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Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.

II

*(Non-legislative acts)***ACTS ADOPTED BY BODIES CREATED BY
INTERNATIONAL AGREEMENTS**

Only the original UN/ECE texts have legal effect under international public law. The status and date of entry into force of this Regulation should be checked in the latest version of the UN/ECE status document TRANS/WP.29/343, available at:

<http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29fdocsts.html>

**Regulation No 58 of the Economic Commission for Europe of the United Nations (UN/ECE) —
Uniform provisions concerning the approval of:****I. Rear underrun protective devices (RUPDs)****II. Vehicles with regard to the installation of an RUPD of an approved type****III. Vehicles with regard to their rear underrun protection (RUP) [2019/272]**

Incorporating all valid text up to:

03 series of amendments to the Regulation – Date of entry into force: 18 June 2016

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1. SCOPE

1.1. This Regulation applies to:

- 1.1.1. PART I: the RUPDs which are intended to be fitted to vehicles of categories M, N and O ⁽¹⁾;
- 1.1.2. PART II: the installation on vehicles of categories M, N and O ⁽¹⁾ of RUPDs which have been type approved to Part I of this Regulation;
- 1.1.3. PART III: vehicles of categories M, N and O ⁽¹⁾ equipped with an RUPD which has not been separately approved according to Part I of this Regulation or so designed and/or equipped that its component parts can be regarded as totally or partially fulfilling the function of the RUPD;
- 1.1.4. Vehicles of categories M₁, M₂, M₃, N₁, O₁ and O₂ ⁽¹⁾ on grounds of rear underrun protection.

⁽¹⁾ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.6, para. 2 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

- 1.2. This Regulation does not apply to:
 - 1.2.1. Tractive units for articulated vehicles;
 - 1.2.2. Trailers specially designed and constructed for the carriage of very long loads of indivisible length, such as timber, steel bars, etc.;
- 1.3. Vehicles where any RUPD (e.g. fixed, removable, foldable, adjustable, etc.) is incompatible with their use on traffic roads may be partly or fully exempted from this Regulation, subject to the decision of the Type Approval Authority.

2. GENERAL REQUIREMENTS

- 2.1. All vehicles shall be so constructed and/or equipped as to offer effective protection over their whole width against under-running of vehicles mentioned in paragraph 1 of this Regulation in the event of rear collision with vehicles of category M₁ and N₁ ⁽²⁾.
- 2.2. The vehicle shall be tested under the conditions as laid down in paragraph 2 of Annex 5.
- 2.3. Any vehicle in one of the categories M₁, M₂, M₃, N₁, O₁ or O₂ shall be deemed to satisfy the condition set out above:
 - (a) If it satisfies the same conditions as set out in Part II or Part III, or
 - (b) If the ground clearance of the rear part of the unladen vehicle does not exceed 550 mm over a width which is not shorter than that of the rear axle by more than 100 mm on either side (excluding any tyre bulging close to the ground), or
 - (c) If, in case of vehicles of categories O₁ and O₂ where the tyres project for more than half of their width outside the bodywork (excluding the wheel guards) or outside the chassis in the absence of bodywork, the ground clearance of the rear part of the unladen vehicle does not exceed 550 mm over a width which is not less than 100 mm deducted from the distance measured between the innermost points of the tyres (excluding any tyre bulging close to the ground), on either side.

Where there is more than one rear axle, the width to be considered is that of the widest.

The requirements of paragraphs 2.3(b) and 2.3(c) above shall be satisfied at least on a line:

- (a) At a distance of not more than 450 mm from the rear extremity of the vehicle;
 - (b) That may have interruptions totalling not more than 200 mm.
- 2.4. Any vehicle of category G will be deemed to satisfy the condition for the ground clearance set out above, if the departure angle (ISO 612:1978) does not exceed:
 - (a) 10° for vehicles of categories M₁G and N₁G;
 - (b) 20° for vehicles of categories M₂G and N₂G; and
 - (c) 25° for vehicles of categories M₃G and N₃G;

over a width which is not shorter than that of the rear axle by more than 100 mm on either side (excluding any bulging of the tyres close to the ground).

Where there is more than one rear axle, the width to be considered is that of the widest. The requirements of subparagraphs (a) to (c) of this paragraph shall be satisfied at least on a line:

- (a) At a distance of not more than 450 mm from the rear extremity of the vehicle;
- (b) That may have interruptions summing up in not more than 200 mm.

3. DEFINITIONS COMMON TO PARTS I, II AND III

- 3.1. For the purpose of this Regulation:
 - 3.1.1. 'Unladen mass' means the mass of the vehicle in running order, unoccupied and unladen but complete with fuel, coolant, lubricant, tools and a spare wheel (if provided as standard equipment by the vehicle manufacturer);
 - 3.1.2. 'Maximum mass' means the mass stated by the vehicle manufacturer to be technically permissible (this mass may be higher than the 'permissible maximum mass' laid down by the national administration);

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

- 3.1.3. An 'RUPD' normally consists of a cross-member and links to the chassis side members or other structural members of the vehicle;
- 3.1.4. 'Separate cab' means a cab attached to the vehicle's frame by specific links and which has no common part with the cargo area.

PART I. APPROVAL OF RUPDs

4. DEFINITIONS

- 4.1. For the purpose of Part I of this Regulation:
 - 4.1.1. 'Approval of an RUPD' means the approval of such a type of RUPD with respect to the requirements laid down in paragraph 7. below;
 - 4.1.2. 'Type of RUPD' means RUPDs which do not differ with respect to the essential characteristics such as shape, dimensions, attachment, materials and the markings cited in paragraph 5.2.2 below.

5. APPLICATION OF APPROVAL

- 5.1. The application for approval of an RUPD shall be submitted by the manufacturer of the RUPD or by his duly accredited representative.
- 5.2. For each type of RUPD the application shall be accompanied by:
 - 5.2.1. Documentation in triplicate giving a description of the technical characteristics of the RUPD: its dimensions, lines and constituent materials and the method of its installation;
 - 5.2.2. A sample of the type of RUPD: the sample shall be clearly and indelibly marked on all its main components with the applicant's trade name or mark and the type designation.
- 5.3. An RUPD representative of the type to be approved shall be submitted to the Technical Service responsible for conducting the approval tests.
- 5.4. The Type Approval Authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted.

6. APPROVAL

- 6.1. If the RUPD submitted for approval pursuant to this Regulation meets the requirements of paragraph 7 below, approval of that type of RUPD shall be granted.
- 6.2. An approval number shall be assigned to each type approved. Its first two digits (at present 03 corresponding to the 03 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another type of rear underrun protective device.
- 6.3. Notice of approval, or of extension or of refusal of approval of a type of RUPD pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement which apply this Regulation, by means of a form conforming to the model in Annex 1 to this Regulation.
- 6.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every RUPD conforming to a type of RUPD approved under this Regulation an international approval mark consisting of:
 - 6.4.1. A circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval ⁽³⁾;
 - 6.4.2. The number of this Regulation, followed by the letter 'R', a dash and the approval number to the right of the circle prescribed in paragraph 6.4.1.
- 6.5. The approval mark shall be clearly legible and be indelible.
- 6.6. Annex 4 to this Regulation gives examples of arrangements of approval marks.

⁽³⁾ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 6, Annex 3 - www.unece.org/trans/main/wp29/wgs/wp29gen/wp29resolutions.html

7. REQUIREMENTS

- 7.1. The cross-member shall have a section height of at least 120 mm. The lateral extremities of the cross member shall not bend to the rear or have a sharp outer edge; this condition is fulfilled when the lateral extremities of the cross-member are rounded on the outside and have a radius of curvature of not less than 2,5 mm.

RUPD intended to be fitted on vehicles of categories M, N₁, N₂ with a maximum mass not exceeding 8 t, O₁, O₂, on vehicles of category G and on vehicles fitted with a platform lift, the cross-member shall have a section height of at least 100 mm.

- 7.2. The RUPD may be so designed to have several positions at the rear of the vehicle. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded. The force applied by the operator to vary the position of the device shall not exceed 40 daN.

For RUPD that are designed to have several positions at the rear of the vehicle, a label shall be provided either with (a) symbol(s) or in the language(s) of the country where the device is sold to inform the operator about the standard position of the RUPD to offer effective protection against under-running.

Label minimum size: 60 × 120 mm

- 7.3. The RUPD shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle. (This shall be demonstrated in accordance with the test procedure and test conditions specified in Annex 5 to this Regulation.) The maximum horizontal deflection of the RUPD observed during and after the application of the test forces specified in Annex 5 shall be recorded on the type approval communication (Annex 1, item 8).
- 7.4. For vehicles fitted with a platform lift at the rear, the underrun device may be interrupted for the purposes of the mechanism. In this case, the following special requirements apply:
- 7.4.1. The maximum lateral clearance measured between the elements of the underrun device and the elements of the platform lift, which move through the interruption when the lift is operated and which make the interruption necessary, may amount to no more than 2,5 cm.
- 7.4.2. The individual elements of the underrun protection, including those outboard of the lift mechanism, where provided, shall have an effective surface area, in each case, of at least 420 cm².
- 7.4.3. For cross-members with a section height of less than 120 mm, the individual elements of the underrun protection, including those outboard of the lift mechanism, where provided, shall have an effective surface area, in each case, of at least 350 cm².
- 7.4.4. In the case of vehicles having a width of less than 2 000 mm and where it is impossible to achieve the requirements of paragraphs 7.4.2 and 7.4.3, the effective surface may be reduced on the condition that the resistance criteria are met.

8. CONFORMITY OF PRODUCTION

The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3), with the following requirements:

- 8.1. Every rear underrun protective device approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set out in paragraph 7 above.
- 8.2. The Type Approval Authority that has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be one every two years.

9. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

- 9.1. The approval granted in respect of a type of RUPD pursuant to this Regulation may be withdrawn if the requirements set forth above are not met or if the protective device has failed to pass the test prescribed in Annex 5.
- 9.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 1 to this Regulation.

10. MODIFICATION AND EXTENSION OF APPROVAL OF AN RUPD TYPE

- 10.1. Every modification of the RUPD type shall be notified to the Type Approval Authority which approved the RUPD type. The Type Approval Authority may then either:
- 10.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the RUPD still complies with the requirements; or
- 10.1.2. Require a further test report from the Technical Service responsible for conducting the tests.
- 10.2. Confirmation or refusal of approval, specifying the alterations shall be communicated by the procedure specified in paragraph 6.3 above to the Parties to the Agreement applying this Regulation.
- 10.3. The Type Approval Authority issuing the extension of approval shall assign a series number of such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

11. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a type of rear underrun protective device approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval. Upon receiving the relevant communication that Authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

12. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF TYPE APPROVAL AUTHORITIES

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

PART II. APPROVAL OF A VEHICLE WITH REGARD TO THE INSTALLATION OF AN RUPD OF AN APPROVED TYPE

13. DEFINITIONS

13.1. For the purposes of Part II of this Regulation:

- 13.1.1. 'Approval of a vehicle' means the approval of a vehicle type with regard to the installation of an RUPD of an approved type according to Part I of this Regulation;

- 13.1.2. 'Vehicle type' means vehicles which do not differ in such essential aspects as:

The width of the rear axle;

The structure, the dimensions, the shape and the height from the ground of the rear part of the vehicle and the characteristics of the suspension, in so far as they have a bearing on the requirements specified in paragraph 19. of this Regulation;

The approved RUPDs fitted to the vehicle.

