only the front fog lamp³ lit at a time, the test shall be carried out in accordance with this condition, activating² successively the principal passing-beam one third of the time, the driving-beam(s) one third of the time and the front fog lamp for one third of the time specified in paragraph 1.1..
- (e) In the case of a passing-beam designed to provide bend lighting with the addition of a filament light source and/or one or more LED module(s), this light source and/or LED module(s) shall be switched on for one minute, and switched off for nine minutes during the activation of the passing-beam only (see Annex 4 – Appendix 1).

1.1.1.2.

Test voltage

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

- (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 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 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 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 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.

1.1.2. Test results

1.1.2.1. Visual inspection

Once the headlamp has been stabilized to the ambient temperature, the headlamp lens and the external lens, if any, shall be cleaned with a clean, damp cotton cloth. It shall then be inspected visually; no distortion, deformation, cracking or change in colour of either the headlamp lens or the external lens, if any, shall be noticeable.

1.1.2.2. Photometric test

To comply with the requirements **of the pertinent Regulation**, the photometric values shall be verified in the following points:

In the case of a head lamp with an asymmetrical beam pattern:

Passing-beam:

50 R - B 50 L – **25L** for headlamps designed for right-hand traffic,

50 L - B 50 R – **25R** for headlamps designed for left-hand traffic.

Driving-beam:

Point I_{\max}

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

For Class B headlamp:

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

Driving beam: Point of I_{\max}

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_{\max}

In the case of a front fog lamps:

In case of Class "B" front fog lamps: at point HV and the point of I_{\max} in zone D.

In case of Class "F3" 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 headlamp base due to heat (the change of the position of the cut-off line is covered in paragraph 2. of this annex).

In the case of a head lamp with an asymmetrical beam pattern or front fog lamps:

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.

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

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.

1.2. Dirty headlamp

After being tested as specified in paragraph 1.1., the headlamp shall be operated for one hour as described in paragraph 1.1.1., after being prepared as prescribed in paragraph 1.2.1., and checked as prescribed in paragraph 1.1.2.

1.2.1. Preparations of the headlamp

1.2.1.1. Test mixture

See Appendix 2 to this Annex

1.2.1.2. 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 in this annex:

In the case of a head lamp with an asymmetrical beam pattern:

Point of E_{\max} in passing-beam/driving-beam and in driving-beam only,

50 R and 50 V⁵ for a headlamp producing only a passing-beam, designed for right-hand traffic,

50 L and 50 V⁶ for a headlamp producing only a passing-beam, designed for left-hand traffic.

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

For Class B headlamp:

Passing beam/driving beam and driving beam only: Point of E_{\max}

Passing beam only: B 50 and 50 V

For Class C, D and E headlamp:

Passing beam/driving beam and driving beam only: Point of E_{\max}

Passing beam only: 0.50U/1.5L and 1.5R and 0.86D/V

In the case of a front fog lamps:

⁵Point 50 V is situated 375 mm below HV on the vertical line v-v on the screen at 25 m distance.

point of Emax in zone D for a front fog lamp;

2. 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.

The headlamp 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.

2.1. Test

The test shall be carried out in a dry and still atmosphere at an ambient temperature of $23 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$.

Using a mass production filament lamp or the LED module(s) as submitted with the headlamp, which has (have) been aged for at least one hour, the headlamp shall be operated on the principal passing-beam 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 1.1.1.2.). The position of the cut-off line in its horizontal part (between vv and the vertical line passing through point B 50 L for right-hand traffic or B 50 R for left-hand traffic) shall be verified 3 minutes (r_3) and 60 minutes (r_{60}) 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.

2.2. Test results

2.2.1. The result expressed in milliradians (mrad) shall be considered as acceptable for a passing-beam headlamp when the absolute value $\Delta r_1 = |r_3 - r_{60}|$ recorded on the headlamp is not more than 1.0 mrad ($\Delta r_1 \leq 1.0 \text{ mrad}$) upward and not more than 2.0 mrad ($\Delta r_1 \leq 2.0 \text{ mrad}$) downwards.

2.2.2. However, if this value is:

| <i>Movement</i> | |
|-----------------|--|
| upward | more than 1.0 mrad but not more than 1.5 mrad ($1.0 \text{ mrad} < \Delta r_1 \leq 1.5 \text{ mrad}$) |
| downward | more than 2.0 mrad but not more than 3.0 mrad ($2.0 \text{ mrad} < \Delta r_1 \leq 3.0 \text{ mrad}$) |

a further sample of a headlamp shall be tested as described in paragraph 2.1. after being subjected three consecutive times to the cycle as described below, in order to stabilize the position of mechanical parts of the headlamp on a base representative of the correct installation on the vehicle:

Operation of the passing-beam for one hour, (the voltage shall be adjusted as specified in paragraph 1.1.1.2.),

After this period of one hour, the headlamp type shall be considered as acceptable if the absolute value Δr measured on this sample meets the requirements in paragraph 2.2.1..

