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I

(Acts whose publication is obligatory)

Technical requirements of Regulation No 48 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex II, item 1, of Commission Directive 97/28/EC adapting to technical progress Council Directive 76/756/EEC relating to the installation of lighting and light-signalling devices on motor vehicles and their trailers⁽¹⁾

2. DEFINITIONS

For the purpose of this Regulation

2.2. 'Vehicle type with regard to the installation of lighting and light-signalling devices' means vehicles which do not differ in the essential respects mentioned in paragraphs 2.2.1. to 2.2.4.

The following are likewise considered not to be 'vehicles of a different type': vehicles which differ within the meaning of paragraphs 2.2.1. to 2.2.4., 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;

2.2.1. the dimension and the external shape of the vehicle;

2.2.2. the number and positioning of the devices;

2.2.3. the headlamp-levelling system;

2.2.4. the suspension system.

2.3. 'Transverse plane' means a vertical plane perpendicular to the median longitudinal plane of the vehicle.

2.4. '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.

2.5. '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 5.

2.6. 'Device' means an element or an assembly of elements used to perform one or more functions;

2.7. '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;

2.7.1. 'Light source with regard to filament lamps' means the filament itself. In the case of a lamp having several filaments, each one shall constitute a light source;

2.7.2. '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 this Regulation;

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 1.

- 2.7.3. '*Independent lamps*' means devices having separate illuminating surfaces,⁽¹⁾ separate light sources and separate lamp bodies;
- 2.7.4. '*Grouped lamps*' means devices having separate illuminating surfaces⁽¹⁾ and separate light sources, but a common lamp body;
- 2.7.5. '*Combined lamps*' means devices having separate illuminating surfaces,⁽¹⁾ but a common light source and a common lamp body;
- 2.7.6. '*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 illuminating surfaces⁽¹⁾ and a common lamp body;
- 2.7.7. '*Single-function lamp*' means a part of a device which performs a single lighting or light-signalling function;
- 2.7.8. '*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;
- 2.7.9. '*Driving beam (main-beam) headlamp*' means the lamp used to illuminate the road over a long distance ahead of the vehicle;
- 2.7.10. '*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;
- 2.7.11. '*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 provisions of Regulation No. 'X'.(*)
- 2.7.12. '*Stop lamp*' means the lamp used to indicate to other road-users to the rear of the vehicle that its driver is applying the service brake.
- The stop lamps may be activated by the application of a retarder or a similar device;
- 2.7.13. '*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;
- 2.7.14. '*Front position lamp*' means the lamp used to indicate the presence and the width of the vehicle when viewed from the front;
- 2.7.15. '*Rear position lamp*' means the lamp used to indicate the presence and width of the vehicle when viewed from the rear;
- 2.7.16. '*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;
- For the purposes of this Regulation the following are not considered as retro-reflectors:
- 2.7.16.1. — retro-reflecting number plates;
- 2.7.16.2. — the retro-reflecting signals mentioned in the ADR (European Agreement concerning the international carriage of dangerous goods by road);
- 2.7.16.3. — other retro-reflecting plates and signals which must be used to comply with national requirements for use as regards certain categories of vehicles or certain methods of operation;
- 2.7.17. '*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;

(*) Regulation on VAS, after it was established.

- 2.7.18. 'Front fog lamp' means the lamp used to improve the illumination of the road in case of fog, snowfall, rainstorms or dust clouds;
- 2.7.19. 'Rear fog lamp' means a lamp used to make the vehicle more easily visible from the rear in dense fog;
- 2.7.20. '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;
- 2.7.21. '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;
- 2.7.22. '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;
- 2.7.23. 'Side marker lamp' means a lamp used to indicate the presence of the vehicle when viewed from the side;
- 2.7.24. 'Daytime running lamp' means a lamp facing in a forward direction used to make the vehicle more easily visible when driving during daytime.⁽²⁾
- 2.8. 'Light emitting surface' of a 'lighting device', 'light-signalling device' or a retro-reflector means all or part of the exterior surface of the transparent material as declared in the request for approval by the manufacturer of the device on the drawing, see Annex 3;

2.9. 'Illuminating surface' (see Annex 3);

- 2.9.1. 'Illuminating surface of a lighting device' (paragraphs 2.7.9., 2.7.10., 2.7.18. and 2.7.20) 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 2.9.2. 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 the lens. If the reflector and lens are adjustable relative to one another, the mean adjustment should be used;

- 2.9.2. 'Illuminating surface of a light-signalling device other than a retro-reflector' (paragraphs 2.7.11. to 2.7.15., 2.7.17., 2.7.19. and 2.7.21. to 2.7.24.) 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;

- 2.9.3. 'Illuminating surface of a retro-reflector' (paragraph 2.7.16.) means the orthogonal projection of a retro-reflector in a plane perpendicular to its axis of reference and delimited by planes contiguous to the outermost parts of the retro-reflector's 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;

- 2.10. 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 (a-b),

or the light-emitting surface (c-d),

in a plane perpendicular to the direction of observation and tangential to the most exterior point of the lens (see Annex 3 to this Regulation);

- 2.11. '*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;
- 2.12. '*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;
- 2.13. '*Angles of geometric visibility*' means the angles which determine the field of the minimum solid angle in which the apparent surface of the lamp must be 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. There must 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.

If measurements are taken closer to the lamp, the direction of observation must be shifted parallel to achieve the same accuracy.

On the inside of the angles of geometric visibility no account is taken of obstacles, if they were already presented when the lamp was type-approved.

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 as an optical unit (see Annex 3 of this Regulation);

Nevertheless, when the vertical angle of geometric visibility below the horizontal may be reduced to 5° (lamp at less than 750 mm above the ground) the photometric field of measurements of the installed optical unit may be reduced to 5° below the horizontal.

- 2.14. '*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:
- 2.14.1. of tyres near their point of contact with the ground, and of connections for tyre-pressure gauges;
 - 2.14.2. of any anti-skid devices mounted on the wheels;
 - 2.14.3. of rear-view mirrors;
 - 2.14.4. of side direction indicator lamps, end-outline marker lamps, front and rear position lamps, parking lamps, retro-reflectors and side-marker lamps;
 - 2.14.5. of Customs seals affixed to the vehicle, and of devices for securing and protecting such seals.
- 2.15. '*Overall width*' means the distance between the two vertical planes defined in paragraph 2.14. above;
- 2.16. The following shall be deemed to be:
- 2.16.1. '*A single lamp*' means a device or part of a device, having one function and one apparent surface in the direction of the reference axis (see paragraph 2.10. of this Regulation) and one or more light sources.

For the purpose of installation on a vehicle, a 'single lamp' also means any assembly of two independent or grouped lamps, whether identical or not, having the same function, if they are installed so that the projection of their apparent surfaces in the direction of the reference axis occupies not less than 60 per cent of the smallest rectangle circumscribing the projections of the said apparent surfaces in the direction of the reference axis.

In such a case, each of these lamps shall, where approval is required, be approved as a type 'D' lamp.

This possible combination does not apply to main beam headlamps, dipped beam headlamps and front fog lamps.
 - 2.16.2. '*Two lamps*' or '*an even number of lamps*', means a single light-emitting surface in the shape of a band or strip if such band or strip is placed symmetrically in relation to the median longitudinal plane of the vehicle, extends on both sides to within at least 0.4 m of the extreme outer edge of the vehicle, and is not less than

0.8 m long; the illumination of such surface shall be provided by not less than two light sources placed as close as possible to its ends; the light-emitting surface may be constituted by a number of juxtaposed elements on condition that the projections of the several individual light-emitting surfaces on a transverse plane occupy not less than 60 per cent of the area of the smallest rectangle circumscribing the projections of the said individual light-emitting surfaces;

- 2.17. '*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 the Regulation, the exact edges of apparent surfaces need not be determined.
- 2.18. '*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;
- 2.19. '*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;
- 2.20. '*Optional lamp*' means a lamp, the installation of which is left to the discretion of the manufacturer;
- 2.21. '*Ground*' means the surface on which the vehicle stands which should be substantially horizontal;
- 2.22. '*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;
- 2.23. '*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;
- 2.24. '*Normal condition of use of a vehicle*' means:
 - 2.24.1. 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 2.23.;
 - 2.24.2. and for a trailer, when the trailer is connected to a drawing motor vehicle in the conditions as prescribed in paragraph 2.24.1. and its movable components are in the normal position(s) as defined in paragraph 2.23.
- 2.25. '*Park condition of a vehicle*' means:
 - 2.25.1. 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 2.23;
 - 2.25.2. and for a trailer, when the trailer is connected to a drawing motor vehicle in the condition as described in paragraph 2.25.1. and its movable components are in the normal position(s) as defined in paragraph 2.23.

5. GENERAL SPECIFICATIONS

- 5.1. The lighting and light-signalling devices shall be so fitted that under normal conditions of use as defined in paragraphs 2.24, 2.24.1 and 2.24.2 and notwithstanding any 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.
- 5.2. The illuminating lamps described in paragraphs 2.7.9., 2.7.10. and 2.7.18. shall be so installed that correct adjustment of their orientation can easily be carried out.
- 5.3. For all light-signalling devices, including those mounted on the side panels, the reference axis of the lamp when fitted to the vehicle must be parallel to the bearing plane of the vehicle on the road; in addition it must 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 must be complied with.

- 5.4. 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 paragraphs 2.24., 2.24.1. and 2.24.2.
- 5.5. In the absence of specific instructions lamps constituting a pair shall:
- 5.5.1. 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 2.9.);
- 5.5.2. 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;
- 5.5.3. satisfy the same colorimetric requirements; and
- 5.5.4. have substantially identical photometric characteristics.
- 5.6. On vehicles whose external shape is asymmetrical the above requirements shall be satisfied so far as is possible.
- 5.7. 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, for each lamp, are fulfilled.
- 5.8. 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.

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.

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.

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.

- 5.9. In the absence of specific instructions, no lamps other than direction-indicator lamps and the vehicle-hazard warning signal shall be flashing lamps.
- 5.10. No red light which could give rise to confusion shall be emitted from a lamp as defined in paragraph 2.7. in a forward direction and no white light which could give rise to confusion, other than from the reversing lamp, shall be emitted from a lamp as defined in paragraph 2.7. 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:

- 5.10.1. For the visibility of red light towards the front, there must be no direct visibility of the light-emitting surface of a red lamp if viewed by an observer moving within Zone 1 in a transverse plane situated 25 m in front of the vehicle (see Annex 4);
- 5.10.2. For the visibility of white light towards the rear, there must be no direct visibility of a light-emitting 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 4);
- 5.10.3. In their respective planes, the zones 1 and 2 explored by the eye of the observer are bounded;
- 5.10.3.1. In height, by two horizontal planes 1 m and 2.2 m respectively above the ground,
- 5.10.3.2. 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.

- 5.11. The electrical connections must 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.

This condition does not apply when using front and rear position lamps, as well as side-marker lamps when combined or reciprocally incorporated with said lamps, as parking lamps.

- 5.12. The electrical connections must 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 5.11 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.

- 5.13. *Tell-tale*

Where a closed-circuit tell-tale is prescribed by this Regulation it may be replaced by an 'operating' tell-tale.

- 5.14. *Concealable lamps*

- 5.14.1. 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.

- 5.14.2. 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.

- 5.14.3. It must 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.

- 5.14.4. It must 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.

- 5.14.5. When the concealment device has a temperature of -30°C to $+50^{\circ}\text{C}$ the headlamps must be capable of reaching the position of use within three seconds of initial operation of the control.

- 5.15. The colours of the light emitted by the lamps are the following:

main-beam headlamp	white
dipped-beam headlamp	white
front fog lamp	white or yellow
reversing lamp	white
direction indicator lamp	amber
hazard warning signal	amber
stop lamp	red
rear registration plate lamp	white
front position lamp	white
rear position lamp	red
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(*)
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 or the red rearmost side-marker lamp

(*) Also known as white or colourless retro-reflector.

5.16. *Number of lamps*

The number of lamps mounted on the vehicle shall be equal to the number(s) specified in subparagraph 2 of each of the paragraphs 6.1 to 6.19.

5.17. Except as provided by paragraphs 5.18., 5.19. and 5.21., lamps may be installed on movable components.

5.18. Rear position lamps, rear direction indicators and rear retro-reflectors, triangular as well as non triangular, must not be installed on movable components unless at all fixed positions of the movable components the lamps on the movable components meet all the position, geometric visibility and photometric requirements for those lamps.

Should the above functions be obtained by an assembly of two lamps marked 'D' (see paragraph 2.16.1.) only one of these lamps needs to meet the above mentioned requirements.

5.19. There must not be any movable component, with or without a light-signalling device installed on it, which in any fixed position hides more than 50 % of the apparent surface of front and rear position lamps, front and rear direction indicator lamps and retro-reflectors when viewed in the reference axis of this specific device.

If this is not practicable:

5.19.1. a remark in the communication form (item 10.1. of annex 1) shall inform other Administrations that more than 50 % of the apparent surface in the direction of the reference axis can be hidden by the movable components;

5.19.2. in case of paragraph 5.19.1. 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.

5.20. When the movable components are in a position other than a 'Normal position' as defined in paragraph 2.23. the devices installed on them shall not cause undue discomfort to road users.

5.21. When a lamp is installed on a movable component and the movable component is in the normal position(s) of use (see paragraph 2.23.), the lamp must 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 % from the average of the 10 measured values.

If this value is exceeded each limit specified in paragraph 6.2.6.1.1. shall then be modified by this excess to decrease the allowed range of inclinations when checking the vehicle according to Annex 6.

- 5.22. 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 filament lamp.

6. INDIVIDUAL SPECIFICATIONS

6.1. *Main-beam headlamp*

6.1.1. Presence

Mandatory on motor vehicles. Prohibited on trailers.

6.1.2. Number

Two or four.

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 5.12.) in daylight.

6.1.3. Arrangement

No individual specifications.

6.1.4. Position

6.1.4.1. In width: no individual specifications.

6.1.4.2. In height: no individual specifications.

6.1.4.3. In length: at the front of the vehicle and fitted in such a way that the light emitted does not cause discomfort to the driver either directly or indirectly through the rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.1.5. 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, must 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.

6.1.6. Orientation

Towards the front.

Apart from the devices necessary to maintain correct adjustment, and when there are two pairs of headlamps one pair, consisting of headlamps functioning as main-beam headlamps only, may swivel, according to the angle of lock of the steering, about a substantial vertical axis.

6.1.7. Electrical connections

6.1.7.1. The main-beam headlamps may be switched on either simultaneously or in pairs. 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.

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

6.1.7.3. Where four concealable headlamps are fitted their raised position must 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 5.12.) in daylight.

6.1.8. Tell-tale

Circuit-closed tell-tale mandatory.

6.1.9. Other requirements

6.1.9.1. The aggregate maximum intensity of the main-beam headlamps which can be switched on simultaneously shall not exceed 225,000 cd, which corresponds to a reference value of 75.

6.1.9.2. This maximum intensity shall be obtained by adding together the individual reference marks which are indicated on the several headlamps. The reference mark '10' shall be given to each of the headlamps marked 'R' or 'CR'.

6.2. *Dipped-beam headlamp*

6.2.1. Presence

Mandatory on motor vehicles. Prohibited on trailers.

6.2.2. Number

Two.

6.2.3. Arrangement

No special requirement.

6.2.4. Position

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

6.2.4.2. In height: not less than 500 mm and not more than 1,200 mm above the ground.

6.2.4.3. 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 rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.2.5. Geometric visibility

Defined by angles α and β as specified in paragraph 2.13.

$\alpha = 15^\circ$ upwards and 10° downwards,

$\beta = 45^\circ$ outwards and 10° inwards.

Since the photometric values required for dipped-beam headlamps do not cover the full geometric field of vision, a minimum value of 1 cd in the space remaining is required for type-approval purposes. 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.

6.2.6. Orientation

Towards the front.

6.2.6.1. Vertical orientation

6.2.6.1.1. 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 % 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 6.2.6.1.2.

6.2.6.1.2. 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% and -2.5%

initial aiming: between -1.0% and -1.5%

$0.8 \leq h \leq 1.0$

limits: between -0.5% and -2.5%

initial aiming: between -1.0% and -1.5%

or, at the discretion of the manufacturer,

limits: between -1.0% and -3.0%

initial aiming: between -1.5% and -2.0%

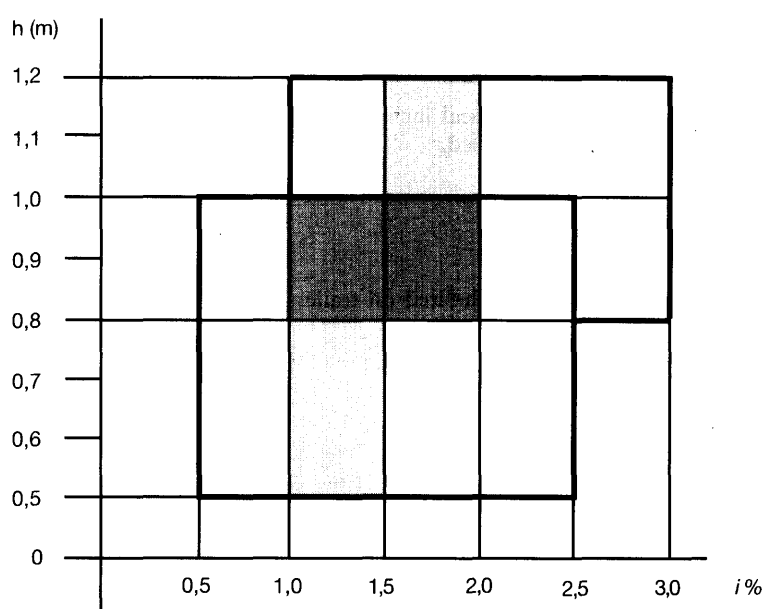
The application for the vehicle type-approval shall, in this case, contain information as to which of the two alternatives is to be used.

$h > 1.0$

limits: between -1.0% and -3.0%

initial aiming: between -1.5% and -2.0%

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



6.2.6.2. Headlamp levelling device

6.2.6.2.1. In the case where a headlamp levelling device is necessary to satisfy the requirements of paragraphs 6.2.6.1.1. and 6.2.6.1.2., the device shall be automatic.

6.2.6.2.2. 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 6.2.6.1.1. by means of the usual adjusting screws or similar means.

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

Continually adjustable devices must 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 must 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 5.

For these devices also, the loading conditions of annex 5 that require adjustment of the dipped-beam shall be clearly marked near the control of the device (see annex 8).'

6.2.6.3. Measuring procedure

6.2.6.3.1. 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 5.'

6.2.6.3.2. In the event of a failure of devices described in paragraphs 6.2.6.2.1. and 6.2.6.2.2., 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.'

6.2.7. Electrical connections

The control for changing over to the dipped-beam must switch off all main-beam headlamps simultaneously. The dipped beam may remain switched on at the same time as the main beams.