- 13.2. Other definitions applicable to this Part II are contained in paragraph 3 of this Regulation.

14. APPLICATION FOR APPROVAL

- 14.1. The application for approval of a vehicle type with regard to the installation of an RUPD(s) of an approved type shall be submitted by the vehicle manufacturer or by his duly accredited representative.

- 14.2. It shall be accompanied by the under-mentioned documents in triplicate and by the following particulars:
- 14.2.1. Drawings of the vehicle showing, according to the criteria referred to in paragraph 13.1.2 of this Regulation, the vehicle type in side and rear elevation with the indication of the position of the approved RUPD(s) and design details of its (their) fixing elements to the chassis of the vehicle;
- 14.2.2. The maximum mass of the vehicle;
- 14.2.3. A list of the RUPDs intended to be fitted to the vehicle;
- 14.2.4. At the request of the Type Approval Authority the type approval communication form (i.e. Annex 1 of this Regulation) of each RUPD shall also be supplied.
- 14.3. A vehicle representative of the type to be approved and fitted with an approved RUPD shall be submitted to the Technical Service responsible for conducting the approval tests.
- 14.3.1. A vehicle not comprising all the components proper to the type may be accepted for test provided that it can be shown by the applicant to the satisfaction of the Type Approval Authority that the absence of the components omitted has no effect on the results of the verifications, so far as the requirements of this Regulation are concerned.
- 14.4. The Type Approval Authority shall verify the existence of satisfactory arrangements for ensuring effective checks on conformity of production before type approval is granted.
15. APPROVAL
- 15.1. If the vehicle submitted for approval pursuant to this Regulation is provided with an approved RUPD and meets the requirements of paragraph 16 below and has been tested following the conditions set out in paragraph 2.2, approval of that vehicle type shall be granted.
- 15.2. An approval number shall be assigned to each type approved. Its first two digits (at present 03 corresponding to the 03 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another vehicle type.
- 15.3. Notice of approval or of extension or of refusal of approval of a vehicle type pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement which apply this Regulation, by means of a form conforming to the model in Annex 2 to this Regulation.
- 15.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation an international approval mark consisting of:
- 15.4.1. A circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval ⁽⁴⁾;
- 15.4.2. The number of this Regulation, followed by the letter 'R', a dash and the approval number to the right of the circle prescribed in paragraph 15.4.1.
- 15.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 15.4.1 need not be repeated; in such a case the Regulation and approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 15.4.1.
- 15.6. The approval mark shall be clearly legible and be indelible.
- 15.7. The approval mark shall be placed close to or on the vehicle data plate affixed by the manufacturer.
- 15.8. Annex 4 to this Regulation gives examples of arrangements of approval marks.

⁽⁴⁾ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 6, Annex 3 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

16. REQUIREMENTS FOR INSTALLATION OF AN APPROVED RUPD

16.1. For vehicles of the categories N_2 with a maximum mass exceeding 8 t, N_3 , O_3 and O_4 , the ground clearance with respect to the underside of the protective device, even when the vehicle is unladen, shall not exceed:

- (a) 450 mm for motor vehicles and trailers with hydropneumatic, hydraulic or pneumatic suspension or a device for automatic levelling according to load. In any case, a departure angle up to 8° according to ISO 612:1978 with a maximum ground clearance of 550 mm shall be deemed to satisfy the requirements.
- (b) 500 mm or a departure angle according to ISO 612:1978 of 8° , whichever is less, for vehicles other than those in (a) above. In any case, a departure angle up to 8° according to ISO 612:1978 with a maximum ground clearance of 550 mm shall be deemed to satisfy the requirements.

This requirement applies over the entire width of the motor vehicle or trailer and shall be such that the height above the ground of the points of application of the test forces applied to the device according to Part I of this Regulation and recorded in the type approval communication form (Annex 1, item 7) does not exceed the values in the paragraphs (a) and (b) above, increased by half the minimum section height required for the cross member of the RUPD.

The height requirement for the application of the test forces shall be adjusted to the adjusted ground clearance due to the provisions for the departure angle specified above.

16.2. For vehicles of categories M, N_1 , N_2 with a maximum mass not exceeding 8 t, O_1 and O_2 , the ground clearance with respect to the underside of the protective device, even when the vehicle is unladen, shall not exceed 550 mm over its entire width and shall be such that the height above the ground of the points of application of the test forces applied to the device according to Part I of this Regulation and recorded in the type approval communication form (Annex 1, item 7) does not exceed 600 mm.

16.3. The width of the rear protective device shall at no point exceed the width of the rear axle measured at the outermost points of the wheels, excluding the bulging of the tyres close to the ground, nor shall RUPD be more than 100 mm shorter on either side. Where the device is contained in or comprises the vehicle bodywork which itself extends beyond the width of the rear axle, the requirement, that the width of the RUPD shall not exceed that of the rear axle, shall not apply. However, in case of vehicles of categories O_1 and O_2 where the tyres project for more than half of their width outside the bodywork (excluding the wheel guards) or outside the chassis in the absence of bodywork, the width of the RUPD shall not be less than 100 mm deducted from the distance measured between the innermost points of the tyres, excluding the bulging of the tyres close to the ground, on either side. Where there is more than one rear axle, the width to be considered is that of the widest rear axle. In addition the requirements of paragraphs 3.1.2 and 3.1.3 of Annex 5 relating the distance of the points of application of the test forces from the outer edges of the rear wheels (Annex 1, item 7) shall be verified and recorded in the type approval communication form.

16.4. For vehicles of categories M, N_1 , N_2 with a maximum mass not exceeding 8 t, O_1 and O_2 , the device shall be so fitted that the horizontal distance between the rear of the cross-member of the device and the most rearward point at the rear extremity of the vehicle, including any platform lift system, does not exceed 400 mm diminished by the largest total deformation including both plastic and elastic deformation (paragraph 7.3 of Part I) measured and recorded during the test at any of the points where the test forces are applied (Annex 1, item 8) during the type approval of the rear underrun protective device in conformity with the provisions of Part I of this Regulation and recorded in the type approval communication form. In measuring this distance, any part of the vehicle which is more than 2 m above the ground for every loading condition of the vehicle shall be excluded.

For vehicles of categories N_2 with a maximum mass exceeding 8 t, N_3 , and vehicles of categories O_3 and O_4 , equipped with a platform lift or being designed as a tipping trailer, the same requirement as above applies; however, for vehicles of these categories, the horizontal distance shall not exceed 300 mm measured to the rear of the cross-member before the test forces are applied.

For vehicles of categories O_3 and O_4 , without any platform lift system and not being designed as a tipping-trailer, the maximum horizontal distances are reduced to 200 mm before the test forces have been applied and 300 mm diminished by the largest total deformation including both plastic and elastic deformation (paragraph 7.3 of Part I) measured and recorded during the test at any of the points where the test forces are applied (Annex 1, item 8).

In any case non-structural protrusions such as tail lamps and those of less than 50 mm of size in any direction, such as rubber bumpers, resilient buffers, hinges and latches shall be excluded from the determination of the most rearward point at the rear extremity.

Before the application of the test forces, the maximum allowed horizontal distance of a single, a segmented or an inclined cross-member of an RUPD is 100 mm between the rear of the cross-member measured at the most forward point and the rear of the cross-member measured at the most rearward point, measured in the longitudinal plane of the vehicle.

- 16.5. The device shall be so fitted that after the application of the test forces specified in Annex 5 for vehicles of the categories N₂ with a maximum mass exceeding 8 t, N₃, O₃ and O₄, the maximum ground clearance of the protective device, even when the vehicle is unladen, shall at any point not exceed by more than 60 mm the value before test. For vehicles with a departure angle up to 8° (paragraph 16.1) the maximum ground clearance shall not exceed 600 mm.

- 16.6. The maximum mass of a vehicle type for which approval is requested shall not exceed the value indicated on the type approval communication form of each approved RUPD intended to be installed on that vehicle.

- 16.7. Given the provisions of paragraph 7.2 for adjustable RUPD the label shall be placed clearly and permanently visible at the driver's place or at the rear area of the vehicle next to the RUPD, at a location, which is easily visible.

17. CONFORMITY OF PRODUCTION

The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3), with the following requirements:

- 17.1. Every vehicle approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set out in paragraph 16 above.

- 17.2. The Type Approval Authority that has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be one every two years.

18. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

- 18.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements set forth above are not met.

- 18.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 2 to this Regulation.

19. MODIFICATION AND EXTENSION OF APPROVAL OF A VEHICLE TYPE

- 19.1. Every modification of the vehicle type shall be notified to the Type Approval Authority which approved the vehicle type. The Type Approval Authority may then either:

- 19.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the vehicle still complies with the requirements; or

- 19.1.2. Require a further test report from the Technical Service responsible for conducting the tests.

- 19.2. Confirmation or refusal of approval, specifying the alteration, shall be communicated by the procedure specified in paragraph 15.3 above to the Parties to the Agreement applying this Regulation.

- 19.3. The Type Approval Authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 2 to this Regulation.

20. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a type vehicle approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval. Upon receiving the relevant communication, that Authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 2 to this Regulation.

21. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF TYPE APPROVAL AUTHORITIES

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

**PART III. APPROVAL OF A VEHICLE WITH REGARD TO ITS REAR UNDERRUN PROTECTION
(RUP)**

22. DEFINITIONS

22.1. For the purposes of Part III of this Regulation:

22.1.1. 'Approval of a vehicle' means the approval of a vehicle type with regard to its RUP;

22.1.2. 'Vehicle type' means a category of vehicles which do not differ with respect to the essential points as the width of the rear axle, the structure, the dimensions, the shape and the materials of the rear part of the vehicle, the characteristics of the suspension in so far as they have a bearing on the requirements specified in paragraph 25 of this Regulation;

22.1.3. 'Rear underrun protection (RUP)' means the presence at the rear of the vehicle of either:

22.1.3.1. A special RUPD; or

22.1.3.2. Body work, chassis parts or other components, such that, by virtue of their shape and characteristics, these elements can be regarded as totally or partially fulfilling the function of the RUPD.

22.2. Other definitions applicable to this Part III are contained in paragraph 3 of this Regulation.

23. APPLICATION FOR APPROVAL

23.1. The application for approval of a vehicle type with regard to the protection afforded by the RUP shall be submitted by the vehicle manufacturer or by his duly accredited representative.

23.2. It shall be accompanied by the under-mentioned documents in triplicate and by the following particulars:

23.2.1. A detailed description of the vehicle type with respect to its structure, dimensions, lines and constituent materials in so far as required for the purpose of this Regulation;

23.2.2. Drawings of the vehicle showing the vehicle type in side and rear elevation and design details of the rear parts of the structure;

23.2.3. The maximum mass of the vehicle;

23.2.4. A detailed description of the RUP: its dimensions, lines, constituent materials and position on the vehicle.

23.3. A vehicle representative of the type to be approved shall be submitted to the Technical Service responsible for conducting the approval tests.