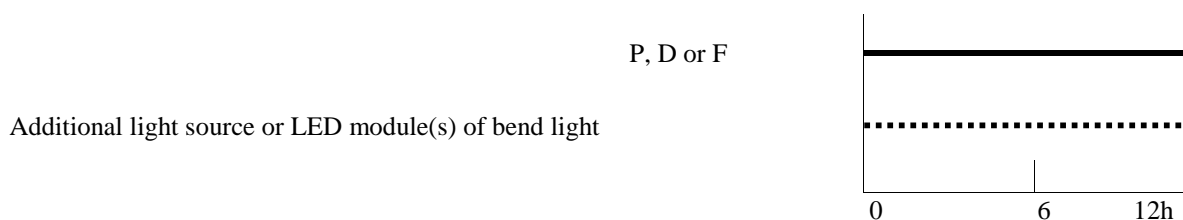
Annex B10 - Appendix 1

Overview of operational periods concerning test for stability of photometric performance

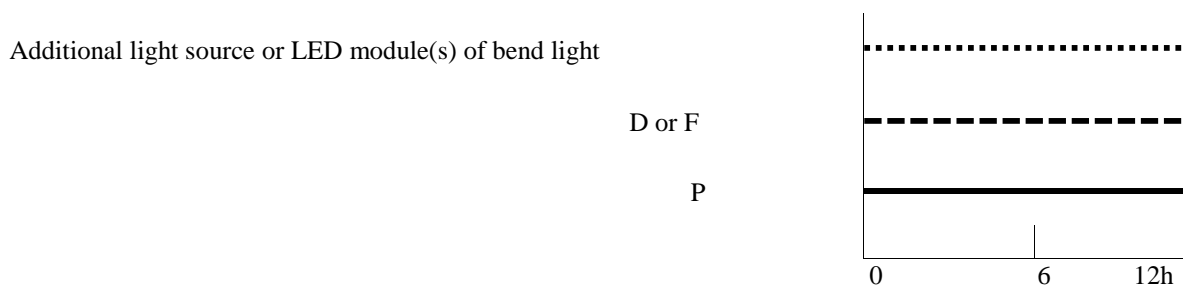
| | |
|----------------|--|
| Abbreviations: | P: passing-beam lamp |
| | D: driving-beam lamp (D ₁ + D ₂ means two driving-beams) |
| | F: front fog lamp |
| - - - - - | means a cycle of 15 minutes off and 5 minutes lit |
| | means a cycle of 9 minutes off and 1 minute lit |

All following grouped headlamps and front fog lamps together with the added marking symbols are given as examples and are not exhaustive.

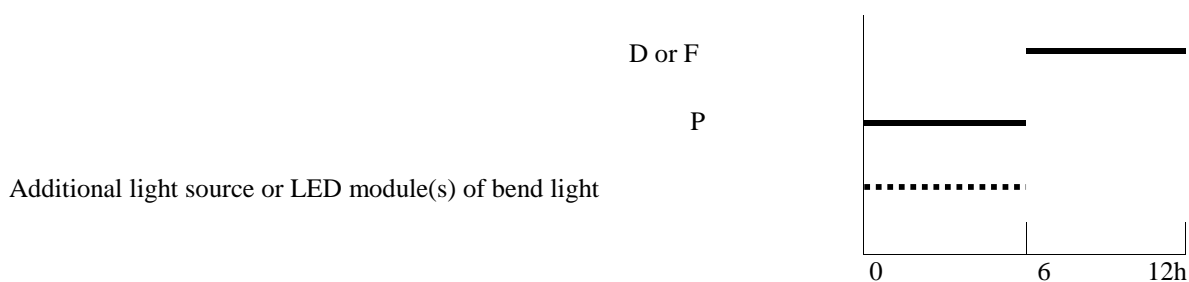
1. P or D or F (HC or HR or B)



2. P+F (HC B) or P+D (HCR)



3. P+F (HC/B) or HC/B or P+D (HC/R)



Annex B10 Appendix 2

TEST MIXTURE

1. Test mixture
- 1.1. For headlamp with the outside lens in glass:

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

9 parts by weight of silica sand with a particle size of 0-100 µm,

1 part by weight of vegetal carbon dust **produced from** ~~(beech wood)~~ with a particle size of 0-100 µm,

0.2 parts by weight of NaCMC¹, and

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

an appropriate quantity of distilled water, with a conductivity of ≤ 1 mS/m.