In the case of dipped-beam headlamps according to Regulation No. 'X'(*) the gas-discharge light sources shall remain switched on during the main-beam operation.

6.2.8. Tell-tale

Tell-tale optional.

6.2.9. Other requirements

The requirements of paragraph 5.5.2. shall not apply to dipped-beam headlamps.

Dipped-beam headlamps shall not swivel according to the angle of lock of steering.

Dipped-beam headlamps with gas-discharge light sources shall only be permitted in conjunction with the installation of headlamp cleaning device(s) according to Regulation No. 45.(4)

In addition, with respect to vertical inclination, the provisions of paragraph 6.2.6.2.2. shall not be applied when these headlamps are installed.

6.3. *Front fog lamp*

6.3.1. Presence

Optional on motor vehicles. Prohibited on trailers.

6.3.2. Number

Two.

6.3.3. Arrangement

No special requirement.

6.3.4. Position

6.3.4.1. 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.

6.3.4.2. In height: not less than 250 mm above the ground. No point on the apparent surface in the direction of the reference axis must be higher than the highest point on the apparent surface in the direction of the reference axis of the dipped-beam headlamp.

6.3.4.3. 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 rear-view mirrors and/or other reflecting surfaces of the vehicle.

6.3.5. Geometric visibility

Defined by angles α and β as specified in paragraph 2.13,

α = 5° upwards and downwards,

β = 45° outwards and 10° inwards.

6.3.6. Orientation

Towards the front.

The alignment of the front fog lamps must not vary according to the angle of lock of the steering.

They must be directed forward without causing undue dazzle or discomfort to oncoming drivers and other road users.

(*) Regulation on Headlamps with gas-discharge light sources, after it was established.

6.3.7. Electrical connections

It must 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.

6.3.8. Tell-tale

Tell-tale optional.

6.3.9. Other requirements

None.

6.4. *Reversing lamp*

6.4.1. Presence

Mandatory on motor vehicles. Optional on trailers.

6.4.2. Number

One or two.

6.4.3. Arrangement

No special requirement.

6.4.4. Position

6.4.4.1. In width: no special requirement.

6.4.4.2. In height: not less than 250 mm nor more than 1,200 mm above the ground.

6.4.4.3. In length: at the back of the vehicle.

6.4.5. Geometric visibility

Defined by angles α and β as specified in paragraph 2.13.,

α = 15° upwards and 5° downwards,

β = 45° to right and to left if there is only one light,

45° outwards and 30° inwards if there are two.

6.4.6. Orientation

Rearwards.

6.4.7. Electrical connections

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.

6.4.8. Tell-tale

Tell-tale optional.

6.4.9. Other requirements

None.

6.5. *Direction indicator lamp*

6.5.1. 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.

6.5.2. Number

According to the arrangement.

6.5.3. 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 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.

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).

6.5.4. Position

6.5.4.1. In width: the edge of the apparent surface in the direction of the reference axis farthest from the median longitudinal plane of the vehicle must 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 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.

6.5.4.2. In height: above the ground.

6.5.4.2.1. The height of the light-emitting surface of the side direction-indicator lamps of categories 5 or 6 must not be less than 500 mm measured from the lowest point or more than 1,500 mm measured from the highest point.

6.5.4.2.2. The height of the direction indicator lamps of categories 1, 1a, 1b, 2a and 2b, measured in accordance with paragraph 5.8., shall not be less than 350 mm or more than 1,500 mm.

6.5.4.2.3. If the structure of the vehicle does not permit these upper limits, measured as specified above, to be respected, 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.

6.5.4.3. In length (see figure below)

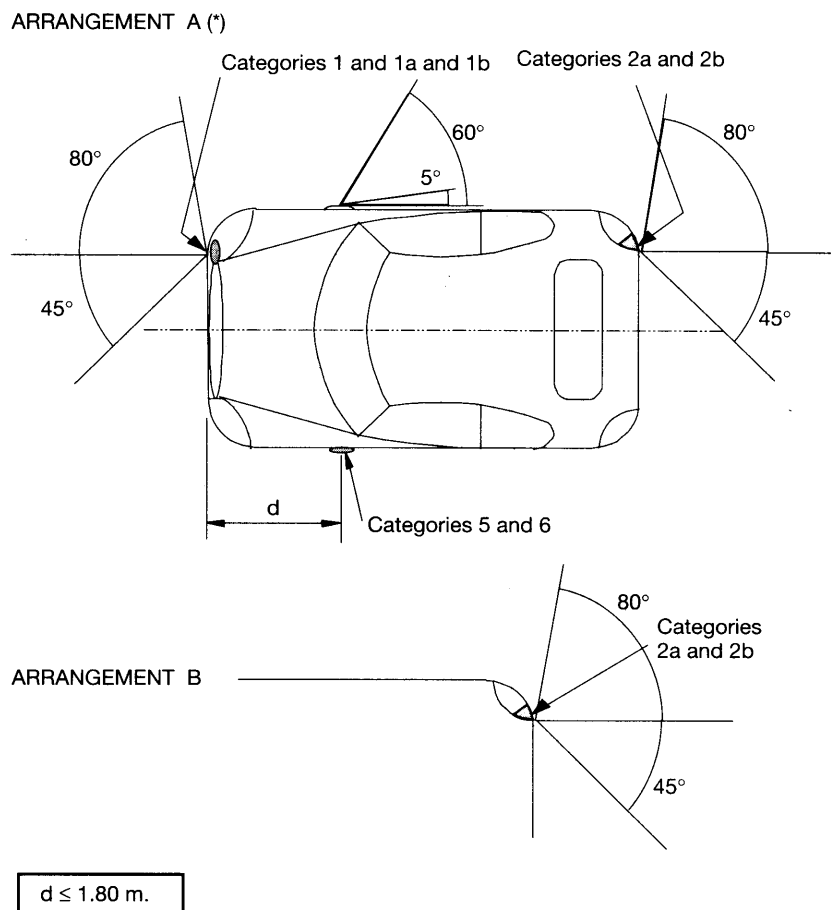
The distance between the light-emitting surface of the side direction indicator lamp (categories 5 and 6) and the transverse plane which marks the forward boundary of the vehicle's overall length, shall not exceed 1,800 mm. If the structure of the vehicle makes it impossible to comply with the minimum angles of visibility, this distance may be increased to 2,500 millimetres.

6.5.5. Geometric visibility

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. The vertical angle below the horizontal may be reduced to 5° if the lamps are less than 750 mm above the ground; 30° above and 5° below the horizontal for direction indicator lamps of category 6.

Figure (see paragraph 6.5)



6.5.6. Orientation

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

6.5.7. 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.

6.5.8. Tell-tale

Operating tell-tale mandatory for front and rear direction-indicator lamps. 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 the front or rear 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 the front or rear direction indicator lamps.

(*) The value of 5° given for dead angle of visibility to the rear of the side direction indicator is an upper limit.

If a motor vehicle is equipped to draw a trailer, it must 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.

6.5.9. 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 must continue to flash, but the frequency in this condition may be different from that prescribed.

6.6. *Hazard warning signal*

6.6.1. Presence

Mandatory.

The signal shall be given by simultaneous operation of the direction indicator lamps in accordance with the requirements of paragraph 6.5. above.

6.6.2. Number

As specified in paragraph 6.5.2.

6.6.3. Arrangement

As specified in paragraph 6.5.3.

6.6.4. Position

6.6.4.1. Width

As specified in paragraph 6.5.4.1.

6.6.4.2. Height

As specified in paragraph 6.5.4.2.

6.6.4.3. Length

As specified in paragraph 6.5.4.3.

6.6.5. Geometric visibility

As specified in paragraph 6.5.5.

6.6.6. Orientation

As specified in paragraph 6.5.6.

6.6.7. Electrical connections

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

6.6.8. Tell-tale

Circuit-closed tell-tale mandatory. Flashing warning light, which can operate in conjunction with the tell-tale(s) specified in paragraph 6.5.8.

6.6.9. Other requirements

As specified in paragraph 6.5.9. 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.

6.7. *Stop lamp*

6.7.1. Presence

Devices of S1 or S2 categories: mandatory on all categories of vehicles.

Devices of S3 category: mandatory on M1 category of vehicles; optional on other categories of vehicles.

6.7.2. Number

Two devices of S1 or S2 categories and one device of S3 category on all categories of vehicles.

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 category on the median longitudinal plane above such movable parts, either:

two devices of the S3 category type 'D' may be installed, or one device of the S3 category may be installed offset to the left or to the right of the median longitudinal plane.

6.7.3. Arrangement

No special requirement.

6.7.4. Position**6.7.4.1. In width:**

For S1 or S2 categories devices: not 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.

For S3 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 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 cases where one S3 category lamp offset from the median longitudinal plane is permitted according to paragraph 6.7.2., this offset shall not exceed 150 mm from the median longitudinal plane to the centre of reference of the lamp.

6.7.4.2. In height:

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);

For S3 category 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 S3 category device shall be above the horizontal plane tangential to the upper edge of the apparent surface of S1 or S2 categories devices.

6.7.4.3. In length:

For S1 or S2 categories devices: at the rear of the vehicle. For S3 category devices: no special requirement.

6.7.5. 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;

For S3 category 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, the vertical angle below the horizontal may be reduced to 5°, if the height of the lamp is less than 750 mm;

For S3 category devices: 10° above and 5° below the horizontal.

6.7.6. Orientation

Towards the rear of the vehicle.

6.7.7. Electrical connections

Must light up when the service brake is applied. The stop lamps need not function if the device which starts and/or stops the engine is in a position which makes it impossible for the engine to operate.

The stop lamps may be activated by the application of a retarder or a similar device.

- 6.7.8. Tell-tale
Tell-tale optional; where fitted, this tell-tale must 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.
- 6.7.9. Other requirements
- 6.7.9.1. The S3 category device may not be reciprocally incorporated with any other lamp.
- 6.7.9.2. The S3 category device may be installed outside or inside the vehicle.
In the case where it is installed inside the vehicle:
the light emitted shall not cause discomfort to the driver through the rear-view mirrors and/or other surfaces of the vehicle (i.e. rear window);
- 6.8. *Rear registration plate lamp*
- 6.8.1. Presence
Mandatory.
- 6.8.2. Number
Such that the device illuminates the site of the registration plate.
- 6.8.3. Arrangement
Such that the device illuminates the site of the registration plate.
- 6.8.4. Position
- 6.8.4.1. In width: such that the device illuminates the site of the registration plate.
- 6.8.4.2. In height: such that the device illuminates the site of the registration plate.
- 6.8.4.3. In length: such that the device illuminates the site of the registration plate.
- 6.8.5. Geometric visibility
Such that the device illuminates the site of the registration plate.
- 6.8.6. Orientation
Such that the device illuminates the site of the registration plate.
- 6.8.7. Electrical connections
In accordance with paragraph 5.11.
- 6.8.8. Tell-tale
Tell-tale optional. If it exists, its function must be carried out by the tell-tale required for the front and rear position lamps.
- 6.8.9. 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.
- 6.9. *Front position lamp*
- 6.9.1. 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.
- 6.9.2. Number
Two.
- 6.9.3. Arrangement
No special requirement.

6.9.4. Position

- 6.9.4.1. 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 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.

- 6.9.4.2. 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).

- 6.9.4.3. In length: no individual specification.

- 6.9.4.4. 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 must be used to verify compliance with the positioning requirements (paragraphs 6.9.4.1. to 6.9.4.3.).

6.9.5. Geometric visibility

Horizontal angle for the two position lamps: 45° inwards and 80° outwards.

In the case of trailers, the angle inwards may be reduced to 5°.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of lamps less than 750 mm above the ground.

6.9.6. Orientation

Forwards.

6.9.7. Electrical connections

In accordance with paragraph 5.11.

6.9.8. 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.

6.9.9. Other requirements

None.

6.10. *Rear position lamp*

6.10.1. Presence

Mandatory.

6.10.2. Number

Two.

6.10.3. Arrangement

No special requirement.

6.10.4. Position

- 6.10.4.1. 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.

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 if the overall width of the vehicle is less than 1,300 mm.

- 6.10.4.2. 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).

- 6.10.4.3. In length: at the rear of the vehicle.

- 6.10.5. Geometric visibility
Horizontal angle: 45° inwards and 80° outwards.
Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of lamps less than 750 mm above the ground.
- 6.10.6. Orientation
Rearwards.
- 6.10.7. Electrical connections
In accordance with paragraph 5.11.
- 6.10.8. Tell-tale
Circuit-closed tell-tale mandatory. It must be combined with that of the front position lamps.
- 6.10.9. Other requirements
None.
- 6.11. *Rear fog lamp*
- 6.11.1. Presence
Mandatory.
- 6.11.2. Number
One or two.
- 6.11.3. Arrangement
No special requirement.
- 6.11.4. Position
- 6.11.4.1. In width: if there is only one rear fog-lamp, it must 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.
- 6.11.4.2. In height: not less than 250 mm nor more than 1,000 mm above the ground.
- 6.11.4.3. In length: at the rear of the vehicle.
- 6.11.5. Geometric visibility
Defined by angles α and β as specified in paragraph 2.13.
 α = 5° upwards and 5° downwards;
 β = 25° to right and to left.
- 6.11.6. Orientation
Rearwards.
- 6.11.7. Electrical connections
These must be such that:
- 6.11.7.1. The rear fog-lamp(s) cannot be switched on unless the main beams, dipped beams or front fog-lamps are lit;
- 6.11.7.2. The rear fog-lamp(s) can be switched off independently of any other lamp;
- 6.11.7.3. Either of the following applies:
- 6.11.7.3.1. 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;
- 6.11.7.3.2. a warning, at least audible, additional to the mandatory tell-tale (paragraph 6.11.8.) 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 6.11.7.1. are on or off, whilst the rear fog lamp switch is in the 'on' position.
- 6.11.7.4. Except as provided in paragraphs 6.11.7.1. and 6.11.7.3., the operation of the rear fog-lamp(s) shall not be affected by switching on or off any other lamps.

- 6.11.8. **Tell-tale**
Circuit-closed tell-tale mandatory. An independent non-flashing warning light.
- 6.11.9. **Other requirements**
In all cases, the distance between the rear fog-lamp and each stop-lamp must be greater than 100 mm.
- 6.12. ***Parking lamp***
- 6.12.1. **Presence**
On motor vehicles not exceeding 6 m in length and not exceeding 2 m in width, optional.
On all other vehicles, prohibited.
- 6.12.2. **Number**
According to the arrangement.
- 6.12.3. **Arrangement**
Either two lamps at the front and two lamps at the rear, or one lamp on each side.
- 6.12.4. **Position**
- 6.12.4.1. 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.
- 6.12.4.2. In height: above the ground, not less than 350 mm nor more than 500 mm (2,100 mm if the shape of the bodywork makes it impossible to keep within 1,500 mm).
- 6.12.4.3. In length: no special requirement.
- 6.12.5. **Geometric visibility**
Horizontal angle: 45° outwards, forwards and rearwards.
Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5°, however, if the height of the lamp is less than 750 mm.
- 6.12.6. **Orientation**
Such that the lamps meet the requirements for visibility forwards and rearwards.
- 6.12.7. **Electrical connections**
The connection must allow the parking lamp(s) on the same side of the vehicle to be lit independently of any other lamps.
The parking lamp(s) must be able to function even if the device which starts and/or stops the engine is in a position which makes it impossible for the engine to operate.
- 6.12.8. **Tell-tale**
Circuit-closed tell-tale optional. If there is one, it must not be possible to confuse it with the tell-tale for the front and rear position lamps.
- 6.12.9. **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.
- 6.13. ***End-outline marker lamp***
- 6.13.1. **Presence**
Mandatory on vehicle 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.
- 6.13.2. **Number**
Two visible from the front and two visible from the rear.
- 6.13.3. **Arrangement**
No special requirement.

6.13.4. Position

6.13.4.1. 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.

6.13.4.2. 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 must 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.

6.13.4.3. In length, no special requirement.

6.13.5. Geometric visibility

Horizontal angle: 80° outwards.

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

6.13.6. Orientation

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

6.13.7. Electrical connections

In accordance with paragraph 5.11.

6.13.8. 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.

6.13.9. Other requirements

Provided that all other requirements are met, the lamp visible from the front and the lamp visible from the rear on the same side of the vehicle may be combined in one device.

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.

6.14. *Rear retro-reflector, non-triangular*

6.14.1. Presence

Mandatory on motor vehicles.

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

6.14.2. Number

Two, the performances of which shall conform to the requirements concerning Class I A retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.14.3. Arrangement

No special requirement.

6.14.4. Position

6.14.4.1. 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 inner edges of the retro-reflector 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.

- 6.14.4.2. 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).
- 6.14.4.3. In length: at the rear of the vehicle.
- 6.14.5. Geometric visibility
Horizontal angle: 30° inwards and outwards.
Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.
- 6.14.6. Orientation
Rearwards.
- 6.14.7. 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.
- 6.15. *Rear retro-reflector, triangular*
- 6.15.1. Presence
Mandatory on trailers.
Prohibited on motor vehicles.
- 6.15.2. Number
Two, the performances of which shall conform to the requirements concerning Class III A retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.
- 6.15.3. Arrangement
The apex of the triangle shall be directed upwards.
- 6.15.4. Position
- 6.15.4.1. 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.
- 6.15.4.2. 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).
- 6.15.4.3. In length: at the rear of the vehicle.
- 6.15.5. Geometric visibility
Horizontal angle: 30° inwards and outwards.
Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.
- 6.15.6. Orientation
Rearwards.
- 6.15.7. Other requirements
No lamp shall be placed inside the triangle.
- 6.16. *Front retro-reflector, non-triangular*
- 6.16.1. Presence
Mandatory on trailers.
Optional on motor vehicles.
- 6.16.2. Number
Two, the performances of which shall conform to the requirements concerning Class I A retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.16.3. Arrangement

No special requirement.

6.16.4. Position

6.16.4.1. 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 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.

6.16.4.2. 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).

6.16.4.3. In length: at the front of the vehicle.

6.16.5. 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 6.16.4.1.), which shall, in conjunction with the mandatory retro-reflectors, give the necessary visibility angle.

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector, less than 750 mm above the ground.

6.16.6. Orientation

Towards the front.

6.16.7. 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.

6.17. *Side retro-reflector, non-triangular*

6.17.1. 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 exceeds 6 m.

6.17.2. Number

Such that the requirements for longitudinal positioning are complied with. The performances of these devices shall conform to the requirements concerning Class I A retro-reflectors in Regulation No 3. Additional retro-reflecting devices and materials are permitted provided they do not impair the effectiveness of the mandatory lighting and light-signalling devices.

6.17.3. Arrangement

No special requirement

6.17.4. Position

6.17.4.1. In width: no special requirement.

6.17.4.2. 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).

6.17.4.3. In length: At least one side retro-reflector must be fitted to the middle third of the vehicle, the foremost side retro-reflector being not further than 3 m from the front; in the case of trailers, account shall be taken of the length of the drawbar for the measurement of this distance.