23.3.1. A vehicle not comprising all the components proper to the type may be accepted for test provided that it can be shown by the applicant to the satisfaction of the Type Approval Authority that the absence of the components omitted has no effect on the results of the verification, so far as the requirements of this Regulation are concerned.

23.4. The Type Approval Authority shall verify the existence of satisfactory arrangements for ensuring effective checks on conformity of production before type approval is granted.

24. APPROVAL

24.1. If the vehicle submitted for approval pursuant to this Regulation meets the requirements of paragraph 2.3(b) or paragraph 2.3(c) or paragraph 25 and has been tested following the conditions set out in paragraph 2.2, approval of that vehicle type shall be granted.

24.2. An approval number shall be assigned to each type approved. Its first two digits (at present 03 corresponding to the 03 series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another vehicle type.

24.3. Notice of approval or of extension or of refusal of approval of a vehicle type pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement which apply this Regulation, by means of a form conforming to the model in Annex 3 to this Regulation.

- 24.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation an international approval mark consisting of:
- 24.4.1. A circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval ⁽⁹⁾;
- 24.4.2. The number of this Regulation, followed by the letter 'R', a dash and the approval number to the right of the circle prescribed in paragraph 24.4.1.
- 24.5. If the vehicle conforms to a vehicle type approved, under one or more other Regulations annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 24.4.1 need not be repeated; in such a case the Regulation and approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 24.4.1.
- 24.6. The approval mark shall be clearly legible and be indelible.
- 24.7. The approval mark shall be placed close to or on the vehicle data plate affixed by the manufacturer.
- 24.8. Annex 4 to this Regulation gives examples of arrangements of approval marks.

25. REQUIREMENTS FOR RUP

- 25.1. For vehicles of the categories N₂ with a maximum mass exceeding 8 t, N₃, O₃ and O₄, the ground clearance with respect to the underside of the RUP, even when the vehicle is unladen, shall not exceed:
- (a) 450 mm for motor vehicles and trailers with hydropneumatic, hydraulic or pneumatic suspension or a device for automatic levelling according to load. In any case a departure angle up to 8° according to ISO 612:1978 with a maximum ground clearance of 550 mm shall be deemed to satisfy the requirements.
- (b) 500 mm or a departure angle according to ISO 612:1978 of 8°, whichever is less, for vehicles other than those in (a) above. In any case a departure angle up to 8° according to ISO 612:1978 with a maximum ground clearance of 550 mm shall be deemed to satisfy the requirements.

This requirement applies over the entire width of the motor vehicle or trailer and shall be such that the height above the ground of the points of application of the test forces applied to the device according to Part I of this Regulation and recorded in the type approval communication form (Annex 1, item 7) does not exceed the values in subparagraphs (a) and (b) above, increased by half the minimum section height required for the cross member of the RUPD.

The height requirement for the application of the test forces shall be adjusted to the adjusted ground clearance due to the provisions for the departure angle specified above.

- 25.2. For vehicles of categories M, N₁, N₂ with a maximum mass not exceeding 8 t, O₁ and O₂, the ground clearance with respect to the underside of the protective device, even when the vehicle is unladen, shall not exceed 550 mm over its entire width and shall be such that the height above the ground of the points of application of the test forces to the RUP does not exceed 600 mm.
- 25.3. For vehicles of categories M, N₁, N₂ with a maximum mass not exceeding 8 t, O₁ and O₂, the RUP shall be situated as close to the rear of the vehicle as possible. The maximum horizontal distance between the rear of the device and the most rearward point at the rear extremity of the vehicle, including any platform lift system, does not exceed 400 mm measured to the rear of the cross-member and recorded during the test when the test forces are applied.

For vehicles of categories N₂ with a maximum mass exceeding 8 t, N₃, and vehicles of categories O₃ and O₄, equipped with a platform lift or being designed as a tipping trailer, the same requirement as above applies; however, for vehicles of these categories, the horizontal distance shall not exceed 300 mm measured to the rear of the cross-member before the test forces are applied.

For RUP for vehicles of categories O₃ and O₄, without any platform lift system and not being designed as a tipping-trailer, the maximum horizontal distance is reduced to 200 mm before and 300 mm during the test when the test forces are applied.

⁽⁹⁾ The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 6, Annex 3 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

In any case nonstructural protrusions such as tail lamps and those of less than 50 mm of size in any direction, such as rubber bumpers, resilient buffers, hinges and latches shall be excluded from the determination of the most rearward point at the rear extremity.

Before the application of the test forces the maximum allowed horizontal distance of a single, a segmented or an inclined cross-member of an RUPD is 100 mm between the rear of the cross-member measured at the most forward point and the rear of the cross-member measured at the most rearward point, measured in the longitudinal plane of the vehicle.

- 25.4. The width of the RUP shall at no point exceed the width of the rear axle measured at the outermost points of the wheels, excluding the bulging of the tyres close to the ground, nor shall RUP be more than 100 mm shorter on either side. Where the device is contained in or comprises the vehicle bodywork which itself extends beyond the width of the rear axle, the requirement, that the width of the RUP shall not exceed that of the rear axle, shall not apply. However, in case of vehicles of categories O_1 and O_2 where the tyres project for more than half of their width outside the bodywork (excluding the wheel guards) or outside the chassis in the absence of bodywork, the width of the RUP shall not be less than 100 mm deducted from the distance measured between the innermost points of the tyres, excluding the bulging of the tyres close to the ground, on either side. Where there is more than one rear axle, the width to be considered is that of the widest rear axle. In addition, the requirements of paragraphs 3.1.2 and 3.1.3 of Annex 5 relating the distance of the points of application of the test forces from the outer edges of the rear wheels (Annex 1, item 7) shall be verified and recorded in the type approval communication form.

- 25.5. The cross-member shall have a section height of at least 120 mm. The lateral extremities of the cross-member shall not bend to the rear or have a sharp outer edge, this condition is fulfilled when the lateral extremities of the RUP are rounded on the outside and have a radius of curvature of not less than 2,5 mm.

For vehicles of the categories M, N_1 , N_2 with a maximum mass not exceeding 8 t, O_1 , O_2 , vehicles of category G and vehicles fitted with a platform lift, the cross-member shall have a section height of at least 100 mm.

- 25.6. The RUP may be so designed to have several positions at the rear of the vehicle. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded. The force applied by the operator to vary the position of the RUP shall not exceed 40 daN.

For RUP that are designed to have several positions at the rear of the vehicle a label shall be provided in the language(s) of the country where the device is sold.

Label minimum size: 60 × 120 mm.

The label shall be placed clearly and permanently visible at the rear area of the vehicle next to the RUP to inform the operator about the standard position of the RUP to offer effective protection against under-running.

- 25.7. The RUP shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle and be connected, when in the service position, with the chassis side-members or whatever replaces them. This requirement will be satisfied if it is shown that both during and after the application of the forces described in Annex 5 the horizontal distance between the rear of the RUP and the most rearward point at the rear extremity of the vehicle, including any platform lift system, does not exceed 400 mm at any of the points where the test forces are applied. In measuring this distance, any part of the vehicle which is more than 2 m above the ground when the vehicle is unladen shall be excluded.

After applying the test forces specified in Annex 5 for vehicles of the categories N_2 with a maximum mass exceeding 8 t, N_3 , O_3 and O_4 , the maximum ground clearance of the protective device, even when the vehicle is unladen, shall at any point not exceed by more than 60 mm the value before test. For vehicles with a departure angle up to 8° (paragraph 16.1) the maximum ground clearance shall not exceed 600 mm.

- 25.8. A practical test shall not be required where it can be shown by calculation that the requirements of Annex 5, paragraph 3, are met. Where a practical test is carried out, the device shall be connected to the chassis side-members of the vehicle or to a significant part of these or to other structural members.

- 25.9. For vehicles fitted with a platform lift at the rear, the underrun device may be interrupted for the purposes of the mechanism. In this case, the following special requirements apply:
- 25.9.1. The maximum lateral clearance measured between the elements of the underrun device and the elements of the platform lift, which move through the interruption when the lift is operated and which make the interruption necessary, may amount to no more than 2,5 cm.
- 25.9.2. The individual elements of the underrun protection, including those outboard of the lift system, where provided, shall have an effective surface area, in each case, of at least 420 cm².
- 25.9.3. For cross-members with a section height of less than 120 mm, the individual elements of the underrun protection, including those outboard of the lift mechanism, where provided, shall have an effective surface area, in each case, of at least 350 cm².
- 25.9.4. In the case of vehicles having a width of less than 2 000 mm and where it is impossible to achieve the requirements of paragraphs 25.9.2 and 25.9.3 above, the effective surface may be reduced on the condition that the resistance criteria are met.
26. CONFORMITY OF PRODUCTION
- The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3), with the following requirements:
- 26.1. Every vehicle approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set out in paragraph 25 above.
- 26.2. The Type Approval Authority that has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be one every two years.
27. PENALTIES FOR NON-CONFORMITY OF PRODUCTION
- 27.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements set forth above are not met or if the vehicle has failed to pass the test prescribed in Annex 5.
- 27.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in Annex 3 to this Regulation.
28. MODIFICATION AND EXTENSION OF APPROVAL OF A VEHICLE TYPE
- 28.1. Every modification of the vehicle type shall be notified to the Type Approval Authority which approved the vehicle type. The Type Approval Authority may then either:
- 28.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the vehicle still complies with the requirements; or
- 28.1.2. Require a further test report from the Technical Service responsible for conducting the tests.
- 28.2. Confirmation or refusal of approval, specifying the alterations shall be communicated by the procedure specified in paragraph 24.3 above to the Parties to the Agreement applying this Regulation.
- 28.3. The Type Approval Authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 3 to this Regulation.
29. PRODUCTION DEFINITELY DISCONTINUED
- If the holder of the approval completely ceases to manufacture a vehicle type approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval. Upon receiving the relevant communication that Authority shall inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 3 to this Regulation.

30. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF TYPE APPROVAL AUTHORITIES

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.