The mixture must not be more than 14 days old.
- 1.2. For headlamp with outside lens in plastic material:

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

9 parts by weight of silica sand with a particle size of 0-100 µm,

1 part by weight of vegetal carbon dust **produced from** ~~(beech wood)~~ with a particle size of 0-100 µm,

0.2 parts by weight of NaCMC¹, and

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

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

2 ± 1 parts by weight of surface-actant⁴.

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

¹ NaCMC represents the sodium salt of carboxymethylcellulose, customarily referred to as CMC. The NaCMC used in the dirt mixture shall have a degree of substitution (DS) of 0.6-0.7 and a viscosity of 200-300 cP for a 2 per cent solution at 20° C.

REQUIREMENTS FOR LAMPS INCORPORATING LENSES

OF PLASTIC MATERIAL

– TESTING OF LENS OR MATERIAL SAMPLES

- 0. General administrative requirements:
 - 0.1. **A test report shall be prepared on the base of this HRD, covering the test and test results as described below , which will be added to the test report and the documentation to a specific head lamp or front fog lamp for approval.**
 - 0.2. For the test of plastic material of which the lenses are made:
 - 0.2.1. Fourteen lenses;
 - 0.2.1.1. 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 measuring at least 15 x 15 mm;
 - 0.2.1.2. Every such lens or sample of material shall be produced by the method to be used in mass production;
 - 0.2.2. A reflector to which the lenses can be fitted in accordance with the manufacturer's instructions.
 - 0.2.3. For testing the ultraviolet (UV)-resistance of light transmitting components made of plastic material against UV radiation of LED modules inside the headlamp:
 - 0.2.3.1. One sample of each of the relevant material as being used in the headlamp or one headlamp 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;
 - 0.2.3.2. 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 Annex B13 are being applied or if provisions are taken, to shield the relevant headlamp components from UV radiation, e.g. by glass filters.
- 1. General requirements
 - 1.1. The samples supplied pursuant to paragraph 0.2. shall satisfy the requirements indicated in paragraphs 2.1. to 2.5..
 - 1.2. The two samples of complete lamps supplied pursuant to paragraph 3.2.4.5. and incorporating lenses of plastic material shall, with regard to the lens material, satisfy the requirements indicated in paragraph 2.6..
 - 1.3. The samples of lenses of plastic material or samples of material shall be subjected, with the reflector to which they are intended to be fitted (where

applicable), to approval tests in the chronological order indicated in Table A reproduced in Appendix 1 to this annex.

1.4. However, if the lamp manufacturer can prove that the product has already passed the tests prescribed in paragraphs 2.1. to 2.5., or the equivalent tests pursuant to another regulation, those tests need not be repeated; only the tests prescribed in Appendix 1, Table B, shall be mandatory.

2. Tests

2.1. Resistance to temperature changes

2.1.1. Tests

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 $40\text{ °C} \pm 2\text{ °C}$ and 85-95 per cent RH;

1 hour at $23\text{ °C} \pm 5\text{ °C}$ and 60-75 per cent RH;

15 hours at $-30\text{ °C} \pm 2\text{ °C}$;

1 hour at $23\text{ °C} \pm 5\text{ °C}$ and 60-75 per cent RH;

3 hours at $80\text{ °C} \pm 2\text{ °C}$;

1 hour at $23\text{ °C} \pm 5\text{ °C}$ and 60-75 per cent RH;

Before this test, the samples shall be kept at $23\text{ °C} \pm 5\text{ °C}$ and 60-75 per cent RH for at least four hours.

Note: The periods of one hour at $23\text{ °C} \pm 5\text{ °C}$ shall include the periods of transition from one temperature to another which are needed in order to avoid thermal shock effects.

2.1.2. Photometric measurements

2.1.2.1. Method

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

These measurements shall be made using a standard (étalon) lamp and/or LED module(s), **or if applicable with a standard gas-discharge light source**, as present in the headlamp, at the following points:

In the case of a head lamp with an asymmetrical beam pattern:

B 50 L and 50 R for the passing-beam (B 50 R and 50 L in the case of headlamps intended for left-hand traffic);

I_{\max} for the driving-beam.

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

B 50, 50L and 50R for Class B headlamp, 0.86D/3.5R, 0.86D/3.5L, 0.50U/1.5L and 1.5R for Class C, D and E headlamp for the passing beam or a passing/driving lamp; I_{\max} for the driving beam of a driving lamp or a passing/driving lamp;

In the case of a front fog lamps:

In the case of Class "B" front fog lamps:

(a) at point HV and

(b) point $h = 0$, $v = 2^\circ$ D in zone D.