The distance between two adjacent side retro-reflectors shall not exceed 3 m.

If the structure 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.

6.17.5. Geometric visibility

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

Vertical angle: 15° above and below the horizontal. The vertical angle below the horizontal may be reduced to 5° in the case of a retro-reflector less than 750 mm above the ground.

6.17.6. Orientation

Towards the side.

6.17.7. Other requirements

The illuminating surface of the side retro-reflector may have parts in common with the apparent surface of any other side lamp.

6.18. *Side-marker lamps*

6.18.1. Presence

Mandatory: On all vehicles the length of which exceeds 6 m, except for chassis-cabs; the length of trailers shall be calculated including the drawbar.

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.

Optional:

On all other vehicles.

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

6.18.2. Minimum number per side

Such that the rules for longitudinal positioning are complied with.

6.18.3. Arrangement

No individual specifications.

6.18.4. Position

6.18.4.1. In width: no individual specifications.

6.18.4.2. 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).

6.18.4.3. In length: at least one side-marker lamp must be fitted to the middle third of the vehicle, the foremost side-marker lamp being not further than 3 m from the front; in the case of trailers account shall be taken of the length of the drawbar for the measurement of this distance.

The distance between two adjacent side-marker lamps shall not exceed 3 m. If the structure 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.

6.18.5. 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°.

Vertical angle: 10° above and below the horizontal.

The vertical angle below the horizontal may be reduced to 5° in the case of a side-marker lamp less than 750 mm above the ground.

- 6.18.6. Orientation
Towards the side.
- 6.18.7. Electrical connections
In accordance with paragraph 5.11.
- 6.18.8. 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.
- 6.18.9. 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.
- 6.19. *Daytime running lamp* ⁽⁵⁾
- 6.19.1. Presence
Optional on motor vehicles. Prohibited on trailers.
- 6.19.2. Number
Two.
- 6.19.3. Arrangement
No special requirement.
- 6.19.4. Position
- 6.19.4.1. 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.
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.
- 6.19.4.2. In height: above the ground not less than 250 mm nor more than 1,500 mm.
- 6.19.4.3. 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 rear-view mirrors and/or other reflecting surfaces of the vehicle.
- 6.19.5. Geometric visibility
Horizontal: outwards 20° and inwards 20°.
Vertical: upwards 10° and downwards 10°
- 6.19.6. Orientation
Towards the front.
- 6.19.7. Electrical connections
The daytime running lamp must be so connected that it cannot be on unless the rear position lamps are on at the same time. The daytime running lamp shall switch off automatically when the headlamps are switched on, except when the latter are used to give intermittent luminous warnings at short intervals.
- 6.19.8. Tell-tale
Optional.

Note:

⁽¹⁾ In the case of lighting devices for the rear registration plate and the direction indicators (categories 5 and 6), replace by 'light-emitting surface' in the absence of an illuminating surface.

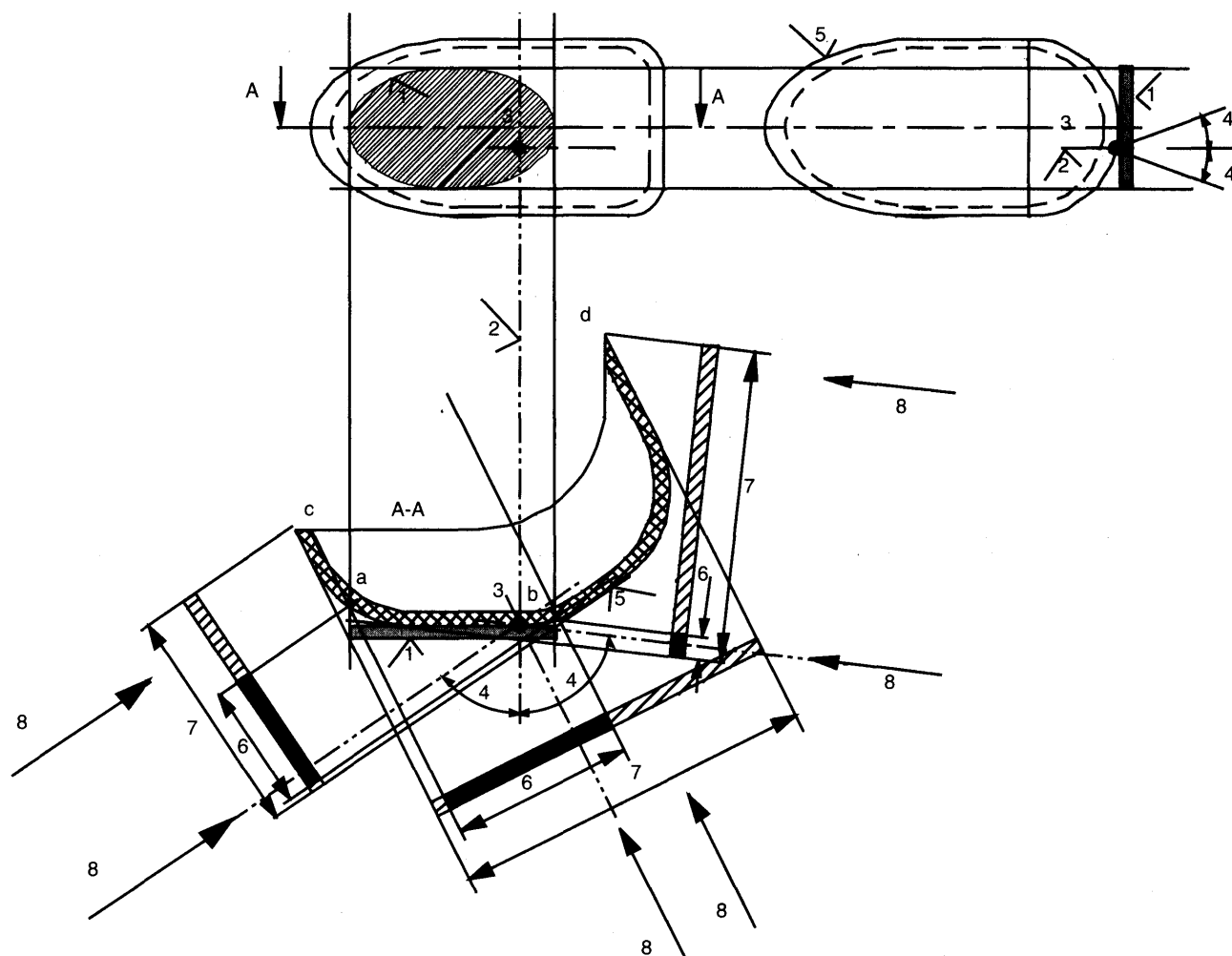
⁽²⁾ National requirements may permit the use of other devices to meet this function.

⁽⁴⁾ Contracting Parties to the respective regulations can still prohibit the use of mechanical cleaning systems when headlamps with plastic lenses, marked 'PL', are installed.

⁽⁵⁾ The installation of this device may be forbidden on the basis of national regulations.

ANNEX 3

Lamp surfaces, axis and centre of reference, and angles of geometric visibility



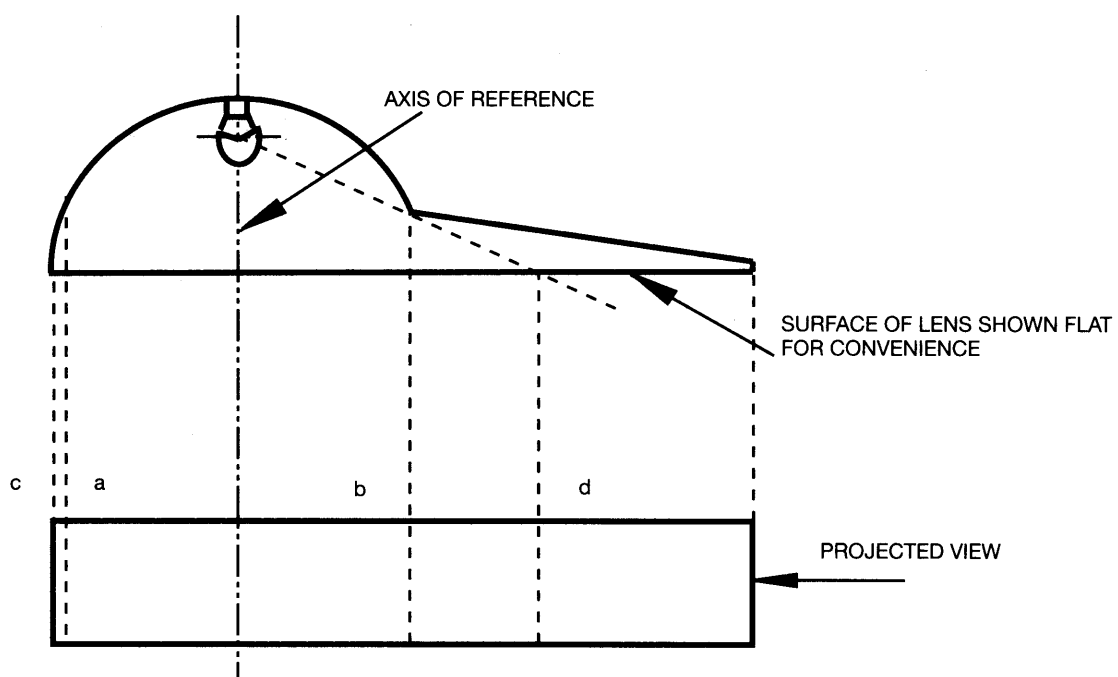
KEY

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 illuminating surface
7. Apparent surface based light-emitting surface
8. Direction of visibility

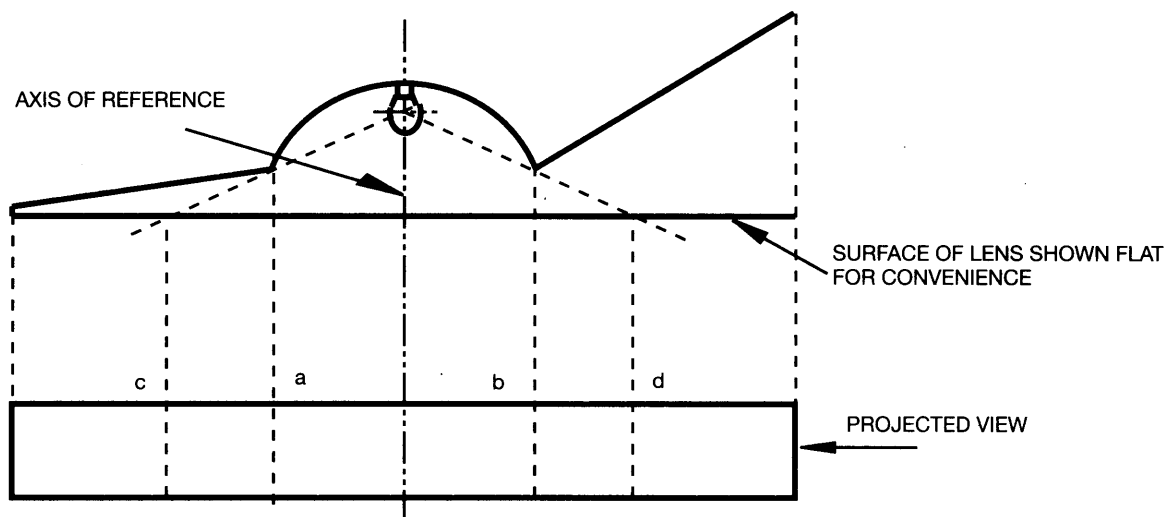
Note: Notwithstanding the drawing the apparent surface is to be considered as tangent to the light-emitting surface.

Illuminating surface in comparison with light-emitting surface

(See paragraphs 2.9. and 2.8. of this Regulation)



	illuminating surface	light-emitting surface
edges are	a and b	c and d



	illuminating surface	light-emitting surface
edges are	a and b	c and d

ANNEX 4

Visibility of a red lamp to the front and visibility of a white lamp to the rear
(See paragraphs 5.10.1. and 5.10.2. of this Regulation)

Visibility of a red lamp to the front

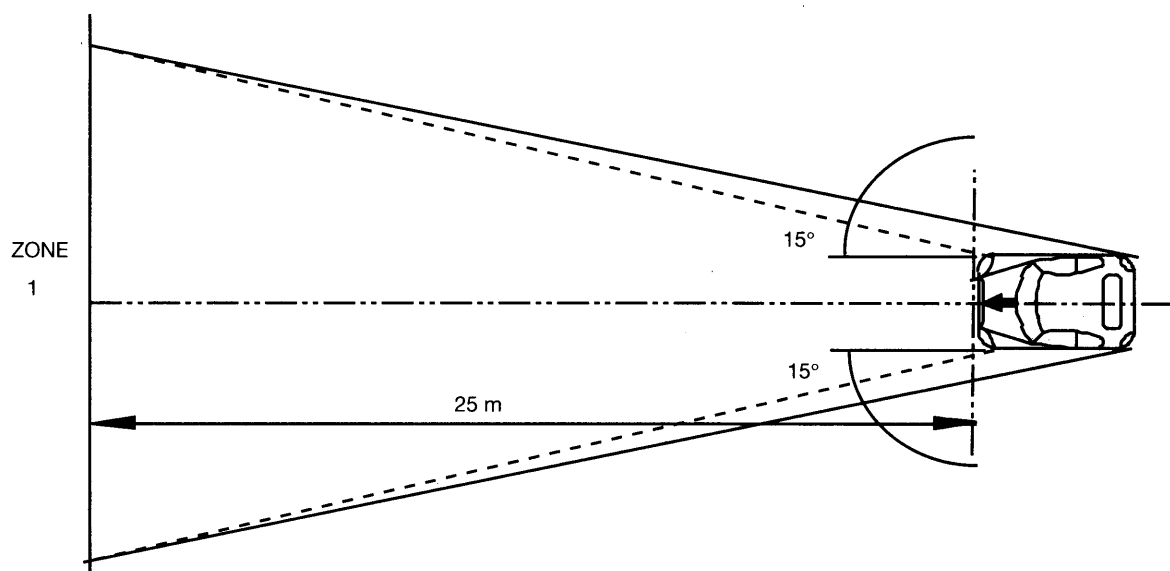


Figure 1

Visibility of a white lamp to the rear

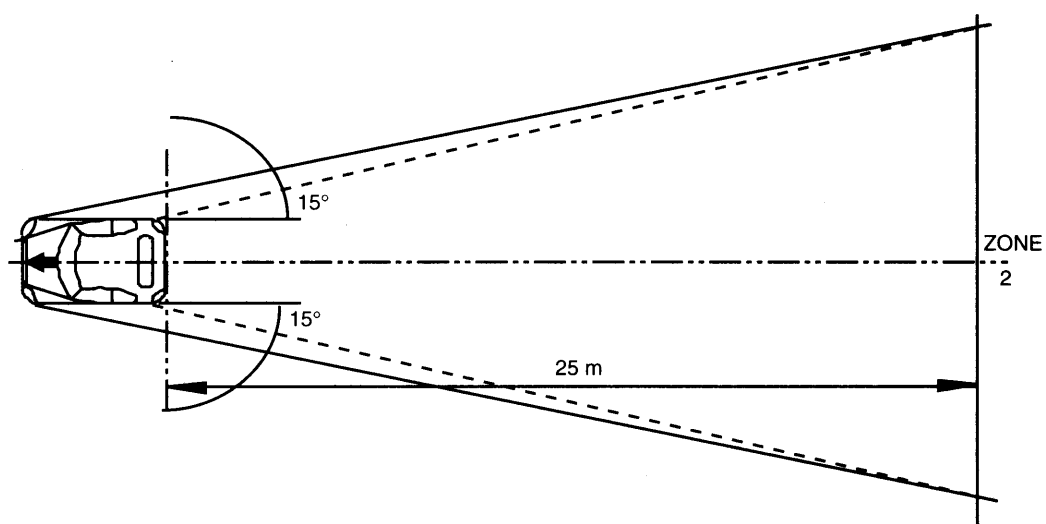


Figure 2

ANNEX 5

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 6.2.6.1. and 6.2.6.3.1.

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 M1⁽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 must 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 must be taken of any loading restrictions laid down by the manufacturer.
 - 2.2. Vehicles in categories M2 and M3⁽¹⁾:
The angle of the light beam from the dipped-beam headlamps must be determined under the following loading conditions:
 - 2.2.1. vehicle unladen and one person in the driver's seat;
 - 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 must 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 % 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.

Note:

⁽¹⁾ For definitions of the categories, see the Consolidated Resolution on the Construction of Vehicles (R.E. 3, annex 7) (TRANS/SC1/WP29/78/Amend.3).

ANNEX 6

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 5, 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.

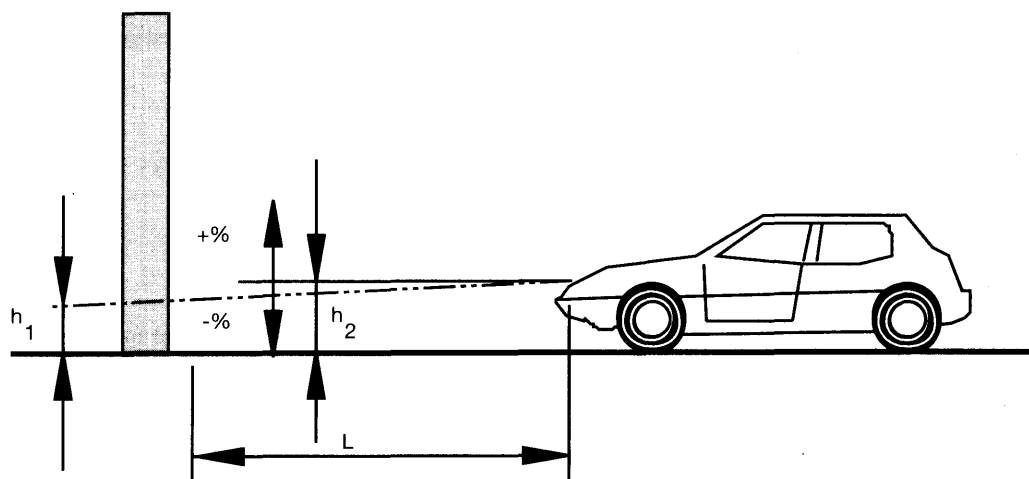


Figure 1

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 ± 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 ± 0.5 mrad (± 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 must 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. above.
- 4.5. If a photometric or visual method is used, headlamps with a well-defined dipped-beam cutt-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 5, shall be within the limits set out in paragraph 5.5. below. The load shall be applied gradually without subjecting the vehicle to excessive shocks.

- 5.2. Determination of the measured initial inclination

The vehicle shall be prepared as specified in paragraph 4 above and laden as specified in annex 5 (first loading condition of the respective vehicle category).

Before each measurement, the vehicle shall be rocked as specified in paragraph 5.4. below.