PART IV. TRANSITIONAL PROVISIONS

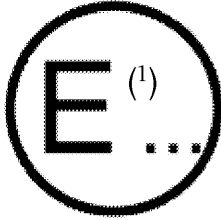
31. TRANSITIONAL PROVISIONS

- 31.1. As from the official date of entry into force of the 03 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals of vehicles, components or separate technical units under Parts I, II or III of this Regulation as amended by the 03 series of amendments.
- 31.2. Until 1 September 2019, Contracting Parties applying this Regulation shall not refuse to grant or refuse to accept type approvals of vehicles, components or separate technical units under Part I, II or III of this Regulation as amended by the 02 series of amendments.
- 31.3. As from 1 September 2019, Contracting Parties applying this Regulation shall grant approvals only if the type of vehicle, component or separate technical unit to be approved meets the requirements of Part I, II or III of this Regulation as amended by the 03 series of amendments.
- 31.4. As from 1 September 2021, Contracting Parties applying this Regulation shall not be obliged to accept, for the purpose of national or regional type approval, a vehicle, component or separate technical unit which is not type approved under Part I, II or III of the 03 series of amendments to this Regulation.
- 31.5. Until 1 September 2021, Contracting Parties applying this Regulation shall not refuse to grant extensions of approval for vehicles, components or separate technical units which comply with this Regulation as amended by the 02 series of amendments. However, Contracting Parties which are still accepting approvals according to the 02 series of amendments as given in paragraph 31.4 beyond 1 September 2021 shall not refuse to grant extensions to approvals after 1 September 2021.
- 31.6. Notwithstanding the transitional provisions above, Contracting Parties whose application of this Regulation comes into force after the date of entry into force of the most recent series of amendments are not obliged to accept approvals which were granted in accordance with any of the preceding series of amendments to this Regulation.
-

ANNEX 1

COMMUNICATION

(Maximum format: A4 (210 × 297 mm))



issued by:

Name of administration:

.....

.....

.....

Concerning ⁽²⁾:

- Approval granted
- Approval extended
- Approval refused
- Approval withdrawn
- Production definitively discontinued

of a type of rear underrun protective device (RUPD) pursuant to UN Regulation No 58

Approval No: Extension No:

1. Trade name or mark of device
2. Device type
3. Name and address of manufacturer
4. If applicable, name and address of manufacturer's representative
5. Characteristics of the device (dimensions and its fixing elements)
6. Test conducted on a vehicle/on a representative part of the chassis of a vehicle ⁽²⁾
7. Position on the device of the points of application of the test forces
8. Maximum horizontal and vertical deflection observed during and after the application of the test forces in Annex 5
9. Restrictions on application
 - Vehicles on which the device may be installed (if applicable)
 - Characteristics of the chassis to which the device may be installed (e.g. stiffness, profile dimensions, ...) (if applicable)
10. Maximum mass of vehicle on which the device may be installed
11. Device submitted for approval on
12. Technical Service responsible for conducting approval tests
13. Date of report issued by that service
14. Number of report issued by that service
15. Approval has been granted/refused/extended/withdrawn in respect of the RUPD ⁽²⁾
16. Position of approval mark on the device

17. Place
18. Date
19. Signature

20. The following documents, bearing the approval number shown above, are available upon request:

Drawings, diagrams and layout plans of the components of the structure considered to be of importance for the purposes of this Regulation;

Detailed information about the devices representing the vehicle structures used for the mounting of the RUPD (e.g. moment of inertia of the beams);

Where applicable drawings of the protective devices and their position on the vehicle.

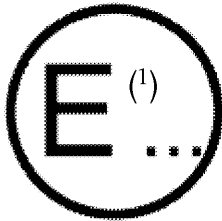
⁽¹⁾ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in this Regulation).

⁽²⁾ Strike out what does not apply.

ANNEX 2

COMMUNICATION

(Maximum format: A4 (210 × 297 mm))



issued by:

Name of administration:

.....

.....

.....

Concerning ⁽²⁾: Approval granted
 Approval extended
 Approval refused
 Approval withdrawn
 Production definitively discontinued

of a type of a vehicle with regard to the installation of a rear underrun protective device (RUPD) of an approved type pursuant to Part II of UN Regulation No 58

Approval No: Extension No:

1. Trade name or mark of vehicle
2. Vehicle type
3. Manufacturer's name and address
4. If applicable, name and address of manufacturer's representative
5. Brief description of the vehicle type as regards its dimensions and lines
6. Trade name or mark of the RUPD(s) and its/their approval number(s)
7. Maximum mass of vehicle
8. Vehicle submitted for approval on
9. Technical Service responsible for conducting approval tests
10. Date of report issued by that service
11. Number of report issued by that service
12. Approval granted/refused/extended/withdrawn ⁽²⁾
13. Position of approval mark on the vehicle
14. Place
15. Date
16. Signature
17. The following documents, bearing the approval number shown above, are available upon request:
 Drawings, diagrams and layout plans of the components of the structure considered to be of importance for the purposes of this Regulation;
 Where applicable drawings of the protective devices and their position on the vehicle.

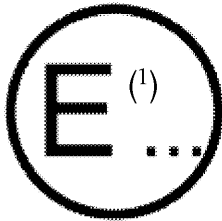
⁽¹⁾ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in this Regulation).

⁽²⁾ Strike out what does not apply.

ANNEX 3

COMMUNICATION

(Maximum format: A4 (210 × 297 mm))



issued by:

Name of administration:

.....

.....

.....

Concerning ⁽²⁾:

- Approval granted
- Approval extended
- Approval refused
- Approval withdrawn
- Production definitively discontinued

of a type of a vehicle with regard to its rear underrun protection (RUP) pursuant to paragraph 2.3(b)/paragraph 2.3(c)/Part III ⁽²⁾ of UN Regulation No 58.

Approval No: Extension No:

1. Trade name or mark of vehicle
2. Vehicle type
3. Manufacturer's name and address
4. If applicable, name and address of manufacturer's representative
5. Brief description of the vehicle type as regards its structure, dimensions, lines and any fixing elements
6. Brief description of the RUP, as regards its dimensions and constituent materials
7. Maximum mass of vehicle
8. Value of force applied in test
9. Vehicle submitted for approval on
10. Technical Service responsible for conducting approval tests
11. Date of report issued by that service
12. Number of report issued by that service
13. Approval granted/refused/extended/withdrawn ⁽²⁾
14. Position of approval mark on the vehicle
15. Place
16. Date
17. Signature
18. The following documents, bearing the approval number shown above, are available upon request:
 Drawings, diagrams and layout plans of the components of the structure considered to be of importance for the purpose of this Regulation;
 Where applicable drawings of the protective devices and their position on the vehicle.

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

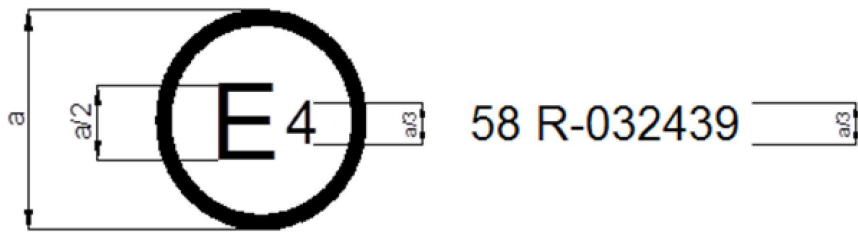
⁽²⁾ Strike out what does not apply.

ANNEX 4

ARRANGEMENTS OF APPROVAL MARKS

MODEL A

(see paragraphs 6.4, 15.4, 24.4 of this Regulation)

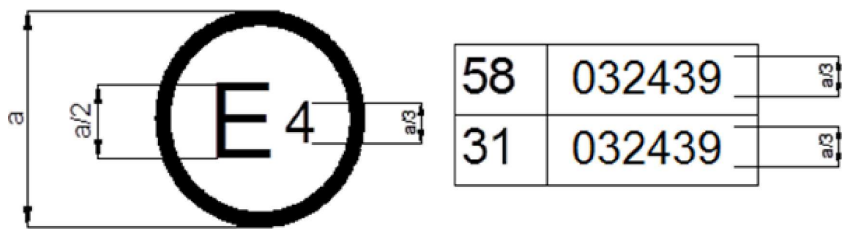


a = 8 mm min

The above approval mark affixed to a vehicle or to an RUPD shows that the vehicle type or RUPD type concerned has, with regard to the rear underrun protection in the event of a collision, been approved in the Netherlands (E 4) pursuant to UN Regulation No 58 under approval number 032439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of UN Regulation No 58 as amended by the 03 series of amendments.

MODEL B

(see paragraphs 6.5, 15.5, 24.5 of this Regulation)



a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in the Netherlands (E 4) pursuant to UN Regulations Nos 58 and 31 ⁽¹⁾. The approval numbers indicate that, at the dates when the respective approvals were given, UN Regulation No 58 included the 03 series of amendments and UN Regulation No 31 was still in its original form.

⁽¹⁾ The latter number is given as an example only.

ANNEX 5

TEST CONDITIONS AND PROCEDURES

1. TEST CONDITIONS FOR RUPDs

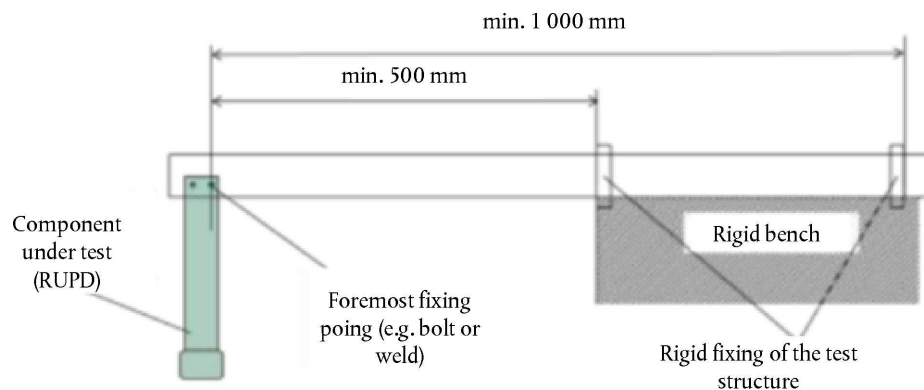
1.1. At the request of the manufacturer the test may be conducted either:

1.1.1. On a vehicle of the type for which RUPD is intended; in this case the conditions set out in paragraph 2 below shall be observed; or

1.1.2. On a part of the chassis of the vehicle type for which the RUPD is intended; this part shall be representative of the vehicle type(s) in question; or

1.2. In the case of paragraph 1.1.2, the parts used to connect the RUPD to part of the vehicle chassis shall be equivalent to those which are used to secure the RUPD when it is installed on the vehicle. The part of the chassis can be fixed on a test bench as shown in the figure below, representing the minimum requirements to be fulfilled. The structures used as side rails shall be representative of the chassis of vehicles for which the underrun protection system is intended.

The distance of the foremost fixing point of the RUPD from the rigid test bench shall not be less than 500 mm. If a diagonal strut is used to support the RUPD, this distance shall be measured between the foremost fixing point of the strut to the side rail structures and the rigid test bench.



1.3. At the request of the manufacturer and with the consent of the Technical Service the test procedure described in paragraph 3 may be simulated by calculation.

The mathematical model shall be validated in comparison with the actual test conditions. To that effect, a physical test shall be conducted for the purposes of comparing the results obtained when using the mathematical model with the results of a physical test. Comparability of the test results shall be proven. A validation report shall be drafted by the manufacturer or by the technical service and submitted to the Type Approval Authority.

Any change made to the mathematical model or to the software likely to invalidate the validation report shall be brought to the attention of the Type Approval Authority which may require a new validation process to be conducted.