In the case of Class "F3" front fog lamps:

(a) intersection VV line with line 6 and

(b) intersection VV line with line 4.

The head lamp or front fog lamp used for this test shall be noted in the test report.

2.1.2.2. 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.

2.2. Resistance to atmospheric and chemical agents

2.2.1. 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 $1,200 \text{ W/m}^2 \pm 200 \text{ W/m}^2$ for a period such that the luminous energy that they receive is equal to $4,500 \text{ MJ/m}^2 \pm 200 \text{ MJ/m}^2$. Within the enclosure, the temperature measured on the black panel placed on a level with the samples shall be $50 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$. 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 samples shall be sprayed with distilled water of conductivity lower than 1 mS/m at a temperature of $23 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$, in accordance with the following cycle:

spraying: 5 minutes; drying: 25 minutes.

2.2.2. Resistance to chemical agents

After the test described in paragraph 2.2.1. and the measurement described in paragraph 2.2.3.1. have been carried out, the outer face of the said three samples shall be treated as described in paragraph 2.2.2.2. with the mixture defined in paragraph 2.2.2.1..

2.2.2.1. 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).

2.2.2.2. Application of the test mixture

Soak a piece of cotton cloth (as per ISO 105) until saturation with the mixture defined in paragraph 2.2.2.1. and, within 10 seconds, apply it for 10 minutes to the outer face of the sample at a pressure of 50 N/cm^2 , 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.

2.2.2.3. 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 2.3.1. (Resistance to detergents)

23 °C ± 5 °C.

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

2.2.3. Results

2.2.3.1. 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 according to the procedure described in Appendix 2 to this annex shall not exceed 0.020 ($\Delta t_m \leq 0.020$).

2.2.3.2. 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 according to

the procedure described in Appendix 2 to this annex shall not exceed 0.020 ($\Delta d_m \leq 0.020$).

2.2.4. Resistance to light source radiations

The following test shall be done:

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

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

2.3. Resistance to detergents and hydrocarbons

2.3.1. Resistance to detergents

The outer face of three samples (lenses or samples of material) shall be heated to 50 °C ± 5 °C and then immersed for five minutes in a mixture maintained at 23 °C ± 5 °C and composed of 99 parts distilled water containing not more than 0.02 per cent impurities and one part alkylaryl sulphionate.

At the end of the test, the samples shall be dried at 50 °C ± 5 °C. The surface of the samples shall be cleaned with a moist cloth.

2.3.2. 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.

2.3.3. 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 to this annex shall not exceed 0.010 ($\Delta t_m \leq 0.010$).

2.4. Resistance to mechanical deterioration

2.4.1. 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 Appendix 3 to this annex.

2.4.2. Results

After this test, the variations:

in transmission: $\Delta t = \frac{T_2 - T_3}{T_2}$,

and in diffusion: $\Delta t = \frac{T_5 - T_4}{T_2}$,

shall be measured according to the procedure described in Appendix 2 in the area specified in paragraph 0.2.1.1. of this Annex. The mean value of the three samples shall be such that:

$$\Delta t_m \leq 0.100;$$

$$\Delta d_m \leq 0.050.$$

2.5. Test of adherence of coatings, if any

2.5.1. 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.

2.5.2. 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 Appendix 4 to this annex. 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 2.5.1..

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 \pm 0.2 m/s.

2.5.3. 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.

-
- 2.6. Tests of the complete headlamp incorporating a lens of plastic material
 - 2.6.1. Resistance to mechanical deterioration of the lens surface
 - 2.6.1.1. Tests

The lens of lamp sample No. 1 shall be subjected to the test described in paragraph 2.4.1..
 - 2.6.1.2. Results

After the test, the results of photometric measurements carried out on the headlamp in accordance with the pertinent Regulation shall not exceed by more than 30 per cent the maximum values prescribed at points B 50 L and HV and not be 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).
 - 2.6.2. Test of adherence of coatings, if any

The lens of lamp sample No. 2 shall be subjected to the test described in paragraph 2.5..
 - 3. Verification of the conformity of production
 - 3.1. With regard to the materials used for the manufacture of lenses, the lamps of a series shall be recognized as complying with the pertinent Regulation. if:
 - 3.1.1. After the test for resistance to chemical agents and the test for resistance to detergents and hydrocarbons, the outer face of the samples exhibits no cracks, chipping or deformation visible to the naked eye (see paras. 2.2.2., 2.3.1. and 2.3.2.);

-
- 3.1.2. After the test described in paragraph 2.6.1.1., the photometric values at the points of measurement considered in paragraph 2.6.1.2. are within the limits prescribed for conformity of production by this Regulation.
- 3.2. If the test results fail to satisfy the requirements, the tests shall be repeated on another sample of headlamps selected at random.