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. M1 category vehicles with conventional suspension

With the vehicle standing on the measuring site and, if necessary, with the wheels resting on floating platforms (which must 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. above.

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 5).

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.

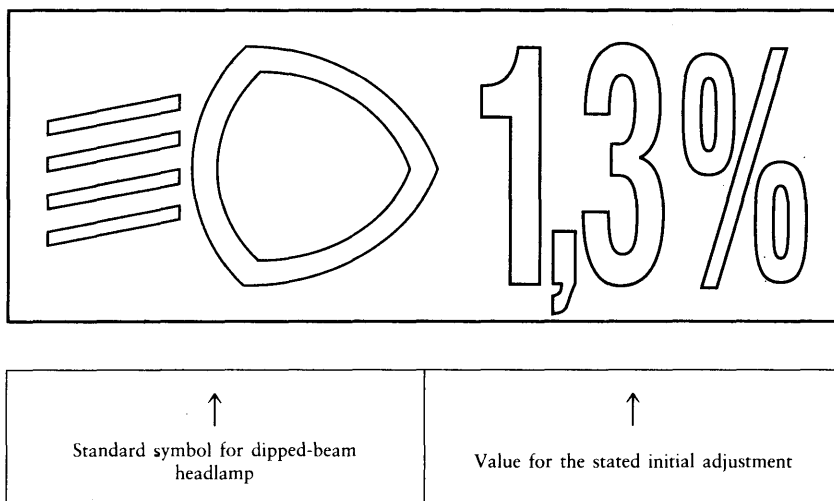
5.5.4. Requirements have been met, if, under all loading conditions, the variation between the measured initial inclination determined in accordance with paragraph 5.2. and the inclination measured under each loading condition is less than the values calculated in paragraph 5.5.1. (without safety margin).

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 7

Indication of the stated initial adjustment referred to in paragraph 6.2.6.1.1. of this regulation

Example



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

ANNEX 8

The controls for the headlamp-levelling devices referred to in paragraph 6.2.6.2.2. of this regulation

1. Specifications

1.1. Downward inclination of the dipped-beam must 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 counterclockwise 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 must be installed to the left or below the button(s) for other dipped-beam positions.

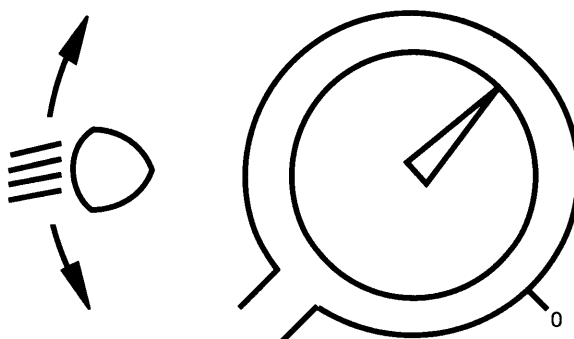
A rotary control which is installed edge-on, or with only the edge visible, should follow the operating principles of control of types (a) or (c).

- 1.1.1. This control must carry symbols indicating clearly the movements corresponding to the downward and upward inclination of the dipped beam.
- 1.2. The 'O' position corresponds to the initial inclination according to paragraph 6.2.6.1.1. of this Regulation.
- 1.3. The 'O' position which, according to paragraph 6.2.6.2.2. of this Regulation has to be a 'stop position', need not necessarily be at the end of the scale.
- 1.4. The marks used on control must be explained in the owner's handbook.
- 1.5. Only the following symbols may be used to identify the controls:

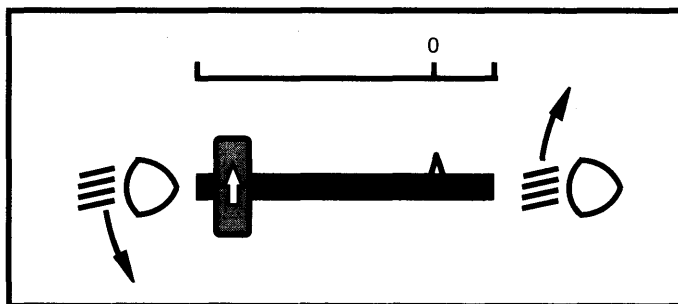


Symbols employing five lines instead of four may also be used

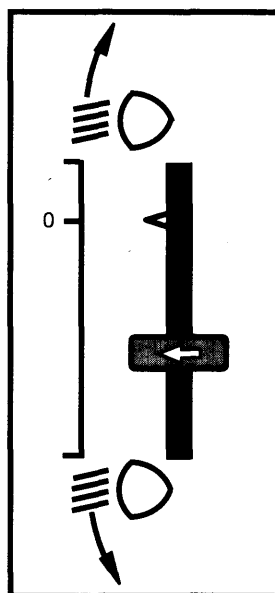
Example 1:



Example 2:



Example 3:



ANNEX 9

Control of conformity of production

1. Tests

1.1. Position of lamps

The position of lamps, as defined in paragraph 2.7. of this Regulation, in width, in height and in length shall be checked in accordance with the general requirements set out in paragraphs 2.8. to 2.10., 2.14. and 5.4. of this Regulation.

The values measured for the distances shall be such that the individual specifications 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 2.13. of this Regulation.

The values measured for the angles shall be such that the individual specifications applicable to each lamp are fulfilled except that the limits of the angles may have an allowance corresponding to the $\pm 3^\circ$ variation permitted in paragraph 5.3. for the mounting of the light-signalling devices.

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 5.10. of this Regulation.

1.3. Alignment of dipped-beam headlamps towards the front

1.3.1. Initial downward inclination

The initial downward inclination of the cut-off of the dipped beam shall be set to the plated figure as required and shown in annex 7.

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 6 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 % to 2.8 % for headlamp mounting height $h < 0.8$:

0.2 % to 2.8 % for headlamp mounting height $0.8 \leq h \leq 1.0$

or

0.7 % to 3.3 % (according to the aiming range chosen by the manufacturer at the approval);

0.7 % to 3.3 % for headlamp mounting height $h > 1.0$.

The states of loading to be used shall be as follows, as indicated in annex 5 of this Regulation, for every system adjusted accordingly.

1.3.2.1. Vehicles in category M1:

Paragraph 2.1.1.1.

Paragraph 2.1.1.6. taking into account

Paragraph 2.1.2.

1.3.2.2. Vehicles in category M2 and M3:

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 5.11. to 5.13. of this Regulation and with the individual specifications 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 6.1.9.2. of this Regulation. The value obtained shall be such that the requirement in paragraph 6.1.9.1. of this Regulation 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 5.15 and 5.16 as well as in the individual specifications applicable to each lamp are fulfilled.

Technical requirements of Regulation No 3 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex II, item 2.1 of Commission Directive 97/29/EC⁽¹⁾ adapting to technical progress Council Directive 76/757/EEC relating to retro-reflectors for motor vehicles and their trailers

2. DEFINITIONS⁽²⁾

For the purpose of this Regulation,

- 2.1. The definitions given in Regulation No. 48 and its series of amendments in force at the time of application for type approval shall apply to this Regulation.
- 2.2. '*Retroreflection*' 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.
- 2.3. '*Retroreflecting optical unit*' means a combination of optical components producing retroreflection.
- 2.4. '*Retroreflecting device*'⁽¹⁾ means an assembly ready for use and comprising one or more retroreflecting optical units.
Note:
⁽¹⁾ Also called 'retroreflector(s)'.
- 2.5. '*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.
- 2.6. '*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.
- 2.7. '*Angle of rotation*' means the angle through which the retroreflecting device is rotated about its axis of reference starting from one given position.
- 2.8. '*Angular diameter of the retroreflecting 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.
- 2.9. '*Illumination of the retroreflecting 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.
- 2.10. '*Coefficient of luminous intensity (CIL)*' means the quotient of the luminous intensity reflected in the direction considered, divided by the illumination of the retroreflecting device for given angles of illumination, divergence and rotation.
- 2.11. The symbols and units used in this Regulation are given in annex 1 to this Regulation.
- 2.12. A type of 'retroreflecting device' is defined by the models and descriptive literature submitted with the application for approval. Retroreflecting devices can be considered as belonging to the same type if they have one or more 'retroreflecting 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 this Regulation applies.
- 2.13. Retroreflecting devices are divided into three classes according to their photometric characteristics: Class I A, Class III A and Class IV A.

6. GENERAL SPECIFICATIONS

- 6.1. Retroreflecting devices 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.

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 11.

⁽²⁾ The definitions of the technical terms (excluding the ones in Regulation No. 48) are those adopted by the International Commission on Illumination (CIE).

- 6.2. The components of retroreflecting devices must not be capable of being easily dismantled.
- 6.3. Retroreflecting optical units may not be replaceable.
- 6.4. The outer surface of retroreflecting devices must be easy to clean. Hence it must not be a rough surface; any protuberances it may exhibit must not prevent easy cleaning.
- 6.5. For devices of Class IV A their means of fixation shall be such that they allow a stable and durable connection between the device and the vehicle.

7. SPECIAL SPECIFICATIONS (TESTS)

- 7.1. Retroreflecting devices must also satisfy the conditions as to dimensions and shape, and the colorimetric, photometric, physical and mechanical requirements set forth in annexes 5 to 11 and 13 to this Regulation. The test procedures are described in annex 4 (Class I A and Class III A) and annex 14 (Class IV A).
 - 7.2. Depending on the nature of the materials of which the retroreflecting devices and, in particular, their optical units, are made, the competent authorities may authorize laboratories to omit certain unnecessary tests, subject to the express reservation that such omission must be mentioned under 'Remarks' on the form notifying approval.
-

ANNEX 1

Retroreflecting device

Symbols and units

A = Area of the illuminating surface of the retroreflecting 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 retroreflecting 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

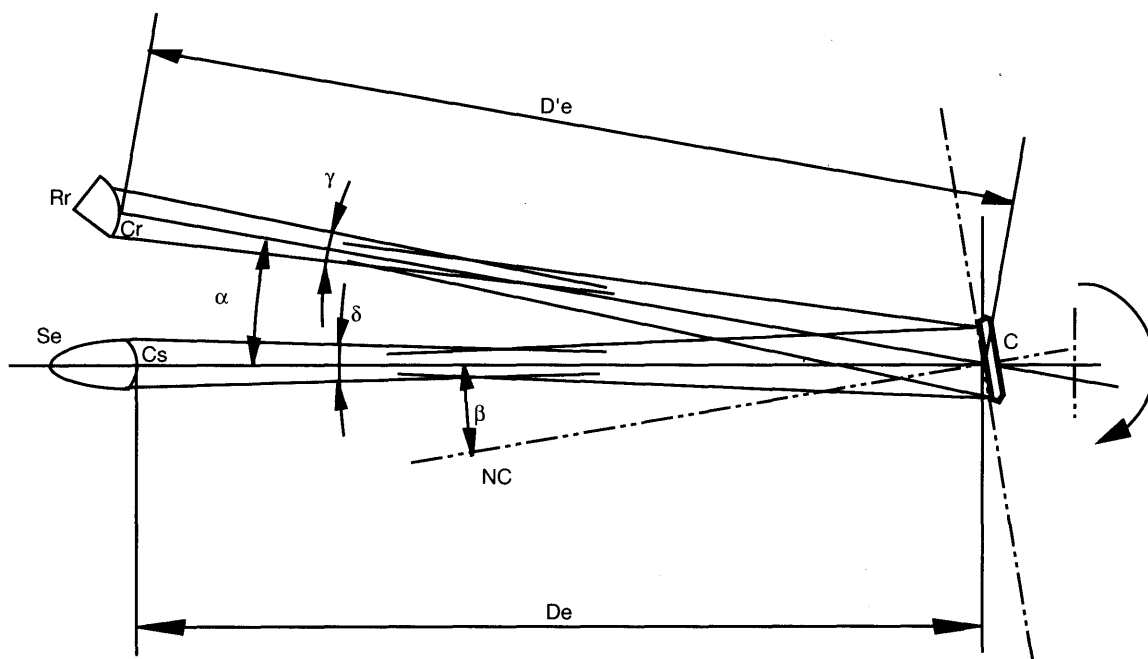
ε = Angle of rotation. This angle is positive when the rotation is clockwise as seen when looking towards the illuminating surface. If the retroreflecting device is marked 'TOP', the position thus indicated is taken as the origin.

E = Illumination of the retroreflecting device (lux)

CIL = Coefficient of luminous intensity (millicandelas/lux)
Angles are expressed in degrees and minutes.

Retroreflectors

Symbols



Elevation

ANNEX 4

Test procedure — Class I A and Class III A

1. The applicant shall submit for approval ten samples which shall be tested in the chronological order indicated in annex 12.
2. After verification of the general specifications (paragraph 6 of the Regulation) and the specifications of shape and dimensions (annex 5), the ten samples shall be subjected to the heat resistance test described in annex 10 to this Regulation and at least one hour after this test examined as to their colorimetric characteristics (annex 6) and CIL (annex 7) for an angle of divergence of 20' and an illumination angle $V = H = 0^\circ$ or if necessary, in the position defined in annex 7, paragraphs 4 and 4.1. The two retroreflecting devices giving the minimum and maximum values shall then be fully tested as shown in annex 7. These two samples shall be kept by the laboratories for any further checks which may be found necessary. The other eight samples shall be divided into four groups of two:
 - First group: The two samples shall be subjected successively to the water penetration test (annex 8, paragraph 1) and then, if this test is satisfactory, to the tests for resistance to fuels and lubricants (annex 8, paragraphs 3 and 4).
 - Second group: The two samples shall, if necessary, be subjected to the corrosion test (annex 8, paragraph 2), and then to the abrasive-strength test of the rear face of the retroreflecting device (annex 8, paragraph 5).
 - Third group: The two samples shall be subjected to the test for stability in time of the optical properties of retroreflecting device (annex 9).
 - Fourth group: The two samples shall be subjected to the colour-fastness test (annex 11).
3. After undergoing the tests referred to in the above paragraph, the retroreflecting devices in each group must have:
 - 3.1. a colour which satisfies the conditions laid down in annex 6. This shall be verified by a qualitative method and, in case of doubt, confirmed by a quantitative method.
 - 3.2. a CIL which satisfies the conditions laid down in annex 7. The verification shall be performed only for an angle of divergence of 20' and an illumination angle of $V = H = 0^\circ$ or, if necessary, in the position specified in annex 7, paragraphs 4 and 4.1.

ANNEX 5

Specifications of shape and dimensions

1. SHAPE AND DIMENSIONS OF RETROREFLECTING DEVICES IN CLASS I A

- 1.1. The shape of the illuminating surfaces must be simple, and not easily confused at normal observation distances, with a letter, a digit or a triangle.
- 1.2. The preceding paragraph notwithstanding, a shape resembling the letters or digits of simple form O, I, U or 8 is permissible.

2. SHAPE AND DIMENSIONS OF RETROREFLECTING DEVICES IN CLASS III A (see appendix to this annex)

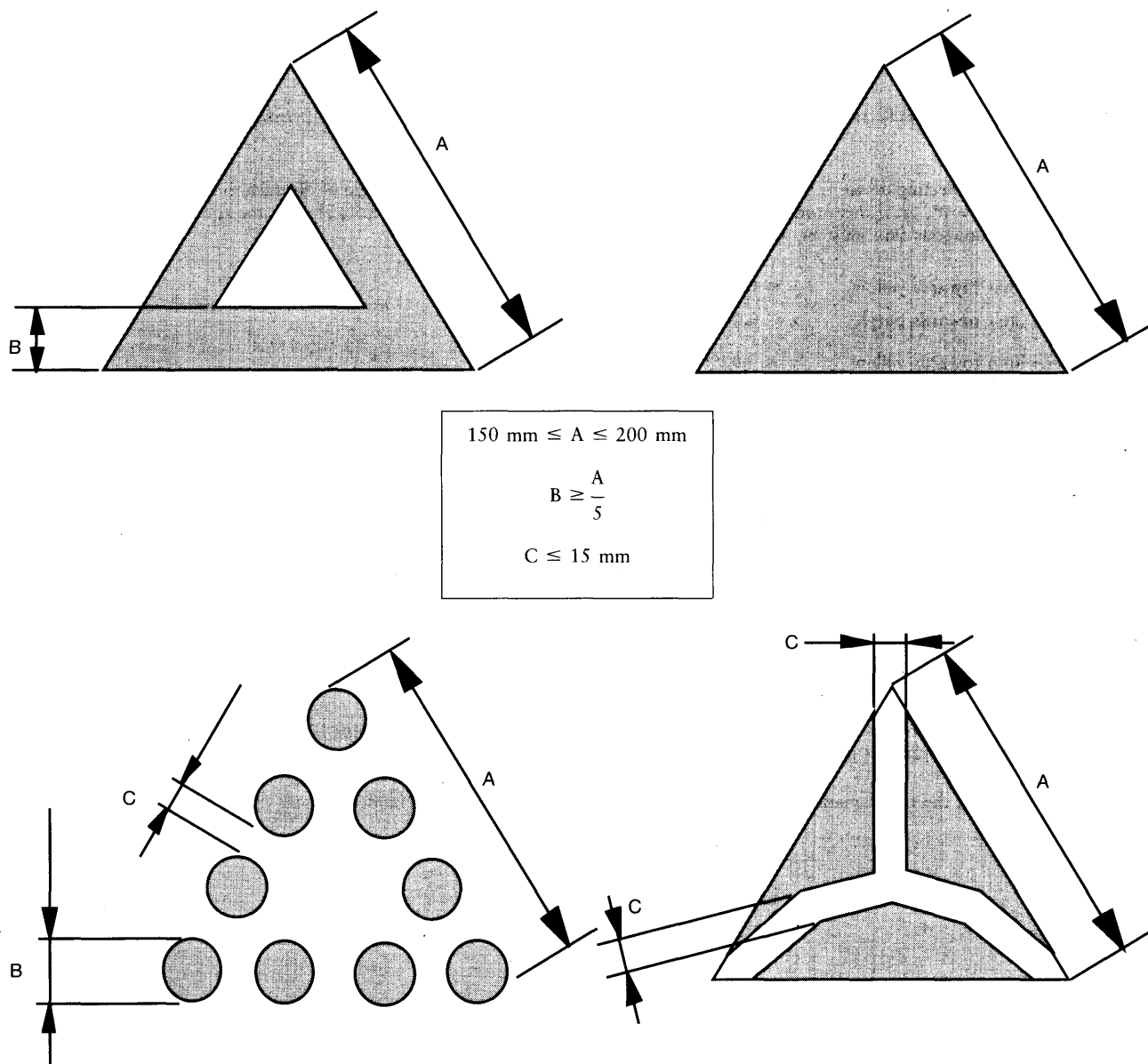
- 2.1. The illuminating surfaces of retroreflecting devices in Class III A must have the shape of an equilateral triangle. If the word 'TOP' is inscribed in one corner, the apex of that corner must be directed upwards.
- 2.2. The illuminating surface may or may not have at its centre a triangular, non-retroreflecting area, with sides parallel to those of the outer triangle.
- 2.3. The illuminating surface may or may not be continuous. In any case, the shortest distance between two adjacent retroreflecting optical units must not exceed 15 mm.
- 2.4. The illuminating surface of a retroreflecting device shall be considered to be continuous if the edges of the illuminating surfaces of adjacent separate optical units are parallel and if the said optical units are evenly distributed over the whole solid surface of the triangle.
- 2.5. If the illuminated surface is not continuous, the number of separate retroreflecting optical units including the corner units shall not be less than four on each side of the triangle.
 - 2.5.1. The separate retroreflecting optical units shall not be replaceable unless they consist of approved retroreflecting devices in Class I A.
- 2.6. The outside edges of the illuminating surfaces of triangular retroreflecting devices in Class III A shall be between 150 mm and 200 mm long. In the case of devices of hollow-triangle type, the width of the sides, measured at right angles to the latter, shall be equal to at least 20 per cent of the effective length between the extremities of the illuminating surface.