1.4. In the case of an RUPD where the cross-member does not have a vertical flat surface of at least 50 per cent of the minimum section height of the cross-member according to paragraph 7.1 or 25.5 of this Regulation at the height of the points of application of the test forces according to paragraph 16.1 or 25.1, the manufacturer shall supply the Technical Service with a device that allows the application of horizontal test loads on the cross-member with the test equipment used by the Technical Service. The device shall not modify the dimensional and mechanical characteristics of the RUPD or increase its resistance during test. The device shall neither be rigidly fixed to the RUPD nor to the test equipment.

2. TEST CONDITIONS FOR VEHICLES

2.1. The vehicle shall be at rest on a level, flat, rigid and smooth surface.

2.2. The front wheels shall be in the straight-ahead position.

2.3. The tyres shall be inflated to the pressure recommended by the vehicle manufacturer.

- 2.4. The vehicle may, if necessary to achieve the test forces required in paragraph 3.1 below, be restrained by any method, this method to be specified by the vehicle manufacturer.
- 2.5. Vehicles equipped with hydropneumatic, hydraulic or pneumatic suspension or a device for automatic levelling according to load shall be tested with the suspension or device in the normal running condition specified by the manufacturer.

3. TEST PROCEDURE

- 3.1. The requirements of paragraphs 7.3 and 25.7 of this Regulation shall be verified by means of suitable test mandrels; the forces for tests prescribed in paragraphs 3.1.1 and 3.1.2 below shall be applied separately and consecutively, via a surface not more than 250 mm in height (but covering the maximum section height of the cross-member or RUP, the exact height shall be indicated by the manufacturer) and 200 mm wide, with a radius of curvature of 5 ± 1 mm at the vertical edges. The RUP shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle. The surface shall not be rigidly fixed to the RUPD or to the RUP and shall be articulated in all directions. The height above the ground of the centre of the surface shall be defined by the manufacturer within the lines that bound the device horizontally. When the test is carried out on a vehicle the height shall not, however, exceed the height as specified in paragraphs 16.1 and 16.2 or as specified in paragraphs 25.1 and 25.2 of this Regulation when the vehicle is unladen. The order in which the forces are applied may be specified by the manufacturer.

The device used to distribute the test force over the stated flat surface shall be connected to the force actuator through a swivel joint. The arrangement of the force actuator, whether pulling or pushing, shall be arranged such that it does not add any stiffness or stability to the underrun protection system structure, i.e. it shall neither increase the instability threshold force nor decrease the maximum deflection of the underrun protection system.

- 3.1.1. A horizontal force of 180 kN or 85 per cent of the force generated by the maximum mass of the vehicle, whichever is the lesser, shall be applied consecutively to two points situated symmetrically about the centre line of the device or of the vehicle whichever is applicable at a minimum distance apart of 700 mm and a maximum of 1 m. The exact location of the points of application shall be specified by the manufacturer.

Notwithstanding the provision above for non-separate cab vehicles of category N₂ with a maximum mass not exceeding 8 t, the horizontal forces may be reduced to 100 kN or 50 per cent.

- 3.1.2. In the cases defined in paragraphs 1.1.1 and 1.1.2 of this annex a horizontal force of 100 kN or 50 per cent of the force generated by the maximum mass of the vehicle, whichever is the lesser, shall be applied consecutively to two points located 300 ± 25 mm from the longitudinal planes tangential to the outer edges of the wheels on the rear axle or of the RUPD, if it exceeds the width of the rear axle, and to a third point located on the line joining these two points, in the median vertical plane of the vehicle.

Notwithstanding the provision above for non-separate cab vehicles of category N₂ with a maximum mass not exceeding 8 t, the horizontal forces may be reduced to 50 kN or 25 per cent.

- 3.1.3. Upon request of the manufacturer, the force levels can be reduced to 80 per cent of the requirement given in paragraphs 3.1.1 to 3.1.2 for the vehicles listed in Annex 6.

3.2. Replacement force application points

If any point defined under paragraph 3.1 is located within the interruption area of the underrun protection device as mentioned in paragraph 7.4 or 25.8 of this Regulation, the test forces shall be applied at replacement points located:

- 3.2.1. for the requirement under paragraph 3.1.1, on the horizontal centerline and within 50 mm of each vertical edge closest to the intended points of force application, as defined in that paragraph, and
 - 3.2.2. for the requirement under paragraph 3.1.2, at the intersection of the horizontal and vertical centerlines of each element furthest from the vertical centerline of the device or of the vehicle, whichever is applicable. These points should be a maximum of 325 mm from the longitudinal planes tangential to the outer edges of the wheels on the rear axle.
-

ANNEX 6

SPECIFIC VEHICLES

1. Specific types of vehicles
 - 1.1. Vehicles with tipping-bodies;
 - 1.2. Vehicles fitted with a platform lift at the rear.
-

ANNEX 7

REQUIREMENTS FOR DIFFERENT VEHICLE CATEGORIES

Vehicle category or type of vehicle	Geometry referred to in paragraph			Test force referred to in paragraph(s)
	Section height	Ground clearance before the test	Horizontal distance between the rear of the RUPD and the rear of the vehicle	
M, N ₁ , N ₂ with a MaxM (*) < 8 t, O ₁ , O ₂ , G	2.3/2.4/7.1/25.5	2.3/2.4/16.2/25.2	2.3/2.4/16.4/25.3	2.3/2.4/A5/3.1.1 to 3.1.2
N ₂ with a MaxM (*) > 8 t, N ₃	7.1 or 25.5	16.1 or 25.1	16.4 or 25.3	A5/3.1.1 to 3.1.2
O ₃ , O ₄	7.1 or 25.5	16.1/16.2 or 25.1/25.2	16.4 or 25.3	A5/3.1.1 to 3.1.2
Specific vehicles (see Annex 6)	7.1 or 25.5	16.1/16.2 or 25.1/25.2	16.4 or 25.3	A5/3.1.3

(*) MaxM means maximum mass.

Note: A reference such as A5/3.1.1 in the table indicates the annex (Annex 5) and paragraph (3.1.1) of that annex, where the relevant vehicle or requirement is described and specified. A reference such as 2.3 in the table indicates paragraph (2.3) of this Regulation, where the relevant requirement is specified.

Only the original UN/ECE texts have legal effect under international public law. The status and date of entry into force of this Regulation should be checked in the latest version of the UN/ECE status document TRANS/WP.29/343, available at:

<http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29docstts.html>

Regulation No 123 of the Economic Commission for Europe of the United Nations (UN/ECE) — Uniform provisions concerning the approval of adaptive front-lighting systems (AFS) for motor vehicles [2019/273]

Incorporating all valid text up to:

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A. ADMINISTRATIVE PROVISIONS

SCOPE

This Regulation applies to adaptive front-lighting systems (AFS) for motor vehicles of categories M and N ⁽¹⁾.

1. DEFINITIONS

For the purpose of this Regulation:

- 1.1. The definitions given in Regulation No 48 and its series of amendments in force at the time of application for type approval shall apply;
- 1.2. 'Adaptive front-lighting system' (or 'system') means a lighting device, providing beams with differing characteristics for automatic adaptation to varying conditions of use of the dipped-beam (passing-beam) and, if it applies, the main-beam (driving-beam) with a minimum functional content as indicated in paragraph 6.1.1; such systems consist of the 'system control', one or more 'supply and operating device(s)', if any, and the 'installation units' of the right and of the left side of the vehicle;
- 1.3. 'Class' of a passing-beam (C, V, E or W) means the designation of a passing-beam, identified by particular provisions according to this Regulation and Regulation No 48 ⁽²⁾;
- 1.4. 'Mode' of a front-lighting function provided by a system means a beam within the provisions (see paragraphs 6.2 and 6.3 of this Regulation) either for one of the passing-beam classes or for the main beam, designed and specified by the manufacturer for adaptation to dedicated vehicle and ambient conditions;
 - 1.4.1. 'Bending mode' means the designation of a mode of a front-lighting function with its illumination being laterally moved or modified (to obtain an equivalent effect), designed for bends, curves or intersections of the road, and, identified by particular photometric provisions;
 - 1.4.2. 'Category 1 bending mode' means a bending mode with horizontal movement of the kink of the cut-off;
 - 1.4.3. 'Category 2 bending mode' means a bending mode without horizontal movement of the kink of the cut-off;
- 1.5. 'Lighting unit' means a light emitting part of the system, which may consist of optical, mechanical and electrical components, designed to provide or contribute to the beam of one or more front-lighting function(s) provided by the system;
- 1.6. 'Installation unit' means an indivisible housing (lamp body) which contains one or more lighting unit(s);
- 1.7. 'Right side' respectively 'left side' means the combined total of the lighting units intended to be installed to that side of the longitudinal median plane of the vehicle, relative to its forward motion;
- 1.8. 'System control' means that part(s) of the system receiving the signals from the vehicle and controlling the operation of the lighting units automatically;
- 1.9. 'Neutral state' means the state of the system when a defined mode of the Class C passing-beam ('basic passing-beam') or of the main beam, if any, in the maximum condition of activation is produced, and no AFS control signal applies;
- 1.10. 'Signal' means any AFS control signal as defined in Regulation No 48 or, any additional control input to the system or, a control output from the system to the vehicle;
- 1.11. 'Signal generator' means a device, reproducing one or more of the signals for system tests;
- 1.12. 'Supply and operating device' means one or more components of a system providing power to one or more parts of the system, including such as power and/or voltage control(s) for one or more light sources as e.g. electronic light source control gears;
- 1.13. 'System reference axis' means the intersection line of the vehicle's longitudinal median plane with the horizontal plane through the centre of reference of one lighting unit specified in the drawings according to paragraph 2.2.1 below;

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

⁽²⁾ For explanation only. The provisions of the passing-beam classes are dedicated to conditions as follows: C for the basic passing-beam, V for use in lit areas such as towns, E for use on roads such as motorways, W for use in adverse conditions such as wet road.

- 1.14. 'Lens' means the outermost component of an installation unit, which transmits light through the illuminating surface;
- 1.15. 'Coating' means any product(s) applied in one or more layers to the outer face of a lens;
- 1.16. 'Systems of different types' means systems which differ in such essential respects as:
 - 1.16.1. The trade name or mark(s):
 - (a) Lamps bearing the same trade name or mark but produced by different manufacturers shall be considered as being of different types;
 - (b) Lamps produced by the same manufacturer differing only by the trade name or mark shall be considered as being of the same type.
 - 1.16.2. The inclusion or elimination of components capable of altering optical characteristics/photometric properties of the system;
 - 1.16.3. Suitability for right-hand or left-hand traffic or for both traffic systems;
 - 1.16.4. The front-lighting function(s), mode(s) and classes produced;
 - 1.16.5. The characteristic(s) of the signal(s), specified for the system.
- 1.17. 'Aiming' means the positioning of the beam or part thereof on an aiming screen according to the relevant criteria;
- 1.18. 'Adjustment' means the use of the means provided by the system for vertical and/or horizontal aiming of the beam;
- 1.19. 'Traffic-change function' means any front-lighting function or a mode thereof, or part(s) thereof only, or any combination of these, intended to avoid glare and provide sufficient illumination in case where a vehicle being equipped with a system designed for one traffic direction only is temporarily used in a country with the opposite direction of traffic;
- 1.20. 'Substitute function' means any specified front-lighting and/or front light-signalling, be it a front-lighting and/or a front light-signalling function, or a mode thereof, or part(s) thereof only, or any combination of it, intended to replace a front-lighting function/mode in case of failure;
- 1.21. References made in this Regulation to standard (étalon) filament lamp(s) and gas-discharge light source(s) shall refer to Regulations Nos 37 and 99 respectively, and to their series of amendments in force at the time of application for type approval.