Annex B11 - Appendix 1

Chronological order of approval material tests

A. Tests on plastic materials (lenses or samples of material supplied pursuant to paragraph 0.2. of this Annex).

| <i>Samples</i> | <i>Lenses or samples of material</i> | | | | | | | | | | <i>Lenses</i> | | | |
|---|--------------------------------------|---|---|---|---|---|---|---|---|----|---------------|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| <i>Tests</i> | | | | | | | | | | | | | | |
| 1.1. Limited photometry (A.6, para. 2.1.2.) | | | | | | | | | | | X | X | X | |
| 1.1.1. Temperature change (A.6, para. 2.1.1.) | | | | | | | | | | | X | X | X | |
| 1.2. Limited photometry (A.6, para. 2.1.2.) | | | | | | | | | | | X | X | X | |
| 1.2.1. Transmission measurement | X | X | X | X | X | X | X | X | X | | | | | |
| 1.2.2. Diffusion measurement | X | X | X | | | | X | X | X | | | | | |
| 1.3. Atmospheric agents (A.6, para. 2.2.1.) | X | X | X | | | | | | | | | | | |
| 1.3.1. Transmission measurement | X | X | X | | | | | | | | | | | |
| 1.4. Chemical agents (A.6, para.2.2.2.) | X | X | X | | | | | | | | | | | |
| 1.4.1. Diffusion measurements | X | X | X | | | | | | | | | | | |
| 1.5. Detergents (A.6, para. 2.3.1.) | | | | X | X | X | | | | | | | | |
| 1.6. Hydrocarbons (A.6, para. 2.3.2.) | | | | X | X | X | | | | | | | | |
| 1.6.1. Transmission measurement | | | | X | X | X | | | | | | | | |
| 1.7. Deterioration (A.6, para. 2.4.1.) | | | | | | | X | X | X | | | | | |
| 1.7.1. Transmission measurement | | | | | | | X | X | X | | | | | |
| 1.7.2. Diffusion measurement | | | | | | | X | X | X | | | | | |
| 1.8. Adherence (A.6, para. 2.5.) | | | | | | | | | | | | | | X |
| 1.9 Resistance to light source radiations (A.6, para. 2.2.4.) | | | | | | | | | | X | | | | |

Annex 12

Colour fastness to artificial light Xenon-arc lamp test

1. Scope
This annex specifies a method intended for determining the resistance of the colour of test samples of all kinds and in all forms to the action of an artificial light source representative of natural daylight (D65).
2. Principle
A specimen of the test samples to be tested is exposed to artificial light under prescribed conditions, along with a blue wool reference as specified.
3. Reference materials
The colour fastness ratings mentioned in this annex are obtained by comparison unexposed with exposed specified blue wool references for verification of the radiation dose as a required maximum contrast **in the pertinent Regulation.**
- 3.1. Blue wool references developed and produced in Europe are identified by the numerical designation 1 to 8. These references are blue wool cloths dyed with the dyes listed in table 1. For the test **procedure of the pertinent Regulation.** described by this annex only the blue wool references 5 and 7 will be applied as described in Table 1 below.

Table 1
Dyes for blue wool references 5 and 7

| <i>Reference</i> | <i>Dye (Colour Index designation)¹</i> |
|------------------|---|
| 5 | CI Acid Blue 47 |
| 7 | CI Solubilised Vat Blue 5 |

¹ The Colour Index (third edition) is published by The Society of Dyers and Colourists, P.O. Box 244, Perkin House, 82 Grattan Road, Bradford BD1 2JB, UK, and by The American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215, USA.

4. Grey scale
The grey scale for determining changes in colour of test samples in colour fastness tests. A precise colorimetric specification of the scale is given in Appendix 1 to this annex.
- 4.1. The use of the scale is described in paragraph 2 of Appendix 1 to this annex.
5. Xenon-arc lamp apparatus
The apparatus shall be either an air-cooled or water-cooled Xenon-arc weathering device capable of exposing samples in accordance with EN ISO 4892-2.
- 5.1. The exposure conditions shall comply with the requirements in the Table 2 below.