3. SHAPE AND DIMENSIONS OF RETROREFLECTING DEVICES IN CLASS IV A

- 3.1. The shape of the light emitting surfaces must be simple and not easily confused at normal observation distances with a letter, a digit or a triangle. However, a shape resembling the letters and digits of simple form, O, I, U and 8 is permissible.
 - 3.2. The light emitting surface of the retroreflecting device must be at least 25 cm².
4. Compliance with the above specifications shall be verified by visual inspection.

Appendix

RETROREFLECTORS FOR TRAILERS — CLASS III A



Note: These sketches are for illustration purposes only.

ANNEX 6

Colorimetric specifications

1. These specifications shall apply only to clear, red or amber retroreflecting devices.
 - 1.1. Retroreflecting devices may consist of a combined retroreflecting optical unit and filter, which must be so designed that they cannot be separated under normal conditions of use.
 - 1.2. The colouring of retroreflecting optical units and filters by means of paint or varnish is not permitted.
2. When the retroreflecting device is illuminated by ICI standard illuminant A, with an angle of divergence of $\frac{1}{3}^\circ$ and an illumination angle of $V = H = 0^\circ$, or, if this produces a colourless surface reflection, an angle $V = \pm 5^\circ$, $H = 0^\circ$, the trichromatic coordinates of the reflected luminous flux must be within the following limits:

Red:	limit towards yellow	$y \leq 0,335$
	limit towards purple	$z \leq 0,008$
Amber:	limit towards yellow	$y \leq 0,429$
	limit towards red	$y \geq 0,398$
	limit towards white	$z \leq 0,007$
- 2.1. In the case of red and amber, compliance with the colorimetric specifications shall be verified by a visual comparison test.
- 2.2. If any doubt remains after this test, compliance with the colorimetric specifications shall be verified by determining the trichromatic coordinates of the most doubtful sample.
3. Clear retroreflecting devices must not produce a selective reflection, that is to say, the trichromatic coordinates 'x' and 'y' of the standard illuminant 'A' used to illuminate the retroreflecting device must not undergo a change of more than 0.01 after reflection by the retroreflecting device.
 - 3.1. This shall be verified by the visual comparison test indicated above, the control field being illuminated by a light source of which the trichromatic coordinates differ by 0.01 from that of standard illuminant A.
 - 3.2. In case of doubt, the trichromatic coordinates for the most selective sample shall be determined.

ANNEX 7

Photometric specifications

1. When applying for approval, the applicant shall specify the axis of reference. This corresponds to the illumination angle $V = H = 0^\circ$ in the table of coefficients of luminous intensity (CIL).
2. For photometric measurements, only the illuminating surface contained within a circle of 200 mm diameter for Class I A shall be considered, and the illuminating surface itself shall be limited to 100 cm² though the surfaces of the retroreflecting optical units need not necessarily attain this area. The manufacturer shall specify the perimeter of the area to be used. In the case of Class III A and Class IV A, the whole of the illuminating surfaces shall be considered without limitation as to size.
3. CIL VALUES
 - 3.1. Categories I A and III A
 - 3.1.1. The CIL values for red retroreflecting devices must be at least equal to those in the table below, expressed in millicandelas per lux, for the angles of divergence and illumination shown.

Class	Angle of divergence α	Illumination angles (in degrees)			
		Vertical V Horizontal H	0° 0°	±10° 0°	± 5° ±20°
I A	20'		300	200	100
	1°30'		5	2,8	2,5
III A	20'		450	200	150
	1°30'		12	8	8

CIL values lower than those shown in the last two columns of the above table are not permissible within the solid angle having the reference centre as its apex and bounded by the planes intersecting along the following lines:

($V = \pm 10^\circ$, $H = 0^\circ$)

($V = \pm 5^\circ$, $H = \pm 20^\circ$).

- 3.1.2. CIL values for amber retroreflecting devices in Class I A must be at least equal to those in the table of paragraph 3.1.1. above multiplied by the coefficient 2.5.
- 3.1.3. CIL values for colourless retroreflecting devices in Class I A must be at least equal to those in the table of paragraph 3.1.1. above multiplied by the coefficient 4.
- 3.2. For devices of Class IV A the CIL values must be at least equal to those in the table below, expressed in millicandelas per lux, for the angles of divergence and illumination shown.

Colour	Angle of divergence α	Illumination angles (in degrees)						
		Vertical V Horizontal H	0 0	±10 0	0 ±20	0 ±30	0 ±40	0 ±50
White	20'		1 800	1 200	610	540	470	400
	1°30'		34	24	15	15	15	15
Amber	20'		1 125	750	380	335	290	250
	1°30'		21	15	10	10	10	10
Red	20'		450	300	150	135	115	100
	1°30'		9	6	4	4	4	4

4. When the CIL of a retroreflecting device is measured for an angle β of $V = H = 0^\circ$, it shall be ascertained whether any mirror effect is produced by slightly turning the device. If there is any such effect, a reading shall be taken with an angle β of $V = \pm 5^\circ$, $H = 0^\circ$. The position adopted shall be that corresponding to the minimum CIL for one of these positions.
 - 4.1. With an illumination angle β of $V = H = 0^\circ$, or the angle specified in paragraph 4 above, and an angle of divergence of $20'$, retroreflecting devices which are not marked 'TOP' shall be rotated about their axes of reference to the position of minimum CIL, which must conform to the value specified in paragraph 3 above. When the CIL is measured for the other angles of illumination and divergence, the retroreflecting device shall be placed in the position corresponding to this value of ϵ . If the specified values are not attained, the device may be rotated about its axis of reference $\pm 5^\circ$ from that position.
 - 4.2. With an illumination angle β of $V = H = 0^\circ$, or the angle specified in paragraph 4 above, and an angle of divergence of $20'$, retroreflecting devices marked 'TOP' shall be rotated about their axes $\pm 5^\circ$. The CIL must not fall below the prescribed value in any position assumed by the device during this rotation.
 - 4.3. If for the direction $V = H = 0^\circ$, and for $\epsilon = 0^\circ$ the CIL exceeds the specified value by 50 per cent or more, all measurements for all angles of illumination and divergence shall be made for $\epsilon = 0^\circ$.
-

ANNEX 8

Resistance to external agents

1. RESISTANCE TO PENETRATION OF WATER

- 1.1. Retroreflecting devices whether part of a lamp or not, shall be stripped of all removable parts and immersed for 10 minutes in water at a temperature of $50^{\circ} \pm 5^{\circ}\text{C}$, the highest point of the upper part of the illuminating surface being 20 mm below the surface of the water. This test shall be repeated after turning the retroreflecting device through 180°C , so that the illuminating surface is at the bottom and the rear face is covered by about 20 mm of water. These optical units shall then be immediately immersed in the same conditions in water at a temperature of $25^{\circ} \pm 5^{\circ}\text{C}$.
- 1.2. No water must penetrate to the reflecting surface of the retroreflecting optical unit. If visual inspection clearly reveals the presence of water, the device shall not be considered to have passed the test.
- 1.3. If visual inspection does not reveal the presence of water or in case of doubt, the CIL shall be measured by the method described in annex 4, paragraph 3.2. or annex 14, paragraph 4.2., the retroreflecting device being first lightly shaken to remove excess water from the outside.

2. RESISTANCE TO CORROSION

- 2.1. Retroreflecting devices must be so designed that they retain the prescribed photometric and colorimetric characteristics despite the humidity and corrosive influences to which they are normally exposed. The resistance of the front surface to tarnishing and of the protection of the rear face to deterioration shall be checked, particularly when an essential metal component seems liable to be attacked.
- 2.2. The retroreflecting device, or the lamp if the device is combined with a light, shall be stripped of all removable parts and subjected to the action of a saline mist for a period of 50 hours, comprising two periods of exposure of 24 hours each, separated by an interval of two hours during which the sample is allowed to dry.
- 2.3. The saline mist shall be produced by atomizing, at a temperature of $35^{\circ} \pm 2^{\circ}\text{C}$, a saline solution obtained by dissolving 20 ± 2 parts by weight of sodium chloride in 80 parts of distilled water containing not more than 0.02 per cent of impurities.
- 2.4. Immediately after completion of the test, the sample must not show signs of excessive corrosion liable to impair the efficiency of the device.

3. RESISTANCE TO FUELS

The outer surface of the retroreflecting device and, in particular, of the illuminating surface, shall be lightly wiped with a cotton cloth soaked in a mixture of 70 vol. per cent of n-heptane and 30 vol. per cent of toluol. After about five minutes, the surface shall be inspected visually. It must not show any apparent surface changes, except that slight surface cracks will not be objected to.

4. RESISTANCE TO LUBRICATING OILS

The outer surface of the retroreflecting device and, in particular, the illuminating surface, shall be lightly wiped with a cotton cloth soaked in a detergent lubricating oil. After about five minutes, the surface shall be cleaned. The CIL shall then be measured (annex 4, paragraph 3.2. or annex 14, paragraph 4.2.).

5. RESISTANCE OF THE ACCESSIBLE REAR FACE OF MIRROR-BACKED RETROREFLECTING DEVICES

- 5.1. After having brushed the rear face of the retroreflecting device with a hard nylon brush, a cotton cloth soaked in the mixture, defined in paragraph 3 shall be applied to the said rear face for one minute. The cotton cloth is then removed and the retroreflecting device left to dry.
- 5.2. As soon as evaporation is completed, an abrasion test shall be made by brushing the rear face with the same nylon brush as before.
- 5.3. The CIL shall then be measured (annex 4, paragraph 3.2. or annex 14, paragraph 4.2.) after the whole surface of the mirror-backed rear face has been covered with Indian ink.

ANNEX 9

Stability in time of the optical properties of retroreflecting devices⁽¹⁾

1. The authority which granted approval shall have the right to check the stability in time of the optical properties of a type of retroreflecting device in service.
2. The competent authorities of countries other than the country in which approval was granted may carry out similar checks in their territory. If a type of retroreflector in use exhibits a systematic defect, the said authorities shall transmit any components removed for examination to the authority which granted approval, with a request for its opinion.
3. In the absence of other criteria, the concept of 'systematic defect' of a type of retroreflector in use shall be interpreted in conformity with the intention of paragraph 6.1. of this Regulation.

Note:

- ⁽¹⁾ Despite the importance of tests to check the stability in time of the optical properties of retroreflecting devices, it is in the present state of the art not yet possible to assess this stability by laboratory tests of limited duration.

ANNEX 10

Resistance to heat

1. The retroreflecting device shall be kept for 48 consecutive hours in a dry atmosphere at a temperature of $65 \pm 2^\circ\text{C}$.
2. After this test, no cracking or appreciable distortion of the retroreflecting device and, in particular, of its optical component must be visible.

ANNEX 11

Colour-fastness⁽¹⁾

1. The authority which granted approval shall have the right to check the colour-fastness of a type of retroreflecting device in service.
2. The competent authorities of countries other than the country in which approval was granted may carry out similar checks in their territory. If a type of retroreflector in use exhibits a systematic defect, the said authorities shall transmit any components removed for examination to the authority which granted approval, with a request for its opinion.
3. In the absence of other criteria, the concept 'systematic defect' of a type of retroreflector in use shall be interpreted in conformity with the intention of paragraph 6.1. of this Regulation.

Note:

- ⁽¹⁾ Despite the importance of tests to check the colour-fastness of retroreflecting devices, it is in the present state of the art not yet possible to assess colour-fastness by laboratory tests of limited duration.

ANNEX 12

Chronological order of tests

Number of Annex	Number of paragraph of the Regulation	Tests	Samples									
			a	b	c	d	e	f	g	h	i	j
—	6.	General specifications: visual inspection	x	x	x	x	x	x	x	x	x	x
5	—	Shapes and dimensions: visual inspection	x	x	x	x	x	x	x	x	x	x
10	—	Heat: 48 h at 65° ± 2°C	x	x	x	x	x	x	x	x	x	x
		Visual inspection for distortion	x	x	x	x	x	x	x	x	x	x
6	—	Colorimetry: visual inspection	x	x	x	x	x	x	x	x	x	x
		Trichromatic coordinates in case of doubt		x								
7	—	Photometry: limited to 20' and V = H = 0°	x	x	x	x	x	x	x	x	x	x
7	3.	Complete photometry			x	x						
8	1.	Water:										
		10 min in normal position							x	x		
		10 min in inverted position							x	x		
4	3.1.	visual inspection							x	x		
		Trichromatic coordinates in case of doubt							x	x		
4	3.2.	Photometry: limited to 20' and V = H = 0°							x	x		
8	3.	Motor fuels: 5 min							x	x		
		visual inspection							x	x		
8	4.	Oils: 5 min							x	x		
		visual inspection							x	x		
4	3.1.	Colorimetry: visual inspection										
		Trichromatic coordinates in case of doubt							x	x		
4	3.2.	Photometry: limited to 20' and V = H = 0°							x	x		
8	2.	Corrosion: 24 hours					x	x				
		2 hours interval					x	x				
		24 hours					x	x				
		visual inspection					x	x				
8	5.	Rear face: 1 min					x	x				
		visual inspection					x	x				
4	3.1.	Colorimetry: visual inspection					x	x				
		Trichromatic coordinates in case of doubt					x	x				

Number of Annex	Number of paragraph of the Regulation	Tests	Samples									
			a	b	c	d	e	f	g	h	i	j
4	3.2.	Photometry: limited to 20' and $V = H = 0^\circ$					x	x				
9	—	Stability in time										
4	3.1.	Colorimetry: visual inspection or trichromatic coordinates										
4	3.2.	Photometry: limited to 20' and $V = H = 0^\circ$										
11	—	Colour-fastness										
4	3.1.	Colorimetry: visual inspection or trichromatic coordinates										
4	3.2.	Photometry: limited to 20' and $V = H = 0^\circ$										
4	2.	Deposit of samples with administration			x	x						

ANNEX 13

Resistance to impact — Class IV A

1. The retroreflecting device shall be mounted in a manner similar to the way in which it is mounted on the vehicle, but with the lens faced horizontal and directed upwards.
2. Drop a 13 mm diameter polished solid steel ball, once, vertically onto the central part of the lens from a height of 0.76 m. The ball may be guided but not restricted in free fall.
3. When a retroreflecting device is tested at room temperature with this method, the lens shall not crack.

ANNEX 14

Test procedure — Class IV A

1. The applicant shall submit for approval ten samples which shall be tested in the chronological order indicated in annex 15.
2. After verification of the specifications in paragraphs 6.1. to 6.5. and the specifications of shape and dimensions (annex 5), the ten samples shall be subjected to the heat resistance test (annex 10) and one hour minimum after this test examined as to their colorimetric characteristics (annex 6) and CIL (annex 7) for an angle of divergence of 20' and an illumination angle $V = H = 0^\circ$ or, if necessary, in the positions defined in annex 7. The two retroreflecting devices giving the minimum and maximum values shall then be fully tested as shown in annex 7. These two samples shall be kept by the laboratories for any further checks which may be found necessary.
3. Four samples out of the remaining eight samples shall be selected at random and divided into two groups of two in each group.

First group:

The two samples shall be subjected successively to the water-penetration resistance test (annex 8, paragraph 1) and then, if this test is satisfactory, to the tests for resistance to fuels and lubricating oils (annex 8, paragraphs 3 and 4).

Second group:

The two samples shall, if relevant, be subjected to the corrosion test (annex 8, paragraph 2), and then to the abrasive-strength test of the rear face of the retroreflecting device (annex 8, paragraph 5). These two samples shall also be subjected to the impact test (annex 13).

4. After undergoing the tests referred to in the above paragraph, the retroreflecting devices in each group must have:
 - 4.1. A colour which satisfies the conditions laid down in annex 6. This shall be verified by a qualitative method and, in case of doubt, confirmed by a quantitative method;
 - 4.2. A CIL which satisfies the conditions laid down in annex 7. Verification shall be performed only for an angle of divergence of 20' and an illumination angle of $V = H = 0^\circ$ or, if necessary, in the positions specified in annex 7.
5. The four remaining samples can be utilized, if necessary, for any other purpose.

ANNEX 15

Chronological order of tests for Class IV A

Number of Annex	Number of paragraph of the Regulation	Tests	Samples									
			a	b	c	d	e	f	g	h	i	j
—	6.	General specifications: visual inspection	x	x	x	x	x	x	x	x	x	x
5	—	Shape and dimensions: visual inspection	x	x	x	x	x	x	x	x	x	x
10	—	Heat: 48 h at 65°C ± 2°C Visual inspection for distortion	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
6	—	Colorimetry: visual inspection Trichromatic coordinates in case of doubt	x	x x	x	x	x	x	x	x	x	x
7	—	Photometry: limited to 20' and V = H = 0°	x	x	x	x	x	x	x	x	x	x
7	—	Complete photometry	x	x								
8	1.	Water: 10 min in normal position 10 min in inverted position visual inspection			x x x	x x x						
8	3.	Motor fuels: 5 min visual inspection			x x	x x						
8	4.	Oils: 5 min visual inspection			x x	x x						
6	—	Colorimetry: visual inspection Trichromatic coordinates in case of doubt			x x	x x						
7	—	Photometry: limited to 20' and V = H = 0°			x	x						
8	2.	Corrosion: 24 hours 2 hours' interval 24 hours visual inspection					x x x x	x x x x				
8	5.	Rear face: 1 min visual inspection					x x	x x				
13	—	Impact visual inspection					x x	x x				
6	—	Colorimetry: visual inspection Trichromatic coordinates in case of doubt					x x	x x				
7	—	Photometry: limited to 20' and V = H = 0°					x	x				
14	2.	Deposit of samples with administration	x	x								

Technical requirements of Regulation No 7 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex II, item 2.1 of Commission Directive 97/30/EC⁽¹⁾ adapting to technical progress Council Directive 76/758/EEC relating to the end-outline marker lamps, front position (side) lamps, rear position (side) lamps, stop lamps, daytime running lamps and side marker lamps for motor vehicles and their trailers

1. DEFINITIONS

For the purposes of this Regulation,

- 1.1. '*Front position (side) lamp*' means the lamp used to indicate the presence and the width of the vehicle when viewed from the front;
- 1.2. '*Rear position (side) lamp*' means the lamp used to indicate the presence and the width of the vehicle when viewed from the rear;
- 1.3. '*Stop-lamp*' means the lamp used to indicate to other road-users to the rear of the vehicle that its driver is applying the service brake.