2. APPLICATION FOR APPROVAL OF A SYSTEM

- 2.1. The application for approval shall be submitted by the owner of the trade name or mark or by his duly accredited representative.

It shall specify:
- 2.1.1. The front-lighting functions, which are intended to be provided by the system, for which Approval is sought according to this Regulation;
 - 2.1.1.1. Any other front-lighting or front light signalling function(s), provided by any lamp(s) being grouped, combined or reciprocally incorporated to the lighting units of the system, for which approval is sought; sufficient information for identification of the respective lamp(s) and indication of the Regulation(s), according to which they are intended to be (separately) approved;
- 2.1.2. Whether the passing-beam is designed for both left-hand and right-hand traffic or for either left-hand or right-hand traffic only;
- 2.1.3. If the system is equipped with one or more adjustable lighting unit(s):
 - 2.1.3.1. The mounting position(s) of the respective lighting unit(s) in relation to the ground and the longitudinal median plane of the vehicle;
 - 2.1.3.2. The maximum angles above and below the normal position(s) which the device(s) for vertical adjustment can achieve;
- 2.1.4. The category, as listed in Regulation No 37 or 99 and their series of amendments in force at the time of the application for type approval, of replaceable and/or non-replaceable filament or gas discharge light source(s) used and/or the light source module specific identification code(s) for LED modules, if available;

- 2.1.5. If the system is equipped with one or more non-replaceable light source(s):
- 2.1.5.1. Identification of the lighting unit(s) of which said light source(s) is/are a non-replaceable part;
- 2.1.6. The operation conditions e.g. different input voltages according to the provisions of the Annex 9 to this Regulation, if applicable;
- 2.1.7. If the system is designed to provide an adaptive driving-beam;
- 2.2. Every application for approval shall be accompanied by:
- 2.2.1. Drawings in triplicate in sufficient detail to permit identification of the type, showing the position(s) intended for the approval number(s) and the additional symbols in relation to the circle(s) of the approval mark(s), and showing in what geometrical position the lighting units are to be mounted on the vehicle in relation to ground and vehicle longitudinal median plane, and showing each of them in vertical (axial) section and in front elevation, with main details of the optical design including the axis/axes of reference and the point(s) to be taken as centre(s) of reference in the tests and any optical features, of the lens, if applicable;
- If applicable and in case of LED module(s) also the space(s) reserved for the specific identification code(s) of the module(s);
- 2.2.2. A concise technical description of the system specifying:
- (a) The lighting function(s) and their modes to be provided by the system ⁽³⁾;
 - (b) The lighting units contributing to each of them ⁽³⁾ and the signals ⁽⁴⁾ with the technical characteristics relevant to their operation;
 - (c) Which categories ⁽³⁾ of the bending mode requirements apply, if any;
 - (d) Which additional data set(s) of Class E passing-beam provisions according to Table 6 of Annex 3 to this Regulation apply, if any;
 - (e) Which set(s) of Class W passing-beam provisions according to Annex 3 to this Regulation apply, if any;
 - (f) Which lighting units ⁽⁴⁾ provide or contribute to one or more passing-beam cut-off(s);
 - (g) The indication(s) ⁽³⁾ according to the provisions of paragraph 6.4.6 of this Regulation with respect to the paragraphs 6.22.6.1.2.1 of Regulation No 48;
 - (h) Which lighting units are designed to provide the minimum passing-beam illumination according to the paragraph 6.2.8.1 of this Regulation;
 - (i) Mounting and operation specifications for test purposes;
 - (j) Any other relevant information;
 - (k) In the case of LED module(s) this shall include:
 - (i) A brief technical specification of the LED module(s);
 - (ii) A drawing with dimensions and the basic electrical and photometric values and the objective luminous flux and for each LED module a statement whether it is replaceable or not;
 - (iii) In case of electronic light source control gear, information on the electrical interface necessary for approval testing;
 - (l) In the case of adaptation of the driving-beam, which lighting units ⁽⁴⁾ provide or contribute to the gradual adaptation of the driving-beam and of the sensor system along with the technical characteristics relevant to their operation.
- 2.2.2.1. The safety concept as laid down in the documentation, which, to the satisfaction of the Technical Service responsible for type approval tests:
- (a) Describe the measures designed into the system to ensure compliance with the provisions of paragraphs 5.7.3, 5.9, 6.2.5.4 below, and

⁽³⁾ To be indicated in a form conforming to the model of Annex 1.

⁽⁴⁾ To be indicated in a form conforming to the model of Annex 10.

- (b) Indicates the instructions for their verification according to paragraph 6.2.7 below; and/or
 - (c) Gives access to the relevant documents demonstrating the system's performance concerning sufficient reliability and safe operation of the measures specified according to the subparagraph 2.2.2.1(a) above, e.g. FMEA ('Failure Mode and Effect Analysis'), FTA ('Fault Tree Analysis') or any similar process appropriate to system safety considerations.
- 2.2.2.2. The make and type of supply and operating device(s), if any and if not being part of an installation unit;
- 2.2.3. One set of samples of the system, for which approval is sought, including the mounting devices, supply and operating devices, and signal generators if any;
- 2.2.4. For the test of plastic material of which the lenses are made:
- 2.2.4.1. Fourteen lenses;
- 2.2.4.1.1. Ten of these lenses may be replaced by 10 samples of material at least 60 × 80 mm in size, having a flat or convex outer surface and a substantially flat area (radius of curvature not less than 300 mm) in the middle measuring at least 15 × 15 mm;
- 2.2.4.1.2. Every such lens or sample of material shall be produced by the method to be used in mass production;
- 2.2.4.2. A lighting element or optical assembly, if applicable, to which the lenses can be fitted in accordance with the manufacturer's instructions;
- 2.2.5. For testing the resistance of the light transmitting components made of plastic material against UV radiation of those light source(s) inside the system, which can emit UV radiation as e.g. gas discharge light sources, LED modules, according to paragraph 2.2.4 of Annex 6 to this Regulation:
- One sample of each relevant material being used in the system or one system or part(s) thereof, containing these. Each material sample shall have the same appearance and surface treatment, if any, as intended for use in the system to be approved;
- 2.2.6. The materials making up the lenses and coatings, if any, shall be accompanied by the test report of the characteristics of these materials and coatings if they have already been tested;
- 2.2.7. In the case of a type of lamp differing only by the trade name or mark from a type that has already been approved it shall be sufficient to submit:
- 2.2.7.1. A declaration by the lamp manufacturer that the type submitted is identical (except in the trade name or mark) with and has been produced by the same manufacturer as, the type already approved, the latter being identified by its approval code;
- 2.2.7.2. Two samples bearing the new trade name or mark or equivalent documentation.
- 2.2.8. In case of a system according to paragraph 4.1.7 below, a vehicle representative of the vehicle(s) indicated according to paragraph 4.1.6 below.
3. MARKINGS
- 3.1. The installation units of a system submitted for approval shall bear the trade name or mark of the applicant.
- 3.2. They shall comprise each, on the lenses and on the main bodies spaces of sufficient size for the approval mark and the additional symbols referred to in paragraph 4; these spaces shall be indicated on the drawings referred to in paragraph 2.2.1 above.
- 3.2.1. If however the lens cannot be detached from the main body of the installation unit, one marking as per paragraph 4.2.5 shall be sufficient.
- 3.3. The installation units or systems designed to satisfy the requirements both of right-hand and of left-hand traffic shall bear markings indicating the two settings of the optical element(s) on the vehicle or of the light source(s) on the reflector(s); these markings shall consist of the letters 'R/D' for the position for right-hand traffic and the letters 'L/G' for the position for left-hand traffic.
- 3.4. In the case of an AFS with LED module(s), the corresponding installation unit(s) shall bear the marking of the rated voltage and rated wattage and the light source module specific identification code.
- 3.5. LED module(s) submitted along with the approval of the AFS:
- 3.5.1. Shall bear the trade name or mark of the applicant. This marking shall be clearly legible and indelible;

- 3.5.2. Shall bear the specific identification code of the module. This marking shall be clearly legible and indelible.

This specific identification code shall comprise the starting letters 'MD' for 'MODULE' followed by the approval marking without the circle as prescribed in paragraph 4.2.1 below and in the case several non-identical light source modules are used, followed by additional symbols or characters. This specific identification code shall be shown in the drawings mentioned in paragraph 2.2.1 above. The approval marking does not have to be the same as the one on the lamp in which the module is used, but both markings shall be from the same applicant.

- 3.5.3. If the LED module(s) are non-replaceable, the markings for LED module(s) are not required.

- 3.6. If an electronic light source control gear which is not part of a LED module is used to operate a LED module(s), it shall be marked with its specific identification code(s), the rated input voltage and wattage.

4. APPROVAL

4.1. General

- 4.1.1. If all the samples of a type of a system submitted pursuant to paragraph 2 above satisfy the provisions of this Regulation, approval shall be granted.

- 4.1.2. Where lamps being grouped, combined or reciprocally incorporated with the system satisfy the requirements of more than one Regulation, a single international approval mark may be affixed provided that each of the grouped, combined or reciprocally incorporated lamps satisfies the provisions applicable to it.

- 4.1.3. An approval number shall be assigned to each type approved. Its first two digits shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another type of system covered by this Regulation.

- 4.1.4. Notice of approval or of extension or refusal or withdrawal of approval or production definitively discontinued of a type of system pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement applying this Regulation, by means of a form conforming to the model in Annex 1 to this Regulation, with the indications according to paragraph 2.1.3.

- 4.1.4.1. If the installation unit(s) is/are equipped with an adjustable reflector and if this/these installation unit(s) is/are to be used only in mounting positions according to the indications in paragraph 2.1.3 the applicant shall be obliged by approval to inform the user in a proper way about the correct mounting position(s).

- 4.1.5. In addition to the mark prescribed in paragraph 3.1, an approval mark as described in paragraphs 4.2 and 4.3 below shall be affixed in the spaces referred to in paragraph 3.2 above to every installation unit of a system conforming to a type approved under this Regulation.

- 4.1.6. The applicant shall indicate in a form corresponding to the respective model in the Annex 1 to this Regulation, the vehicle(s) for which the system is intended.

- 4.1.7. If approval is sought for a system which is not intended to be included as part of the approval of a vehicle type according to Regulation No 48,

- 4.1.7.1. The applicant shall submit sufficient documentation to prove the capability of the system to comply with the provisions of paragraph 6.22 of Regulation No 48 when correctly installed, and

- 4.1.7.2. The system shall be approved according to Regulation No 10.