Table 2

Artificial weathering test parameters

| <i>Exposure parameters</i> | <i>Air-cooled lamp</i> | <i>Water-cooled lamp</i> |
|--|--|--|
| Light/dark/water spray cycle | Continuous light without water spray | Continuous light without water spray |
| Black standard temperature during light only periods | (47 ± 3) °C using a black standard thermometer | (47 ± 3) °C using a black standard thermometer |
| Relative humidity | Approximately 40 % | Approximately 40 % |
| Filters | Window glass filters requirements see paragraph 5.2. | Window glass filters requirements see paragraph 5.2. |
| <i>Irradiance (W/m²) controlled at:</i> | | |
| Over 300nm to 400nm range | 42±2 | 42±2 |
| Over 300nm to 800nm range | 550 | 630 |
| <p><i>Note 1:</i> Water used for the specimen spray should contain no more than 1 ppm silica. Higher levels of silica can produce spotting on samples and variability in results. Water of the required purity can be obtained by distillation or by a combination of deionization and reverse osmosis.</p> <p><i>Note 2:</i> While irradiance levels should be set at the above levels, variations in filter ages and transmissivity, and in calibration variations, will generally mean that irradiance error will be in the order of ± 10 per cent.</p> | | |

5.2 Light source

The light source shall consist of a xenon arc lamp of correlated colour temperature 5500 K to 6500 K, the size of which will depend on the type of apparatus used. The xenon-arc lamp shall use filters that provide a reasonable simulation of solar radiation filtered by typical window glass. Table 3 gives the relative spectral irradiance requirements for the filtered xenon-arc. It is the responsibility of the supplier of the exposure device to provide necessary certification that the filters that they supply for use in the exposure tests described in this standard meets the requirements of Table 3.

Table 3

Relative spectral irradiance requirements for window glass filters ^{a, b, c, d, e} used for the Xenon-arc devices used in this standard.

| <i>Spectral Bandpass Wavelength λ in nm</i> | <i>Minimum %^c</i> | <i>CIE No.85, Table 4 plus window glass %^{d, e}</i> | <i>Maximum %^c</i> |
|--|----------------------------------|--|----------------------------------|
| $1 < 300$ | | | 0.29 |
| $300 \leq \lambda \leq 320$ | 0.1 | ≤ 1 | 2.8 |
| $320 < \lambda \leq 360$ | 23.8 | 33.1 | 35.5 |
| $360 < \lambda \leq 400$ | 62.4 | 66.0 | 76.2 |

^a Data in Table 3 is the irradiance in the given bandpass expressed as a percentage of the total irradiance from 290 nm to 400 nm. To determine whether a specific filter or set of filters for a xenon-arc meets the requirements of Table 3, the spectral irradiance from 250 nm to 400 nm must be measured. The total irradiance in each wavelength bandpass is then summed and divided by the total irradiance from 290 nm to 400 nm.

^b The minimum and maximum data in Table 3 are based on more than 30 spectral irradiance measurements for water and air cooled xenon-arcs with window glass filters of various lots and ages. Spectral irradiance data is for filters and xenon-burners within the ageing recommendations of the device manufacturer. As more spectral irradiance data become available, minor changes in the limits are possible. The minimum and maximum data are at least the three sigma limits from the mean for all measurements.

^c The minimum and maximum columns will not necessarily sum to 100 per cent because they represent the minimum and maximum for the data used. For any individual spectral irradiance, the calculated percentage for the bandpasses in Table 3 will sum to 100 per cent. For any individual xenon-arc lamp with window glass filters, the calculated percentage in each bandpass must fall within the minimum and maximum limits of Table 2. Test results can be expected to differ between exposures using xenon-arc devices in which the spectral irradiance differ by as much as that allowed by the tolerances. Contact the manufacturer of the xenon-arc devices for specific spectral irradiance data for the xenon-arc and filters used.

^d The data from Table 4 in CIE No. 85 [1] plus window glass was determined by multiplying the CIE No. 85, Table 4 data by the spectral transmittance of 3 mm thick window glass (see ISO 11341 [2]). These data are target values for xenon-arc with window glass filters.

^e For the CIE 85 Table 4 plus window glass, the UV irradiance from 300 nm to 400 nm is typically about 9 per cent and the visible irradiance (400 nm to 800 nm) is typically about 91 per cent when expressed as a percentage of the total irradiance from 300 nm to 800 nm. The percentages of UV and visible irradiances on samples exposed in xenon arc devices may vary due to the number and reflectance properties of specimens being exposed.

- 5.3. Light exposure equivalents for blue wool light fastness references for exposure by a Xenon-arc lamp

Table 4

Blue wool reference

| <i>Blue wool reference</i> | | <i>420nm</i> | <i>300 nm–400 nm</i> |
|---|----|-------------------|----------------------|
| No. | | kJ/m ² | kJ/m ² |
| 5 | L6 | 340 | 13824 |
| 7 | L8 | 1360 | 55296 |
| For colour change of step 4 on the grey scale | | | |

6. Procedure (blue wool references)
- 6.1 Place the test samples mounted on the holders in the apparatus and expose them continuously to weathering following the method described below.
- 6.2 At the same time expose the blue wool references mounted on card-board, cover one-third of each.
- 6.3 Only one side of the test samples shall be exposed to weathering and light.
- 6.4 While the specimens are drying, the air in the test chamber shall not be moistened.
- Note:* The actual conditions of the weathering test depend on the kind of test apparatus used.
- 6.5 Before mounting the tested specimens for assessment, dry them in air at a temperature not exceeding 60°C.
- 6.6 Trim and mount the exposed blue wool reference so that they measure at least 15 mm x 30 mm, one on each side of a portion of the original which has been trimmed to the same size and shape as the specimens.
- 6.7 Unexposed samples of original fabric identical to those being tested are required as references for comparison with the specimens during weathering.