The stop-lamps may be activated by the application of a retarder or a similar device.

- 1.4. '*End-outline marker lamp*' means a lamp fitted near to the extreme outer edges and as close as possible to the top of the vehicle and intended to indicate clearly the vehicle's overall width. In the case of certain power-driven vehicles and trailers, this lamp is intended to complement the vehicle's position (side) lamps and draw special attention to its outline;

1.5. '*Definitions of terms*'

The definitions given in Regulation No. 48 and its series of amendments in force at the time of application for type approval shall apply to this Regulation.

- 1.6. '*Front and rear position (side) lamps, stop-lamps and end-outline marker lamps of different types*' means lamps which differ in each said category in such essential respects as:

- The trade name or mark,
- The characteristics of the optical system, (levels of intensity, light distribution angles, type of filament lamp, etc.),
- The system used to reduce illumination at night — in the case of stop-lamps with two levels of intensity.

5. GENERAL SPECIFICATIONS

- 5.1. Each device supplied shall conform to the specifications set forth in paragraphs 6 and 8 below.
- 5.2. The devices must be so designed and constructed that in normal conditions of use, and notwithstanding the vibrations to which they may be subjected in such use, their satisfactory operation remains assured and they retain the characteristics prescribed by this Regulation.
- 5.3. Lamps having been approved as front or rear position (side) lamps, are deemed being also approved end-outline marker lamps.
- 5.4. Front and rear position (side) lamps which are grouped or combined or reciprocally incorporated may also be used as end-outline marker lamps.

6. INTENSITY OF LIGHT EMITTED

- 6.1. In the reference axis, the light emitted by each of the two devices supplied must be of not less than the minimum intensity and of not more than the maximum intensity specified below:

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 25.

(1)	Minimum intensities cd	Maximum values in cd when used as		
		Single lamp	Lamp (single) marked 'D' (paragraph 4.2.2.6.)	Total for the assembly of two lamps (paragraph 4.2.2.6.)
6.1.1. Front position (side) lamps, front end-outline marker lamp	4	60 ⁽²⁾	42 ⁽²⁾	84 ⁽²⁾
6.1.2. Front position (side) lamps incorporated in headlamp	4	100 ⁽²⁾	—	—
6.1.3. Rear position (side) lamps rear end-outline marker lamp	4	12 ⁽²⁾	8,5 ⁽²⁾	17 ⁽²⁾
6.1.4. Stop-lamps				
6.1.4.1. with 1 level of intensity (category S1)	40	100 ⁽²⁾	70 ⁽²⁾	140 ⁽²⁾
6.1.4.2. with 2 levels of intensity (category S2)				
6.1.4.2.1. by day	130	520 ⁽²⁾	366 ⁽²⁾	728 ⁽²⁾
6.1.4.2.2. by night	30	80 ⁽²⁾	56 ⁽²⁾	112 ⁽²⁾
6.1.4.3. Stop-lamps of category S3	25	80 ⁽²⁾	55 ⁽²⁾	110 ⁽²⁾

Notes to table

(1) The installation of the devices referred to above in power-driven vehicles and their trailers is provided for in the Regulations concerning the installation of lighting and light-signalling devices (Regulations Nos. 48 and 53).

(2) The total value of maximum intensity for an assembly of two lamps is given by multiplying by 1.4 the value prescribed for a single lamp.

When an assembly of two lamps having the same function is deemed to be, for the purpose of installation on a vehicle, a 'single lamp' (following the definition of Regulation No. 48 and its series of amendments in force at the time of application for type approval) each individual lamp constituting the 'single lamp' shall comply with the minimum intensity required and the two lamps together shall not exceed the admissible maximum intensity (last column of the table)

In the case of a single lamp containing more than one light source:

— The lamp shall comply with the minimum intensity required when any one light source has failed, and

— When all light sources are illuminated the maximum intensity specified for a single lamp may be exceeded provided that the single lamp is not marked 'D' and the maximum intensity specified for an assembly of two lamps (last column of the table) is not exceeded.

6.2. Outside the reference axis and within the angular fields defined in the diagrams in annex 1 to this Regulation, the intensity of the light emitted by each of the two devices supplied must:

6.2.1. In each direction corresponding to the points in the light distribution table reproduced in annex 4 to this Regulation, be not less than the product of the minimum specified in paragraph 6.1. above by the percentage specified in the said table for the direction in question;

6.2.2. In no direction within the space from which the light-signalling device is visible, exceed the maximum specified in paragraph 6.1. above;

6.2.3. However, a luminous intensity of 60 cd shall be permitted for rear position (side) lamps reciprocally incorporated with stop-lamps (see paragraph 6.1.3. above) below a plane forming an angle of 5° with and downward from the horizontal plane;

6.2.4. Moreover,

6.2.4.1. Throughout the fields defined in the diagrams in annex 1, the intensity of the light emitted must be not less than 0.05 cd for front and rear position (side) lamps and end-outline marker lamps, not less than 0.3 cd for stop-lamps with one level of intensity, and for stop-lamps with two levels of intensity 0.3 cd by day and 0.07 cd by night;

6.2.4.2. If a rear position (side) lamp is reciprocally incorporated with a stop-lamp, the ratio between the luminous intensities actually measured of the two lamps when turned on simultaneously at the intensity of the rear position (side) lamp when turned on alone should be at least 5: 1 in the field delimited by the straight horizontal lines passing through $\pm 5^\circ$ V and the straight vertical lines passing through $\pm 10^\circ$ H of the light distribution table. If the stop-lamp has two levels of intensity, this requirement must be satisfied when the night condition is switched on;

6.2.4.3. The provisions of paragraph 2.2. of annex 4 to this Regulation on local variations of intensity must be observed.

6.3. The intensities shall be measured with the filament lamp(s) continuously alight and, in the case of devices emitting selective-yellow or red light, in coloured light.

6.4. In the case of a stop-lamp providing two levels of intensity the time that elapses between electrical supply being switched on and the light output measured on the reference axis to reach 90 % of the value measured in accordance with paragraph 6.3. above shall be measured for both the day and the night conditions of use. The time measured for the night condition of use shall not exceed that measured for the day condition of use.

6.5. Annex 4, to which reference is made in paragraph 6.2.1. above, gives particulars of the methods of measurement to be used.

7. TEST PROCEDURE

7.1. All measurements shall be made with a white standard filament lamp of the category prescribed for the device, the supply voltage being so regulated as to produce the normal luminous flux prescribed for that category of lamp.

7.1.1. All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.75 V, 13.5 V or 28.0 V respectively.

In the case of light sources supplied by a special power supply, the above test voltages shall be applied to the input terminals of that power supply. The test laboratory may require from the manufacturer the special power supply needed to supply the light sources.

7.2. However, in the case of a stop-lamp for which an additional system is used to obtain the night-time intensity, the voltage applied to the system for measuring the night-time intensity shall be that which was applied to the filament lamp for measuring the day-time intensity.⁽¹⁾

7.3. Where a rear position (side) lamp is reciprocally incorporated with a dual-intensity stop-lamp and is designed to operate permanently with an additional system to regulate the intensity of the light emitted, measurement of the light emitted shall be performed with the same voltage applied to the system as would, if applied to the filament lamp, enable the lamp to produce the prescribed normal luminous flux.

7.4. The vertical and horizontal outlines of the illuminating surface of a light-signalling device (paragraph 1.6.2.) shall be determined and measured in relation to the centre of reference (paragraph 1.6.5.).

Note:

⁽¹⁾ The functioning and installation conditions of these additional systems will be defined by special provisions.

8. COLOUR OF LIGHT EMITTED

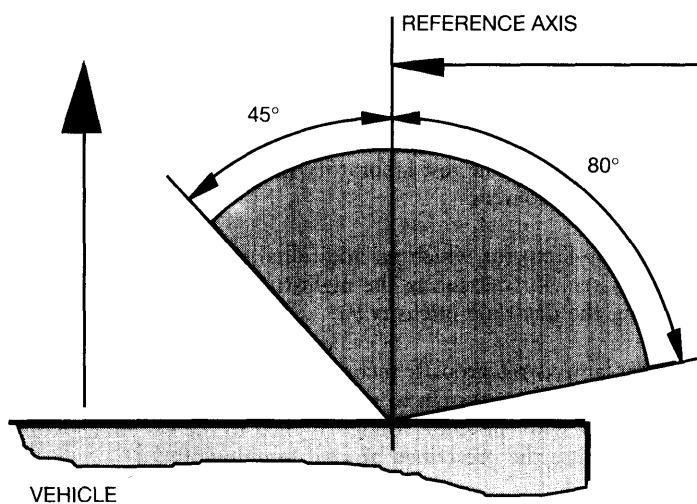
The colour of the light emitted shall be within the limits of the co-ordinates prescribed for the colour in question in annex 5 to this Regulation.

ANNEX 1

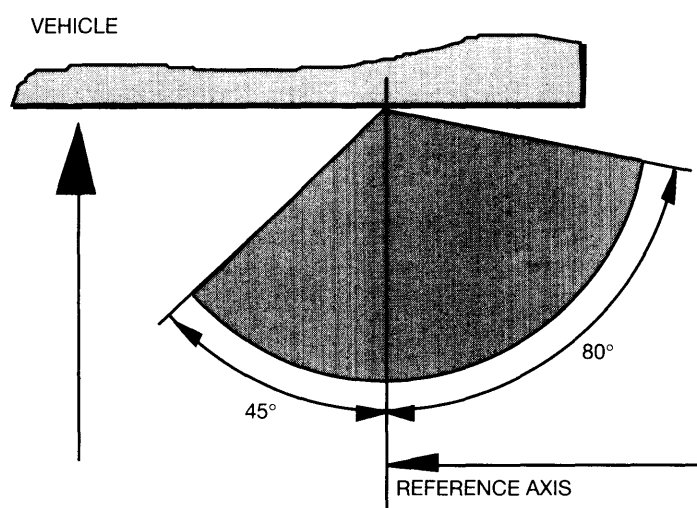
Front and rear position (side) lamps, end-outline marker lamps and stop-lamps: minimum angles required for light distribution in space of these lamps⁽¹⁾

The minimum vertical angles of light distribution in space are 15° above and 15° below the horizontal for all categories of devices included in this Regulation except for category S3 stop lamp for which they are 10° above and 5° below the horizontal.

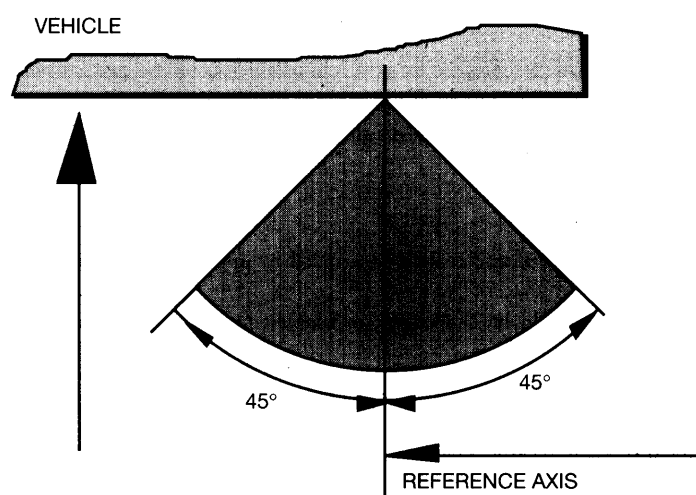
Minimum horizontal angles of light distribution in space



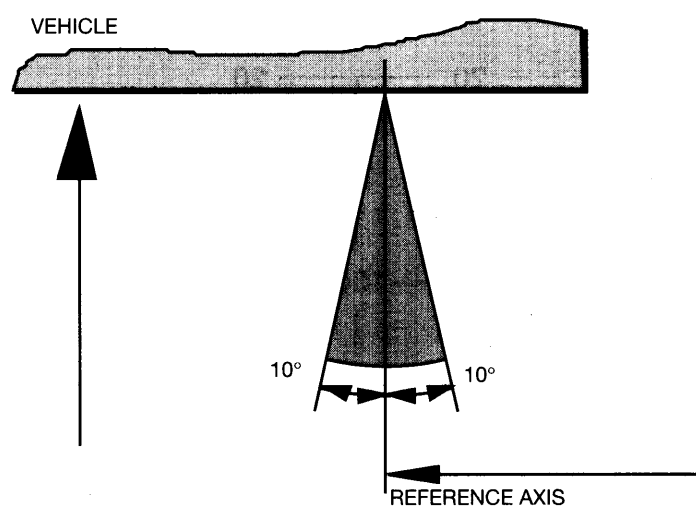
Front position (side) lamps end-outline marker lamps



Rear position lamps end-outline marker lamps



Stop-lamps (S1 and S2)



Stop-lamps (S3)

Note:

- (¹) The angles shown in these diagrams are correct for devices to be mounted on the right side of the vehicle. The arrows point to the front of the vehicles.

ANNEX 4

Photometric measurements

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 lamp is comprised between 10 angular minutes and one 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.

2. TABLE OF STANDARD LIGHT DISTRIBUTION

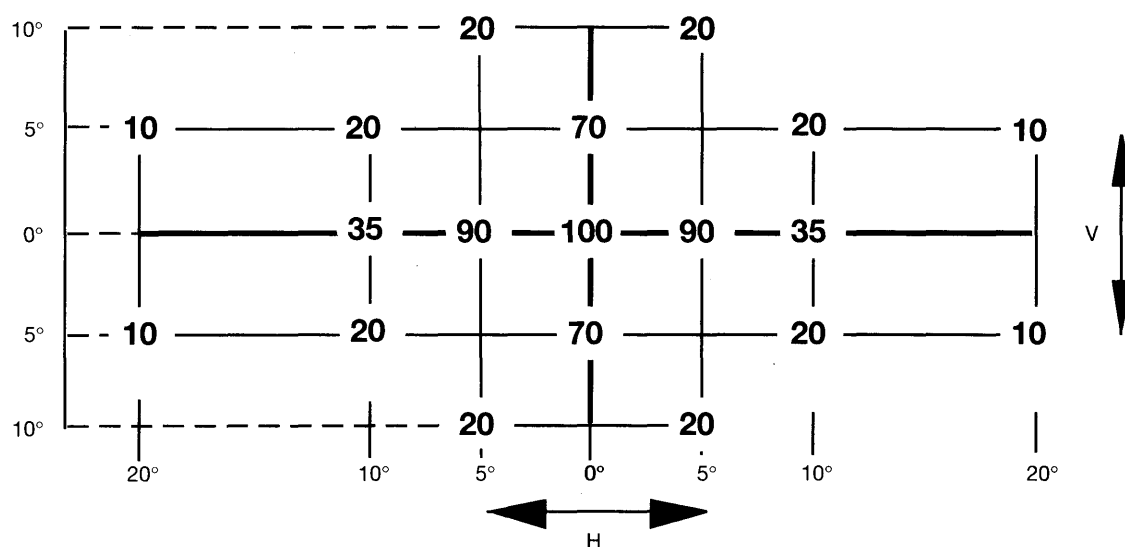


Table of light distribution for category S3 stop-lamp

10°	32	—	64	—	32
5°	64	100	100	100	64
0°	64	100	100	100	64
5°	64	100	100	100	64
10°	32	—	64	—	32

- 2.1. The direction $H = 0^\circ$ and $V = 0^\circ$ corresponds to the reference axis. (On the vehicle it is horizontal, parallel to the median longitudinal plane of the vehicle and oriented in the required direction of visibility). It passes through the centre of reference. The values shown in the table give, for the various directions of measurement, the minimum intensities as a percentage of the minimum required in the axis for each lamp (in the direction $H = 0^\circ$ and $V = 0^\circ$).
- 2.2. Within the field of light distribution of paragraph 2, schematically shown as a grid, the light pattern should be substantially uniform, i.e. the light intensity in each direction of a part of the field formed by the grid lines shall meet at least the lowest minimum value being shown on the grid lines surrounding the questioned direction as a percentage.

3. PHOTOMETRIC MEASUREMENT OF LAMPS EQUIPPED WITH SEVERAL LIGHT SOURCES

The photometric performance shall be checked:

3.1. For non-replaceable light sources (filament lamps and other):

with the light sources present in the lamp, in accordance with paragraph 7.1.1. of this Regulation.

3.2. For replaceable filament lamps:

when equipped with mass production filament lamps at 6.75 V, 13.5 V or 28.0 V the luminous intensity values produced shall lie between the maximum limit given in this Regulation and the minimum limit of this Regulation increased according to the permissible deviation of the luminous flux permitted for the type of filament lamp chosen, as stated in Regulation No. 37 for production filament lamps; 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.

ANNEX 5

Colours of lights

TRICHROMATIC COORDINATES

RED	Limit towards yellow	$y \leq 0,335$
	Limit towards purple	$z \leq 0,008$
WHITE	Limit towards blue	$x \geq 0,310$
	Limit towards yellow	$x \leq 0,500$
	Limit towards green	$y \leq 0,150 + 0,640x$
	Limit towards green	$y \leq 0,440$
	Limit towards purple	$y \geq 0,050 + 0,750x$
	Limit towards red	$y \geq 0,382$
SELECTIVE-YELLOW	Limit towards red	$y \geq 0,138 + 0,580x$
	Limit towards green	$y \leq 1,29x - 0,100$
	Limit towards white	$y \geq -x + 0,966$
	Limit towards spectral value	$y \leq -x + 0,992$

For checking these colorimetric characteristics, a source of light at a colour temperature of 2,856K corresponding to illuminant A of the International Commission on Illumination (CIE) shall be used. However, for lamps equipped with non-replaceable light sources (filament lamps and other), the colorimetric characteristics should be verified with the light sources present in the lamp, in accordance with paragraph 7.1.1. of this Regulation.

Technical requirements of Regulation No 87 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex III, item 2.1 of Commission Directive 97/30/EC⁽¹⁾ adapting to technical progress Council Directive 76/758/EEC relating to the end-outline marker lamps, front position (side) lamps, rear position (side) lamps, stop lamps, daytime running lamps and side marker lamps for motor vehicles and their trailers

2. DEFINITIONS

For the purpose of this regulation:

- 2.1. '*Daytime running lamp*' means a lamp facing in a forward direction used to make the vehicle more easily visible when driving during daytime;
- 2.2. The definitions given in Regulation No. 48 and its series of amendments in force at the time of application for type-approval shall apply to this Regulation.
- 2.3. Daytime running lamps of different '*types*' are daytime running lamps which differ in such essential respects as:
 - 2.3.1. the trade name or mark,
 - 2.3.2. the characteristics of the optical system,
 - 2.3.3. the category of filament lamp.