4.2. Composition of the approval mark

The approval mark shall consist of:

- 4.2.1. An international approval marking, comprising:

- 4.2.1.1. A circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted approval ^(*);

- 4.2.1.2. The approval number prescribed in paragraph 4.1.3 above;

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

- 4.2.2. The following additional symbol (or symbols):
- 4.2.2.1. On a system, the letter 'X', and those of the function(s) being provided by the system:
- 'C' for the Class C passing-beam, with the addition of symbols for the relevant other classes of passing-beam:
 - 'E' for a Class E passing-beam,
 - 'V' for a Class V passing-beam,
 - 'W' for a Class W passing-beam;
 - 'R' for a driving-beam;
- 4.2.2.2. In addition to each symbol and above it a score, if the lighting function or mode thereof is provided by more than one installation unit from one side;
- 4.2.2.3. In addition the symbol 'T', after the symbol(s) of all lighting function(s) and/or class(es) designed to comply with the respective bend lighting provisions, with said symbol(s) arranged together and leftmost;
- 4.2.2.4. On a separate installation unit, the letter 'X', and those of the function(s) being provided by the lighting unit(s) comprised in it;
- 4.2.2.5. If the installation unit on a given side is not the only contributor to a lighting function or mode of a lighting function it shall bear a score above the symbol of the function;
- 4.2.2.6. On a system or part thereof meeting left-hand traffic requirements only, a horizontal arrow pointing to the right of an observer facing the installation unit, i.e. to the side of the road on which the traffic moves;
- 4.2.2.7. On a system or part thereof designed to meet the requirements of both traffic systems e.g. by means of an appropriate adjustment of the setting of the optical element or the light source, a horizontal arrow with a head on each end, the heads pointing respectively to the left and to the right;
- 4.2.2.8. On an installation unit incorporating a lens of plastic material, the group of letters 'PL' to be affixed near the symbols prescribed in paragraphs 4.2.2.1 to 4.2.2.7 above;
- 4.2.2.9. On an installation unit contributing to fulfil the requirements of this Regulation in respect of the driving-beam, an indication of the maximum luminous intensity expressed by the reference mark, as defined in paragraph 6.3.2.1.2 below, placed near the circle surrounding the letter 'E';
- 4.2.3. In every case the relevant operating mode used during the test procedure according to paragraph 1.1.1.1 of Annex 4 and the permitted voltage(s) according to paragraph 1.1.1.2 of Annex 4 shall be stipulated on the approval forms and on the communication forms transmitted to the countries which are Contracting Parties to the Agreement and which apply this Regulation.
- In the corresponding cases, the system or part(s) thereof shall be marked as follows:
- 4.2.3.1. On an installation unit meeting the requirements of this Regulation which is so designed that the light source(s) of the passing-beam shall not be lit simultaneously with that of any other lighting function with which it may be reciprocally incorporated: an oblique stroke (/) shall be placed after the passing-beam symbol(s) in the approval mark.
- 4.2.3.2. On an installation unit meeting the requirements of Annex 4 to this Regulation only when supplied with a voltage of 6 V or 12 V, a symbol consisting of the number 24 crossed out by an oblique cross (X), shall be placed near the holders of the light source(s).
- 4.2.4. The two digits of the approval number which indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval and, if necessary, the required arrow may be marked close to the above additional symbols.
- 4.2.5. The marks and symbols referred to in paragraphs 4.2.1 and 4.2.2 above shall be clearly legible and be indelible. They may be placed on an inner or outer part (transparent or not) of the installation unit which cannot be separated from its light-emitting surface(s). In any case it shall be visible when the installation unit(s) is/are fitted on the vehicle. The displacement of a movable part of the vehicle is permitted to fulfil this requirement.

4.3. Arrangement of the approval mark

4.3.1. Independent lamps

Annex 2, Figures 1 to 10, to this Regulation gives examples of arrangements of the approval mark with the above-mentioned additional symbols.

4.3.2. Grouped, combined or reciprocally incorporated lamps

4.3.2.1. Where lamps being grouped, combined or reciprocally incorporated with the system have been found to comply with the requirements of several Regulations, a single international approval mark may be affixed, consisting of a circle surrounding the letter 'E' followed by the distinguishing number of the country which has granted the approval, and an approval number. This approval mark may be located anywhere on the grouped, combined or reciprocally incorporated lamps, provided that:

4.3.2.1.1. It is visible as per paragraph 4.2.5;

4.3.2.1.2. No part of the grouped, combined or reciprocally incorporated lamps that transmit light can be removed without at the same time removing the approval mark.

4.3.2.2. The identification symbol for each lamp appropriate to each Regulation under which approval has been granted, together with the corresponding series of amendments incorporating the most recent major technical amendments to the Regulation at the time of issue of the approval, and if necessary, the required arrow shall be marked:

4.3.2.2.1. Either on the appropriate light-emitting surface,

4.3.2.2.2. Or in a group, in such a way that each of the grouped, combined or reciprocally incorporated lamps may be clearly identified (see for possible examples in Annex 2).

4.3.2.3. The size of the components of a single approval mark shall not be less than the minimum size required for the smallest of the individual marks by the Regulation under which approval has been granted.

4.3.2.4. An approval number shall be assigned to each type approved. The same Contracting Party may not assign the same number to another type of grouped, combined or reciprocally incorporated lamps covered by this Regulation.

4.3.2.5. Annex 2, Figures 11 and 12, to this Regulation give examples of arrangements of approval marks for grouped, combined or reciprocally incorporated lamps with all the above mentioned additional symbols, and relating to a system with functions provided by more than one installation unit per side of the vehicle.

4.3.2.6. Annex 2, Figure 13, to this Regulation gives examples of approval marks relating to the complete system.

B. TECHNICAL REQUIREMENTS FOR SYSTEMS OR PART(S) OF A SYSTEM

Unless otherwise specified, photometric measurements shall be carried out according to the provisions set out in the Annex 9 to this Regulation.

5. GENERAL SPECIFICATIONS

The requirements contained in sections 5 'General specifications' and 6 'Individual specifications' and in the Annexes referenced in the said sections of UN Regulation No 48, and their series of amendments in force at the time of application for the lamp type approval shall apply to this Regulation.

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

5.1. Each sample, when its approval is sought for right-hand traffic only, shall conform to the specifications set forth in paragraphs 6 and 7 below; if, however, its approval is sought for left-hand traffic, the provisions of paragraph 6 below, including the relevant annexes to this Regulation, apply with the inversion of right to left and vice versa.

Correspondingly, the designation of the angular positions and elements is adjusted by exchanging 'R' for 'L' and vice versa.

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

- 5.2. Systems or part(s) thereof, shall be fitted with a device enabling them to be so adjusted on the vehicle as to comply with the rules applicable to them.
- 5.2.1. Such adjustment device(s) need not be fitted on systems or part(s) thereof, provided that their use is confined to vehicles on which the setting can be adjusted by other means or no such means are needed according to the applicant's system description.
- 5.3. Replaceable and non-replaceable light sources and LED modules:
 - 5.3.1. The system shall only be equipped with one or a combination of:
 - 5.3.1.1. Light sources that are approved according to Regulation No 37 and its series of amendments in force at the time of application for type approval and for which no restriction on the use is made;
 - 5.3.1.2. Light sources that are approved according to Regulation No 99;
 - 5.3.1.3. LED module(s).
 - 5.3.2. If a light source is replaceable:
 - 5.3.2.1. The lamp holder shall conform to the characteristics given on the data sheet of IEC Publication No 60061, as referred to in the relevant light source Regulation.
 - 5.3.2.2. The design of the device shall be such that the filament lamp can be fixed in no other position but the correct one.
 - 5.3.3. The Class C (basic) passing-beam shall be equipped only with replaceable light sources or replaceable or non-replaceable LED modules.
 - 5.3.4. In the case of replaceable LED module, the removal and replacement of this LED module, as described in Annex 11, paragraph 1.4.1, shall be demonstrated to the satisfaction of the Technical Service.
- 5.4. System(s) or part(s) thereof, designed to satisfy the requirements both of right-hand and of left-hand traffic may be adapted for traffic on a given side of the road either by an appropriate initial setting when fitted on the vehicle or by selective setting by the user. In any case, only two different and clearly distinct settings, one for right-hand and one for left-hand traffic, shall be possible, and the design shall preclude inadvertent shifting from one setting to the other or setting in an intermediate state.
- 5.5. Complementary tests shall be done according to the requirements of Annex 4 to this Regulation to ensure that in use there is no excessive change in photometric performance.
- 5.6. If the lens of a lighting unit is of plastic material, tests shall be done according to the requirements of Annex 6 to this Regulation.
- 5.7. On a system or part(s) of, designed to provide alternately the driving-beam and the passing-beam, any mechanical, electro-mechanical or other device incorporated in the lighting unit(s), for switching from one to the other beam shall be so constructed that:
 - 5.7.1. The device is robust enough to withstand 50 000 operations under normal conditions of use. In order to verify compliance with this requirement, the Technical Service responsible for approval tests may:
 - (a) Require the applicant to supply the equipment necessary to perform the test;
 - (b) Forego the test if the headlamp presented by the applicant is accompanied by a test report, issued by a Technical Service responsible for approval tests for headlamps of the same construction (assembly), confirming compliance with this requirement.
 - 5.7.2. Except in the case of adaptation of the driving-beam, either the passing-beam or the driving-beam shall always be obtained, without any possibility of remaining in an intermediate or undefined state; if this is not possible, such a state must be covered by the provisions according to paragraph 5.7.3 below;
 - 5.7.3. In the case of failure it must be possible to obtain automatically a passing beam or a state with respect to the photometric conditions which yields values not exceeding 1 300 cd in the zone III b as defined in Annex 3 to this Regulation and at least 3 400 cd in a point of 'segment I_{max}', by such means as e.g. switching off, dimming, aiming downwards, and/or functional substitution;