Annex B12 - Appendix 1

Definition of the Grey Scale

This section describes the grey scale for determining changes in colour of test samples in colour fastness tests, and its use. A precise colorimetric specification of the scale is given as a permanent record against which newly prepared working standards and standards that may have changed can be compared.

1. The essential, or 5-step, scale consists of five pairs of non-glossy grey colour chips (or swatches of grey cloth), which illustrate the perceived colour differences corresponding to fastness ratings 5, 4, 3, 2 and 1. This essential scale may be augmented by the provision of similar chips or swatches illustrating the perceived colour differences corresponding to the half-step fastness ratings 4-5, 3-4, 2-3 and 1-2, such scales being termed 9-step scales. The first member of each pair is neutral grey in colour and the second member of the pair illustrating fastness rating 5 is identical with the first

member. The second members of the remaining pairs are increasingly lighter in colour so that each pair illustrates increasing contrasts or perceived colour differences which are defined colorimetrically. The full colorimetric specification is given below:

- 1.1. The chips or swatches shall be neutral grey in colour and shall be measured with a spectrophotometer with the specular component included. The colorimetric data shall be calculated using CIE standard colorimetric system for Illuminant D65;
- 1.2. The Y tristimulus value of the first member of each pair shall be 12 ± 1 ;
- 1.3. The second member of each pair shall be such that the colour difference between it and the adjacent first member is as follows.

Table 1
CIELab difference in relation to the Fastness grade

| <i>Fastness grade</i> | <i>CIELab difference</i> | <i>Tolerance</i> |
|-----------------------|--------------------------|------------------|
| 5 | 0 | 0.2 |
| (4-5) | 0.8 | ± 0.2 |
| 4 | 1.7 | ± 0.3 |
| (3-4) | 2.5 | ± 0.35 |
| 3 | 3,4 | ± 0.4 |
| (2-3) | 4.8 | ± 0.5 |
| 2 | 6.8 | ± 0.6 |
| (1-2) | 9.6 | ± 0.7 |
| 1 | 13.6 | ± 1.0 |

Note 1: Bracketed values apply only to the 9-step scale.

Note 2: Use of the scale:

Place a piece of the original blue reference and the exposed specimen of it side by side in the same plane and oriented in the same direction. Place the grey scale nearby in the same plane. The surrounding field should be neutral grey colour approximately midway between that illustrating grade 1 and that illustrating grade 2 of the grey scale for assessing change in colour (this is approximately Munsell N5). Illuminate the surfaces with north sky light in the Northern hemisphere, south sky light in the Southern hemisphere, or an equivalent source with an illumination of 600 lx or more. The light should be incident upon the surfaces at approximately 45° , and the direction of viewing approximately perpendicular to the plane of the surfaces. Compare the visual difference between original and exposed blue standard with the differences represented by the grey scale.

If the 5-step scale is used, the fairness rating of the specimen is that number of the grey scale which has a perceived colour difference equal in magnitude to the perceived colour difference between the original and the treated specimens; if the latter is judged to be nearer the imaginary contrast lying midway between two adjacent pairs than it is to either, the specimen is given an intermediate assessment, for example 4-5 or 2-3. A rating of 5 is given only when there is no perceived difference between the tested specimen and the original material.

If the 9-step scale is used, the fastness rating of the specimen is that number of the grey scale which has a perceived colour difference nearest in magnitude to the perceived colour difference between the original and the tested specimens. A rating of 5 is given only when there is no perceived difference between the tested specimen and the original material.

Insert a new Annex 10, to read:

"Annex B12 - Appendix 2

Description of the measurement geometry for measurement of the colour and the luminance factor of fluorescent retro-reflective materials

Micro-prismatic materials show the phenomenon of 'flares' or 'sparkles' (Note 1), which might influence the measured results unless special precautions are taken. A reference method, using the wider apertures of the CIE 45°a:0° (or 0°:45°a) geometry is introduced in paragraph 12. of Annex 5 to this regulation.

Ideally, the measurements shall be made using the CIE 45°a:0° (or 0°:45°a), called the forty-five annular / normal geometry (or the normal/ forty-five annular geometry) defined in CIE 15 (see paragraph 12. of Annex 5.) The measurement area shall be minimum 4.0 cm².