6. GENERAL SPECIFICATIONS

- 6.1. Each lamp shall conform to the specifications set forth in the paragraphs below.
- 6.2. Daytime running lamps shall be so designed and constructed that in normal use, despite the vibration to which they may then be subjected, they continue to function satisfactorily and retain the characteristics prescribed by this Regulation.

7. INTENSITY OF LIGHT

- 7.1. The intensity of the light emitted by each lamp shall be not less than 400 cd in the axis of reference.
- 7.2. Outside the reference axis, in each direction corresponding to the points in the light distribution table reproduced in annex 3 to this Regulation, the intensity of the light emitted by each lamp shall be not less than the product of the minimum specified in paragraph 7.1 above by the percentage specified in the said table for the direction in question.
- 7.3. The intensity of the light emitted shall be not more than 800 cd in any direction.
- 7.4. In the case of a lamp containing more than one light source the lamp shall comply with the minimum intensity required when any one light source has failed and when all light sources are illuminated the maximum intensity shall not be exceeded.

8. ILLUMINATING SURFACE

The area of the illuminating surface shall be not less than 40 cm².

9. COLOUR OF LIGHT

The colour of the light shall be white. It shall be measured by using a source of light at a colour temperature of 2 856° K (corresponding to illuminant A of the International Commission on Illumination, CIE). However, for lamps equipped with non-replaceable light sources (filament lamps and other), the colorimetric characteristics should be verified with the light sources present in the lamp, in accordance with paragraph 10.2 of this Regulation. The colour must be within the limits of the trichromatic co-ordinates prescribed in annex 4 to this Regulation.

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 25.

10. TEST PROCEDURE

- 10.1. All measurements shall be carried out with a colourless standard filament lamp of the category indicated for the daytime running lamp adjusted to produce the reference luminous flux specified for this category of filament lamp.
- 10.2. All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.75 V, 13.5 V or 28.0 V respectively.

In the case of light sources supplied by a special power supply, the above test voltages shall be applied to the input terminals of that power supply. The test laboratory may require from the manufacturer the special power supply needed to supply the light sources.

11. HEAT RESISTANCE TEST

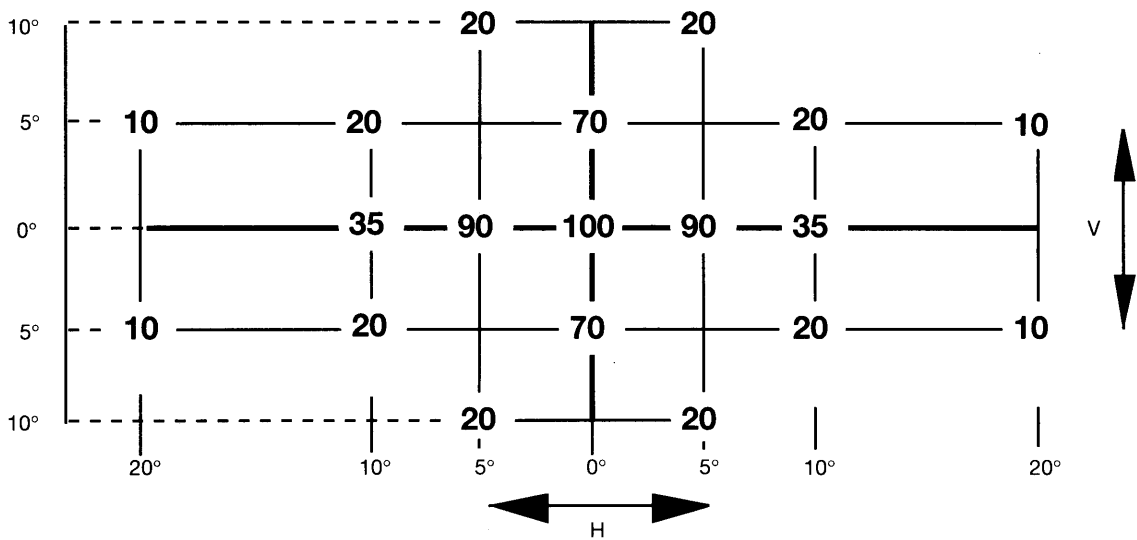
- 11.1. The lamp must be subjected to a one-hour test of continuous operation following a warm-up period of 20 minutes. The ambient temperature shall be $23^{\circ}\text{C} \pm 5^{\circ}$. The filament lamp used shall be a filament lamp of the category specified for the lamp, and shall be supplied with 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 paragraph 10.2. of this Regulation.
- 11.2. Where only the maximum power is specified, the test shall be carried out by regulating the voltage to obtain a power equal to 90 % 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 paragraph 10.2. of this Regulation shall be applied.
- 11.3. 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 according to paragraph 7 above shall be measured. At that measurement the values shall reach at least 90 % of the values obtained before the heat resistance test on the same device.

ANNEX 3

Photometric measurements

- 1. When photometric measurements are taken, stray reflections shall be avoided by appropriate masking.
- 2. In the event that the results of measurements are challenged, measurements shall be taken in such a way as to meet the following requirements:
 - 2.1. the distance of measurement shall be such that the law of the inverse of the square of the distance is applicable:
 - 2.2. the measuring equipment shall be such that the angle subtended by the receiver from the reference centre of the light is between 10' and 1°:
 - 2.3. the intensity requirement for a particular direction of observation shall be satisfied if the required intensity is obtained in a direction deviating by not more than one-quarter of a degree from the direction of observation.

3. TABLE OF STANDARD LIGHT DISTRIBUTION



- 3.1. The direction $H = 0^\circ$ and $V = 0^\circ$ corresponds to the reference axis. (On the vehicle, it is horizontal, parallel to the median longitudinal plane of the vehicle and oriented in the required direction of visibility). It passes through the centre of reference. The values shown in the table give, for the various directions of measurement, the minimum intensities as a percentage of the minimum required in the axis for each lamp (in the direction $H = 0^\circ$ and $V = 0^\circ$).
- 3.2. Within the field of light distribution of paragraph 3 above schematically shown as a grid, the light pattern should be substantially uniform, i.e. in so far as the light intensity in each direction of a part of the field formed by the grid lines shall meet at least the lowest minimum value being shown on the grid lines surrounding the questioned direction as a percentage.

ANNEX 4

Colour of light

TRICHROMATIC COORDINATES

WHITE

Limit towards blue	$X \geq 0,310$
Limit towards yellow	$X \leq 0,500$
Limit towards green	$Y \leq 0,150 + 0,640 X$ $Y \leq 0,440$
Limit towards purple	$Y \geq 0,050 + 0,750 X$
Limit towards red	$Y \geq 0,382$

CORNER POINTS	X	Y
	0,310	0,348
	0,310	0,283
	0,443	0,382
	0,500	0,382
	0,500	0,440
	0,453	0,440

Technical requirements of Regulation No 91 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex IV, item 2 of Commission Directive 97/30/EC⁽¹⁾ adapting to technical progress Council Directive 76/758/EEC relating to the end-outline marker lamps, front position (side) lamps, rear position (side) lamps, stop lamps, daytime running lamps and side marker lamps for motor vehicles and their trailers

2. DEFINITIONS

- 2.1. The definitions given in Regulation No. 48 and the series of amendments in force at the time of application for type approval shall apply to this Regulation.
- 2.2. '*Side-marker lamp*' means a lamp used to indicate the presence of the vehicle when viewed from the side;
- 2.3. '*Type*,' in relation to side-marker lamps, means side-marker lamps which do not differ in such essential respects as:
- 2.3.1. the trade name or mark;
- 2.3.2. the characteristics of the optical system (level of intensity, light distribution angles, type of filament lamp, etc.).

6. GENERAL SPECIFICATIONS

- 6.1. Each side-marker lamp submitted for approval shall conform to the specifications set out in paragraphs 7 and 8 of this Regulation.
- 6.2. Side-marker lamps shall be so designed and made that, in normal use, despite the vibrations to which they may then be subjected, their satisfactory operation continues to be ensured and they retain the characteristics prescribed by this Regulation.

7. INTENSITY OF LIGHT EMITTED

- 7.1. The intensity of the light emitted by each of the two samples submitted shall be:

Side-marker lamp category		SM1	SM2
7.1.1. Minimum intensity	In the axis of reference	4,0 cd	0,6 cd
	Within the specified angular field, other than above	0,6 cd	0,6 cd
7.1.2. Maximum intensity		25,0 cd	25,0 cd
7.1.3. Angular field	Horizontal	±45 deg.	±30 deg.
	Vertical	±10 deg.	±10 deg.

- 7.1.4. In the case of a lamp containing more than one light source:

the lamp shall comply with the minimum intensity required when any one light source has failed;
when all light sources are illuminated the maximum intensity specified may not be exceeded.

- 7.2. Outside the reference axis and within the angular fields defined in the diagrams in annex 1 to this Regulation, the intensity of the light emitted by each of the two side-marker lamps supplied must:

- 7.2.1. In each direction corresponding to the points in the light distribution table reproduced in annex 4 to this Regulation, be not less than the product of the minimum specified in paragraph 7.1 above by the percentage specified in the said table for the direction in question;

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 25.

- 7.2.2. In no direction within the space from which the side-marker lamp is visible, exceed the maximum specified in paragraph 7.1 above;
- 7.2.3. The provisions of paragraph 2.2 of annex 4 to this Regulation on local variations of intensity must be observed.
- 7.3. Annex 4, to which reference is made in paragraph 7.2.1 above, gives particulars of the measurement methods to be used.

8. COLOUR OF LIGHT EMITTED

- 8.1. The side-marker lamp must emit amber light; however it can emit red, if the rearmost side-marker lamp 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 with or has part of the light emitting surface in common with the rear retro-reflector.
- 8.2. The colour of the light emitted must be within the limits of the trichromatic coordinates prescribed for the colour in question in annex 5 to this Regulation.

9. TEST PROCEDURE

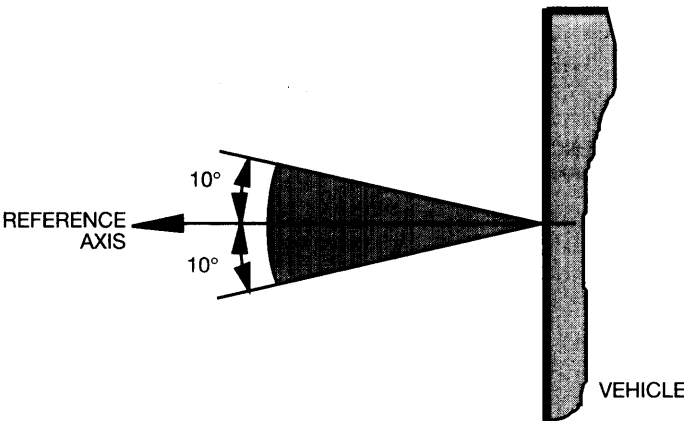
- 9.1. Measurements shall be carried out with a colourless standard filament lamp of the type recommended for the side-marker lamp and so regulated as to produce the reference luminous flux prescribed for this type of lamp, taking into account the provisions of paragraph 9.2 below.
- 9.2. All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.75 V, 13.5 V or 28.0 V respectively.

In the case of light sources supplied by a special power supply, the above test voltages shall be applied to the input terminals of that power supply. The test laboratory may require from the manufacturer the special power supply needed to supply the light sources.

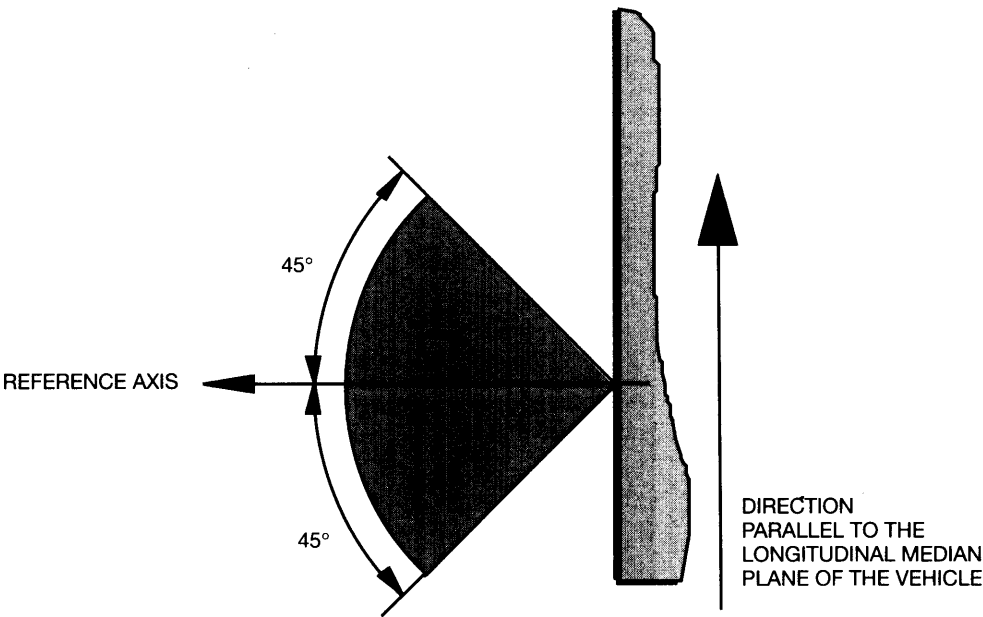
ANNEX 1

Minimum angles required for light distribution in space

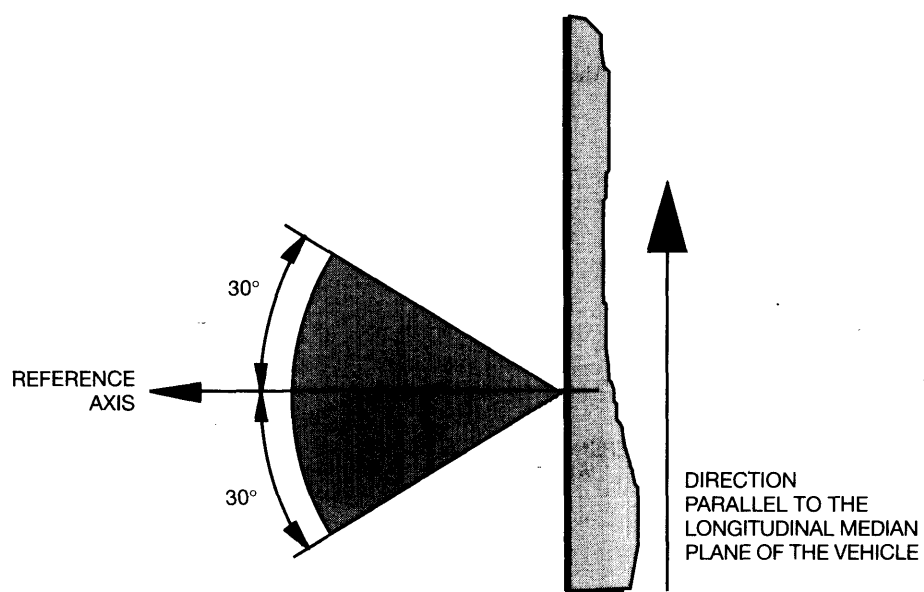
Minimum vertical angles, SM1 and SM2:



Minimum horizontal angles, SM1:



Minimum horizontal angles, SM2:



ANNEX 4

Photometric measurements

1. MEASUREMENT METHODS
- 1.1. During photometric measurement stray reflections shall be avoided by appropriate marking.

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:

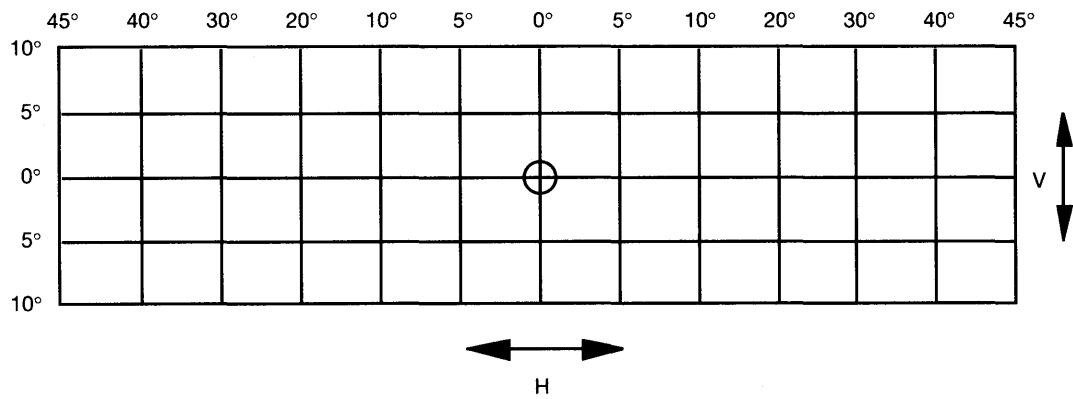
1.2.1. The distance of measurement shall be such that the law of the inverse of the square of the distance is applicable;

1.2.2. The measuring equipment shall be such that the angular aperture of the receiver viewed from the reference centre of the lamp is comprised between 10 minutes 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.

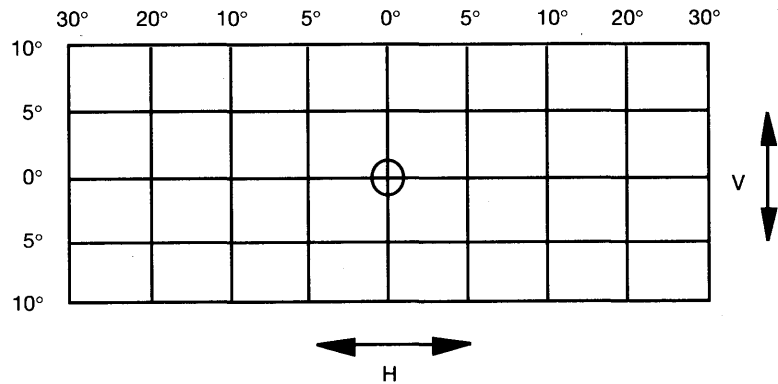
1.3. The direction $H = 0^\circ$ and $V = 0^\circ$ corresponds to the reference axis. (On the vehicle it is horizontal, perpendicular to the median longitudinal plane of the vehicle and oriented in the required direction of visibility.) It passes through the centre of reference.
2. TABLES OF LIGHT DISTRIBUTION

2.1. SM1 category of side-marker lamps



- 2.1.1. Minimum values:
0.6 cd at any point other than the reference axis, at which it shall be 4.0 cd.

2.1.2. Maximum values:
25.0 cd at any point
- 2.2. SM2 category of side-marker lamps



2.2.1. Minimum values:

0.6 cd, at any point

2.2.2. Maximum values:

25.0 cd, at any point

2.3. For SM1 and SM2 category of side-marker lamps it may be sufficient to check only five points selected by the test authority.

2.4. Within the field of light distribution shown above as a grid the light pattern should be substantially uniform, i.e. the light intensity in every direction within a part of the field formed by the grid lines shall meet at least the lowest minimum value applicable to the respective grid lines.

3. PHOTOMETRIC MEASUREMENT OF LAMPS EQUIPPED WITH SEVERAL LIGHT SOURCES

The photometric performance shall be checked:

3.1. For non-replaceable light sources (filament lamps and other):

with the light sources present in the lamp, in accordance with paragraph 9.2. of this Regulation;

3.2. For replaceable filament lamps:

When equipped with mass production filament lamps at 13.5 V or 28 V, the luminous intensity values produced shall lie between the maximum limit given in this Regulation and the minimum limit of this Regulation increased according to the permissible deviation of the luminous flux permitted for the type of filament lamp chosen, as stated in Regulation No 37 for production filament lamps; 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.

ANNEX 5

Colour of light emitted: lights for trichromatic coordinates

Amber	limit towards yellow	$y \leq 0,429$
	limit towards red	$y \geq 0,398$
	limit towards white	$z \leq 0,007$
Red	limit towards yellow	$y \leq 0,335$
	limit towards purple	$z \leq 0,008$

For checking these colorimetric characteristics, a source of light at a colour temperature of 2,856 K, corresponding to illuminant A of the International Commission on Illumination (CIE), shall be used. However, for lamps equipped with non-replaceable light sources (filament lamps and other), the colorimetric characteristics should be verified with the light sources present in the lamp, in accordance with paragraph 9.2. of this Regulation.

Technical requirements of Regulation No 4 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex II, item 2.1 of Commission Directive 97/31/EC⁽¹⁾ adapting to technical progress Council Directive 76/760/EEC relating to the rear registration plate lamps for motor vehicles and their trailers

1. DEFINITION

For the purpose of this Regulation

- 1.1. '*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.
- 1.2. The definitions given in Regulation No. 48 and its series of amendments in force at the time of application for type approval shall apply to this Regulation.

5. GENERAL SPECIFICATIONS

- 5.1. Each sample shall conform to the lighting specifications of paragraph 9.

Illuminating devices must be so designed that the entire surface to be illuminated is visible from the rear within the field of vision indicated in the drawing in annex 4.

- 5.2. All measurements shall be carried out by adjusting the lamp or lamps of the illuminating device to the minimum light flux prescribed for the test voltage in the specification of the lamp or lamps for the device.
- 5.2.1. All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.75 V, 13.5 V or 28.0 V respectively.

In the case of light sources supplied by a special power supply, the above test voltages shall be applied to the input terminals of that power supply. The test laboratory may require from the manufacturer the special power needed to supply the light sources.

6. COLOUR OF LIGHT

The light of the lamp used in the illuminating device must be sufficiently colourless not to cause any appreciable change in the colour of the registration plate.

7. ANGLE OF INCIDENCE

The manufacturer of the illuminating device shall specify the position in which the device is to be fitted in relation to the space for the registration plate; the device must be so placed that the angle of incidence of the light on the surface of the plate does not exceed 82° at any point on the surface to be illuminated, this angle being measured from the extremity of the device's illuminating area which is furthest from the surface of the plate. If there is more than one illuminating device, the foregoing requirement shall apply only to that part of the plate intended to be illuminated by the device concerned.

The device must be so designed that no light is emitted directly towards the rear, with the exception of red light if the device is combined or grouped with a rear lamp.

8. MEASURING PROCEDURE

Luminance measurements shall be made on a piece of clean white blotting paper with a minimum diffuse reflection factor of 70 per cent, of the same dimensions as the registration plate, placed in the position normally occupied by it and 2 mm in front of its holder.

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 49.

Luminance measurements shall be made perpendicularly to the surface of the paper, at the points shown in annex 3 according to the type of plate for which the device is intended, each point representing a circular area 25 mm in diameter.

9. PHOTOMETRIC CHARACTERISTICS

At each of the points of measurement shown in annex 3, the luminance B shall be at least equal to 2.5 cd/m².

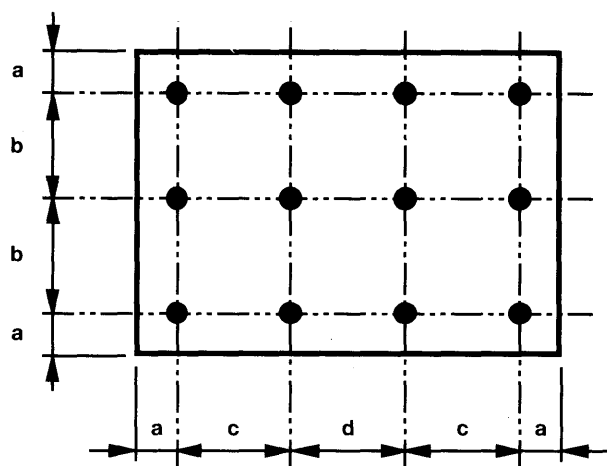
The gradient of the luminance between the values B₁ and B₂, measured at any two points 1 and 2 selected from among those mentioned above, shall not exceed 2 × B₀/cm, B₀ being the minimum luminance measured at the various points, that is to say

$$\frac{B_2 - B_1}{\text{distance 1-2 in cm}} \leq 2 \times B_0/\text{cm}$$

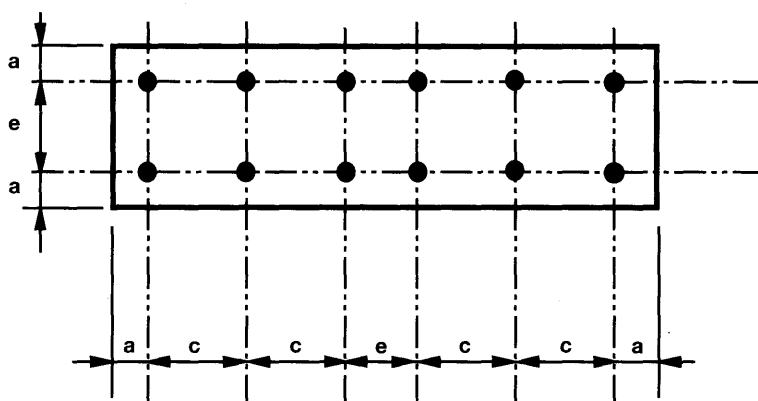
ANNEX 3

Measurement points for test purposes

(a) devices for illuminating a tall plate (340 × 240 mm)



(b) devices for illuminating a wide plate (520 × 120 mm)

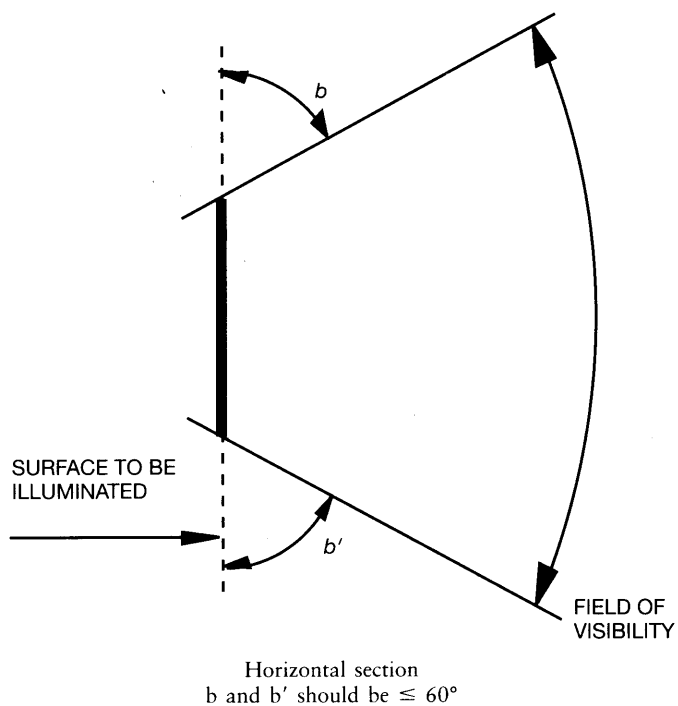
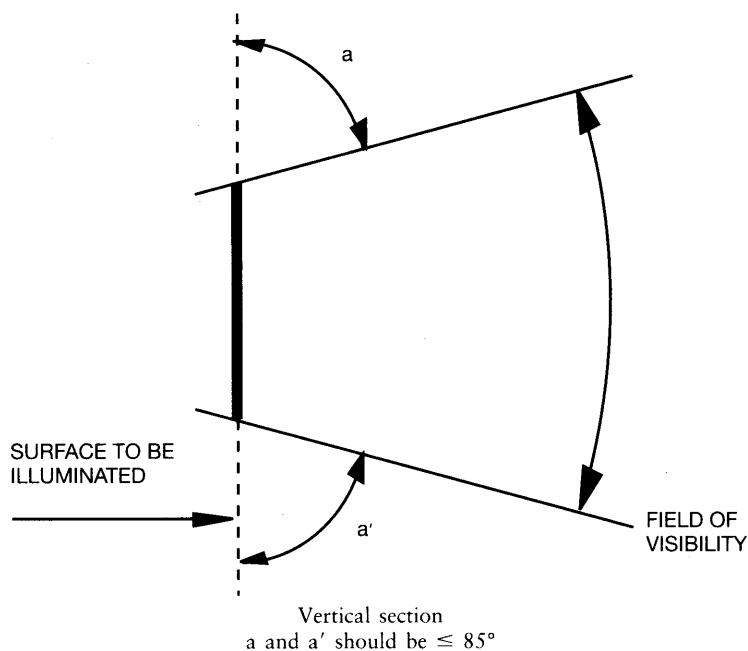


$a = 25 \text{ mm}$ $b = 95 \text{ mm}$ $c = 100 \text{ mm}$ $d = 90 \text{ mm}$ $e = 70 \text{ mm}$

Note: In the case of devices for illuminating both tall and wide plates the measurement points used are obtained by combining the two drawings above in accordance with the outline indicated by the maker of manufacturer; however, if the two measurement points are less than 30 mm apart, only one shall be used.

ANNEX 4

Minimum field of visibility of the surface to be illuminated



1. The field-of-visibility angles shown above relate only to the relative positions of the illuminating device and the space for the registration plate.
2. The field of visibility of the registration plate when mounted on the vehicle remains subject to the relevant national regulations.
3. The angles shown take account of the partial occultation caused by the illuminating device. They must be adhered to in the directions in which there is most occultation. The illuminating devices must be such as to reduce the areas partly occulted to the minimum strictly necessary.

ANNEX 5

Photometric measurement of lamps equipped with several light sources

1. The photometric performance shall be checked:

1.1. For non-replaceable light sources (filament lamps and other):

with the light sources present in the lamp, in accordance with paragraph 5.2.1. of this Regulation;

1.2. For replaceable filament lamps:

when equipped with mass production filament lamps at 6.75 V, 13.5 V or 28.0 V, the luminous intensity values produced shall lie between the maximum limit given in this Regulation and the minimum limit of this Regulation increased according to the permissible deviation of the luminous flux permitted for the type of filament lamp chosen, as stated in Regulation No. 37 for production filament lamps; alternatively a standard filament lamp may be used in turn, in each of the individual position, operated at its reference flux, the individual measurements in each position being added together.

Technical requirements of Regulation No 23 of the United Nations' Economic Commission for Europe referred to in Article 3 and in Annex II, item 2.1 of Commission Directive 97/32/EC⁽¹⁾ adapting to technical progress Council Directive 77/539/EEC relating to reversing lamps for motor vehicles and their trailers

1. DEFINITIONS

For the purposes of this Regulation,

- 1.1. '*reversing lamp*' means the lamp of the vehicle designed 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;
- 1.2. The definitions given in Regulation No 48 and its series of amendments in force at the time of application for type approval shall apply to this Regulation;
- 1.3. reversing lamps of different '*types*' are reversing lamps which differ in such essential respects as,
 - 1.3.1. the trade name or mark;
 - 1.3.2. the characteristics of the optical system;
 - 1.3.3. the inclusion of components capable of altering the optical effects by reflection, refraction or absorption; and
 - 1.3.4. the category of filament lamp.

5. GENERAL SPECIFICATIONS

- 5.1. Each sample shall conform to the specifications set forth in the paragraphs below.
- 5.2. Reversing lamps shall be so designed and constructed that in normal use, despite the vibration to which they may then be subjected, they continue to function satisfactorily and retain the characteristics prescribed by this Regulation.

6. INTENSITY OF LIGHT EMITTED

- 6.1. The intensity of the light emitted by each of the two samples shall be not less than the minima and not greater than the maxima specified below and shall be measured in relation to the axis of reference in the directions shown below (expressed in degrees of angle with the axis of reference).
- 6.2. The intensity along the axis of reference shall be not less than 80 candelas.
- 6.3. The intensity of the light emitted in all directions in which the light can be observed shall not exceed
300 candelas in directions in or above the horizontal plane; or
600 candelas in directions below the horizontal plane.
- 6.4. In every other direction of measurement shown in annex 3 to this Regulation the luminous intensity shall be not less than the minima specified in that annex.

However, in the case where the reversing lamp is intended to be installed on a vehicle exclusively in a pair of devices, the photometric intensity may be verified only up to an angle of 30° inwards where a photometric value of at least 25 cd shall be satisfied.

⁽¹⁾ OJ No L 171, 30. 6. 1997, p. 63.

This condition shall be clearly explained in the application for approval and relating documents (see paragraph 2 of this Regulation).

Moreover, in the case where the type approval will be granted applying the condition above, a statement in paragraph 11 'Comments' of the communication form (see annex 1 to this Regulation), will inform that the device shall only be installed in a pair.

- 6.5. In the case of a single lamp containing more than one light source, the lamp shall comply with the minimum intensity required when any one light source has failed and when all light sources are illuminated the maximum intensities shall not be exceeded.

7. TEST PROCEDURE

- 7.1. All measurements shall be carried out with uncoloured standard filament lamps of the types prescribed for the device, adjusted to produce the normal luminous flux prescribed for those types of filament lamps.

- 7.1.1. All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6.75 V, 13.5 V or 28.0 V respectively.

In the case of light sources supplied by a special power supply, the above test voltages shall be applied to the input terminals of that power supply. The test laboratory may require from the manufacturer the special power supply needed to supply the light sources.

8. COLOUR OF LIGHT EMITTED

The colour of the light emitted shall be white. In case of doubt, the colour may be checked on the basis of the definition of the colour of white light given in annex 4 to this Regulation.

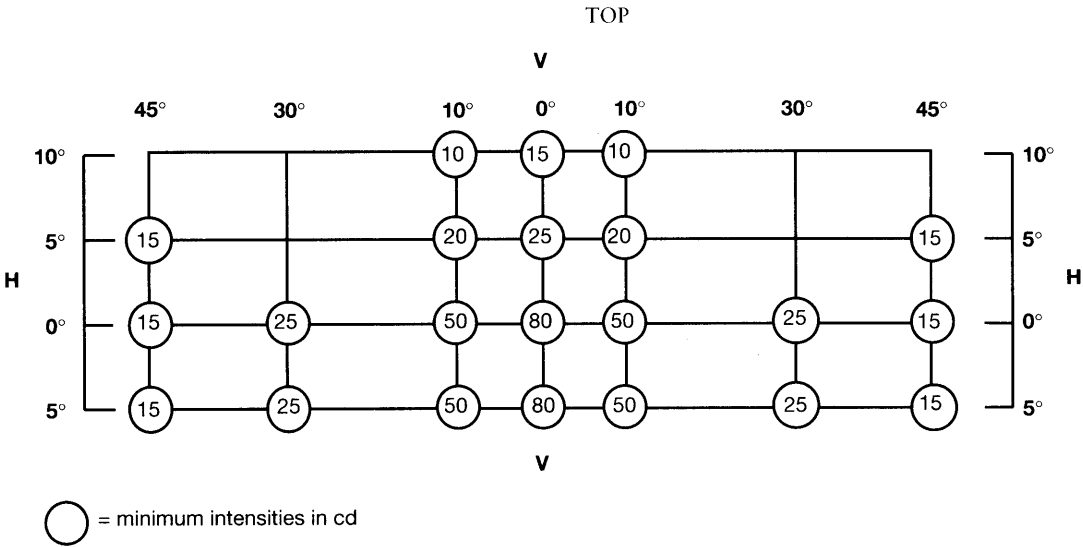
ANNEX 3

Photometric measurements

1. MEASUREMENT METHODS

- 1.1. When photometric measurements are taken, stray reflections shall be avoided by appropriate masking.
- 1.2. In the event that the results of measurements are challenged, measurements shall be taken 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 angle subtended by the receiver from the reference centre of the light is between 10° and 1°;
 - 1.2.3. the intensity requirement for a particular direction of observation shall be satisfied if the required intensity is obtained in a direction deviating by not more than one quarter of a degree from the direction of observation.

2. MEASURING POINTS EXPRESSED IN DEGREES OF ANGLE WITH THE AXIS OF REFERENCE AND VALUES OF THE MINIMUM INTENSITIES OF THE LIGHT EMITTED



- 2.1. The directions H = 0° and V = 0° correspond to the axis of reference. On the vehicle they are horizontal, parallel to the median longitudinal plane of the vehicle and oriented in the required direction of visibility. They pass through the centre of reference. The values shown in the table give, for the various directions of measurement, the minimum intensities in cd.
- 2.2. If visual examination of a lamp appears to reveal substantial local variations of intensity, a check shall be made to ensure that no intensity measured between two of the directions of measurement referred to above is below 50 % of the lower minimum intensity of the two prescribed for these directions of measurement.

3. PHOTOMETRIC MEASUREMENT OF LAMPS EQUIPPED WITH SEVERAL LIGHT SOURCES

The photometric performance shall be checked:

- 3.1. For non-replaceable light sources (filament lamps and other): with the light sources present in the lamp, in accordance with paragraph 7.1.1. of this Regulation.
- 3.2. For replaceable filament lamps:

when equipped with mass production filament lamps at 6.75 V, 13.5 V or 28.0 V the luminous intensity values produced shall lie between the maximum limit given in this Regulation and the minimum limit of this Regulation increased according to the permissible deviation of the luminous flux permitted for the type of filament lamp chosen, as stated in Regulation No 37 for production filament lamps; 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.

ANNEX 4

COLOUR OF WHITE LIGHT

(Trichromatic coordinates)

Limit towards blue	$x \geq 0,310$
Limit towards yellow	$x \leq 0,500$
Limit towards green	$y \leq 0,150 + 0,640x$
Limit towards green	$y \leq 0,440$
Limit towards purple	$y \geq 0,050 + 0,750x$
Limit towards red	$y \geq 0,382$

For checking these colorimetric characteristics, a source of light at a colour temperature of 2,854°K corresponding to illuminant A of the International Commission on Illumination (ICI) shall be used.

However, for lamps equipped with non-replaceable light sources (filament lamps and other), the colorimetric characteristics should be verified with the light sources present in the lamp, in accordance with paragraph 7.1.1. of this Regulation.