For this geometry CIE 15 recommends that:

- (a) The sampling aperture be irradiated uniformly from all directions between two circular cones with their axes normal to the sampling aperture and apices at the centre of the sampling aperture, the smaller of the cones having a half angle of 40° and the larger of 50°;
- (b) The receiver uniformly collects and evaluates all radiation reflected within a cone with its axis on the normal to the sampling aperture, apex at the centre of the sampling aperture, and a half angle of 5°.

The annular geometry can be approximated by the use of a number of light sources in a ring or a number of fibre bundles illuminated by a single source and terminated in a ring to obtain the CIE 45°c:0° (circumferential / normal geometry) (Note 2, Note 3).

An alternative manner of approximation is to use a single light source, but rotate the sample during measurement with a rotational speed that ensures that a number of revolutions takes place during the exposure time interval for a measurement so that all wavelengths are given equal weight (Note 2, Note 3).

In addition, the apertures of the light source and the receiver shall have sufficient dimensions in proportion to distances to ensure a reasonable compliance with the above-mentioned recommendations.

Note 1 'Flares' or 'sparkles' are caused by characteristic paths of rays that enter and leave the sheeting surface at different angles. A characteristic path will dominate by raising the luminance factor value significantly and possibly distorting the chromaticity co-ordinates if it is included within narrow beams of illumination and measurement. However, the average contribution to the daylight reflection is normally small.

Note 2 In practice the recommendations can be approximated only. The important issue is that the annular principle is applied and that illumination and collection occur in directions forming fairly large solid angles, as this will reduce the influence of the above-mentioned 'sparkles' of micro-prismatic materials and of other variations with the precise geometry shown by some of these materials.

Note 3 In spite of such precautions, the practical difficulties of establishing the annular geometry in accordance with the recommendations introduce uncertainty of measurement."

Annex B13

Requirements for LED modules and headlamps including LED modules

1. General requirements 1.1. Each LED module sample submitted shall conform to the relevant requirements of the pertinent Regulation, when tested with the supplied electronic light source control-gear(s), if any.
- 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.
- 1.3. LED module(s) shall be tamperproof.
- 1.4. The design of removable LED module(s) shall be such that:
 - 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 shall be met;
 - 1.4.2. LED modules with different light source module identification codes within the same lamp housing, shall not be interchangeable.
2. Manufacture
 - 2.1. The LED(s) on the LED module shall be equipped with suitable fixation elements.
 - 2.2. The fixation elements shall be strong and firmly secured to the LED(s) and the LED module.
3. Test conditions
 - 3.1. Application
 - 3.1.1. All samples shall be tested as specified in paragraph 4..
 - 3.1.2. The kind of light sources on a LED module shall be light-emitting diodes (LED) as defined in paragraph B2.8.. in particular with regard to the element of visible radiation. Other kinds of light sources are not permitted.
 - 3.2. Operating conditions
 - 3.2.1. LED module operating conditions

All samples shall be tested under the conditions as specified in paragraphs 6.1.4. and 6.1.5. of the pertinent Regulation. If not specified differently in this annex LED modules shall be tested inside the headlamp as submitted by the manufacturer.

3.2.2. Ambient temperature

For the measurement of electrical and photometric characteristics, the headlamp shall be operated in a dry and still atmosphere at an ambient temperature of $23\text{ °C} \pm 5\text{ °C}$.

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.

4. Specific requirements and tests

4.1. Colour rendering

4.1.1. Red content

In addition to measurements as described in paragraph 7. of the pertinent Regulation.

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

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

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.

4.2. UV-radiation

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

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

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.

(For definitions of the other symbols see paragraph 4.1.1.).

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:

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.

| 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 | 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 | 0.000 053 |
| 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 | | | | |

4.3. Temperature stability

4.3.1. Illuminance

4.3.1.1. A photometric measurement of the headlamp 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 50 V

Driving-beam H – V

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.

4.3.1.3. Calculate the ratio between the photometric test point value determined in paragraph 4.3.1.1. and the point value determined in paragraph 4.3.1.2..

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.

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.

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 4.3.1.2. of this annex, shall both be within the required colour boundaries.

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

5.1. The LED module(s) shall be in the configuration as described in the technical specification as defined in paragraph B3.2.2.. 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.

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.

Suitable thermal management (e.g. heat sink) may be provided, to simulate similar thermal conditions as in the corresponding headlamp 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 4.3.1.2. of this annex.

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

"Annex B15

Gonio(photo)meter system used for the photometric measurements as defined in paragraph 2.13. of this Horizontal Reference Document