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

- 5.7.4. The user cannot, with ordinary tools, change the shape or position of the moving parts, or influence the switching device.
- 5.8. Systems shall provide means allowing them to be used temporarily in a territory with the opposite direction of driving than that for which approval is sought, without causing undue dazzle to the oncoming traffic. For these purposes the system(s) or part(s) thereof shall:
- 5.8.1. Be capable of providing a selective setting by the user according to paragraph 5.4 above, without special tools; or
- 5.8.2. Provide means to achieve a traffic-change function, meeting the values shown in the following table when tested according to paragraph 6.2 below with the adjustment left unchanged compared to that for the original traffic direction;
- 5.8.2.1. Passing-beam designed for right-hand traffic and adapted to left-hand traffic:
- At 0,86 D — 1,72 L at least 2 500 cd
- At 0,57 U — 3,43 R not more than 880 cd
- 5.8.2.2. Passing-beam designed for left-hand traffic and adapted to right-hand traffic:
- At 0,86 D — 1,72 R at least 2 500 cd
- At 0,57 U — 3,43 L not more than 880 cd
- 5.9. The system shall be so made that, if a light source and/or a LED module has failed, a failure signal in order to comply with the relevant provisions of Regulation No 48 shall be provided.
- 5.10. The component(s) to which a replaceable light source is assembled shall be so made that the light source fits easily and, even in darkness, can be fitted in no position but the correct one.
- 5.11. In the case of a system according to paragraph 4.1.7 above.
- 5.11.1. The system shall be accompanied by a copy of the form according to paragraph 4.1.4 above and instructions to enable its installation according to the provisions of Regulation No 48.
- 5.11.2. The Technical Service responsible for type approval shall verify that:
- (a) The system can be correctly installed according to said instructions;
- (b) The system, when installed in the vehicle, complies with the provisions of paragraph 6.22 of Regulation No 48.
- To confirm compliance with the provisions of paragraph 6.22.7.4 of Regulation No 48 a test drive is mandatory, which comprises any situation relevant to the system control on the basis of the applicant's description. It shall be notified whether all modes are activated, performing and de-activated according to the applicant's description; obvious malfunctioning, if any, to be contested (e.g. angular excess or flicker).
- 5.12. The AFS, if equipped with LED module(s), and the LED module(s) themselves shall comply with the relevant requirements specified in Annex 11 to this Regulation. The compliance with the requirements shall be tested.
- 5.13. In case of an AFS incorporating light sources and/or LED module(s) producing the basic passing-beam and having a total objective luminous flux of the lighting units as indicated under item 9.2.3 of the communication form conforming to the model in Annex 1 which exceeds 2 000 lumens per side a reference shall be made in item 9.2.3 of the communication form in Annex 1. The objective luminous flux of LED module(s) shall be measured as described in paragraph 5 of Annex 11.
- 5.14. In the case of the basic passing-beam in the neutral state being produced exclusively by LED modules, the total objective luminous flux of these LED modules shall be equal or greater than 1 000 lumen per side, when measured as described in paragraph 5 of Annex 11.
- 5.15. A LED module shall be:
- (a) Only removable from its device with the use of tools, unless it is stated in the communication sheet that the LED module is non-replaceable and,
- (b) So designed that regardless of the use of tool(s), it is not mechanically interchangeable with any replaceable approved light source.

6. ILLUMINATION

6.1. General provisions

6.1.1. Each system shall provide a Class C passing-beam according to paragraph 6.2.4 below and one or more passing-beam(s) of additional class(es); it may incorporate one or more additional modes within each class of passing-beam and the front-lighting functions according to paragraph 6.3 and/or 2.1.1.1 of this Regulation.

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

6.1.3. The system shall be considered acceptable if it meets the relevant photometric requirements of paragraphs 6.2 and 6.3.

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

6.1.4.1. At neutral state according to paragraph 1.9 of this Regulation;

6.1.4.2. At V-signal, W-signal, E-signal, T-signal according to paragraph 1.10 of this Regulation, whichever apply;

6.1.4.3. If applicable, at any other signal(s) according to paragraph 1.10 of this Regulation and combinations of them, according to the applicant's specification.

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

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

6.1.4.4.2. At least 3 100 cd shall be attained at point 50 V when the Class C passing-beam is activated, for systems producing passing-beam only or alternately producing passing-beam and driving-beam functions as described in paragraph 5.7 of this Regulation.

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

6.2. Provisions concerning the passing-beam

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

6.2.1. For each side of the system (vehicle) the passing-beam in its neutral state shall produce from at least one lighting unit a 'cut-off' as defined in Annex 8 to this Regulation or,

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

6.2.1.2. Annex 8 does not apply to the traffic-change function as described in paragraph 5.8 through 5.8.2.1 above.

6.2.2. The system or part(s) thereof shall be aimed according to the requirements of Annex 8 so that the position of the cut-off complies with the requirements indicated in the Table 2 of Annex 3 to this Regulation.

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

6.2.4. When emitting a specified mode of the passing beam, the system shall meet the requirements in the respective section (C, V, E, W) of part A of Table 1 (photometric values) and in Table 2 ($I_{\max}$ and 'cut-off' positions) of Annex 3 to this Regulation, as well as section 1 ('cut-off' requirements) of Annex 8 to this Regulation.

6.2.5. A bending mode may be emitted, provided that:

6.2.5.1. The system meets the respective requirements of part B of Table 1 (photometric values) and item 2.2 of Table 2 ('cut-off' provisions) of Annex 3 to this Regulation, when measured according to the procedure indicated in Annex 9, relevant to the category (either category 1 or category 2) of the bending mode, for which approval is sought;

- 6.2.5.2. When the T-signal corresponds to the vehicle's smallest turn radius to the left (or right), the sum of the luminous intensity values provided by all contributors of the right or the left side of the system shall be at least 2 500 cd at one or more points in the zone extending from H-H to 2 degrees below H-H and from 10 to 45 degrees left (or right).
- 6.2.5.3. If approval is sought for a category 1 bending mode, the use of the system is restricted to vehicles where provisions are taken such that the horizontal position of the 'kink' of the 'cut-off' which is provided by the system, complies with the relevant provisions of paragraph 6.22.7.4.5(i) of Regulation No 48;
- 6.2.5.4. If approval is sought for a category 1 bending mode, the system is designed so that, in the case of a failure affecting the lateral movement or modification of the illumination, it must be possible to obtain automatically either photometric conditions corresponding to paragraph 6.2.4 above or a state with respect to the photometric conditions which yields values not exceeding 1 300 cd in the zone IIIb, as defined in Annex 3 to this Regulation, and at least 3 400 cd in a point of 'segment $I_{\max}$ ';
- 6.2.5.4.1. However, this is not needed if, for positions relative to the system reference axis up to 5 degrees left, at 0,3 degree up from H-H, and greater than 5 degrees left, at 0,57 degree up, a value of 880 cd is in no case exceeded.
- 6.2.6. The system shall be checked on the basis of the relevant instructions of the manufacturer, indicated in the safety concept according to paragraph 2.2.2.1 above.
- 6.2.7. A system or part(s) thereof, designed to meet the requirements of both right-hand and left-hand traffic must, in each of the two setting positions according to 5.4 above meet the requirements specified for the corresponding direction of traffic.
- 6.2.8. The system shall be so made that:
- 6.2.8.1. Any specified passing-beam mode provides at least 2 500 cd at point 50 V from each side of the system;
The mode(s) of the Class V passing-beam are exempted from this requirement;
- 6.2.8.2. Other modes:
When signal inputs according to paragraph 6.1.4.3 of this Regulation apply, the requirements of the paragraph 6.2 above shall be fulfilled.
- 6.3. Provisions concerning the driving-beam
- The system shall, prior to the subsequent test procedures, be set to the neutral state.
- 6.3.1. The lighting unit(s) of the system shall be adjusted, according to the instructions of the manufacturer, such that the area of maximum illumination is centred on the point (HV) of intersection of the lines H-H and V-V;
- 6.3.1.1. Any lighting unit(s) which is/are not independently adjustable, or, for which the aiming was done with respect to any measurements under paragraphs 6.2., shall be tested in its/their unchanged position.
- 6.3.2. When measured according to the provisions laid down in Annex 9 to this Regulation the illumination shall meet the following requirements:

Test point	Angular coordinates (degrees)	Required luminous intensity (cd)
I_m		Min
H-5L	0,0, 5,0 L	40 500
H-2,5L	0,0, 2,5 L	5 100
H-2,5R	0,0, 2,5 R	20 300
H-5R	0,0, 5,0 R	20 300
		5 100

- 6.3.2.1. The point of intersection (HV) of lines h-h and v-v shall be situated within the isolux 80 per cent of maximum luminous intensity ($I_{\max}$)
- 6.3.2.1.1. The maximum value (I_M) shall in no circumstances exceed 215 000 cd.

- 6.3.2.1.2. The reference mark (I'_M) of this maximum intensity, referred to in paragraph 4.2.2.9 above, shall be obtained by the ratio:

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

This value shall be rounded off to the value of: 5 – 10 – 12,5 – 17,5 – 20 – 25 – 27,5 – 30 – 37,5 – 40 – 45 – 50.

- 6.3.3. The illumination or part thereof emitted by the system may be automatically laterally moved (or modified to obtain an equivalent effect), provided that:
- 6.3.3.1. The system meets the requirements of the paragraphs 6.3.2.1.1 and 6.3.2.1.2 above with each lighting unit measured according to the relevant procedure indicated in Annex 9.
- 6.3.4. The system shall be so made that:
- 6.3.4.1. The lighting unit(s) of the right side and of the left side each provide at least 16 200 cd at the point HV.
- 6.3.5. If the specified beam requirements are not met, a re-aiming of the beam position within 0,5 degree up or down and/or 1 degree to the right or left, with respect to its initial aiming is allowed; in the revised position all photometric requirements shall be met. These provisions do not apply to lighting units as indicated under paragraph 6.3.1.1 of this Regulation.
- 6.3.6. In the case of adaptation of the driving-beam function the system shall meet the requirements of the above paragraphs only when it is in the maximum condition of activation.
- 6.3.7. During adaptation, the driving-beam function shall meet the requirements for all the cases of right-hand and left-hand traffic specified in Part A of Table 7 in Annex 3 to this Regulation. These requirements shall be verified during the type approval testing in conjunction with a signal generator to be provided by the applicant. This signal generator shall reproduce the signals provided by the vehicle and cause the adaptation of the driving-beam and in particular shall represent the settings so that the photometric compliance can be verified.
- 6.3.7.1. If the driving-beam function meets the requirements in Part A of Table 7 in Annex 3 to this Regulation specified for line 1 to line 3 for oncoming and preceding vehicles (symmetrical beam) the relevant information shall be noticed in the communication document in Annex 1, item 18.5.
- 6.3.7.2. If the requirements of paragraph 6.3.7 above can be met for right-hand traffic or left-hand traffic only, the relevant information shall be reported in the communication document in Annex 1, item 18.5.

6.4. Other provisions

In the case of a system or part(s) thereof with adjustable lighting units the requirements of paragraphs 6.2 (passing-beam) and 6.3 (driving-beam) are applicable for each mounting position indicated according to paragraph 2.1.3 of this Regulation (adjustment range). For verification the following procedure shall be used:

- 6.4.1. Each applied position is realized on the test goniometer with respect to a line joining the centre of reference and point HV on an aiming screen. The adjustable system or part(s) thereof is then moved into such a position that the light pattern on the screen corresponds to the relevant aiming prescriptions;
- 6.4.2. With the system or part(s) thereof initially fixed according to paragraph 6.4.1 above, the device or part(s) thereof must meet the relevant photometric requirements of paragraphs 6.2 and 6.3 above;
- 6.4.3. Additional tests shall be made after the reflector/system or part(s) thereof has been moved vertically ± 2 degrees or at least into the maximum position if less than 2 degrees, from its initial position by means of the system or part(s) thereof adjusting device. Having re-aimed the system or part(s) thereof as a whole (by means of the goniometer for example) in the corresponding opposite direction the light output in the following directions shall be controlled and lie within the required limits:
- 6.4.3.1. Passing beam: points B50L and 75R, or 50R if applicable;
Driving beam: I_M and point HV (percentage of I_M);
- 6.4.4. If the applicant has indicated more than one mounting position, the procedure of paragraphs 6.4.1 to 6.4.3 above shall be repeated for all other positions;

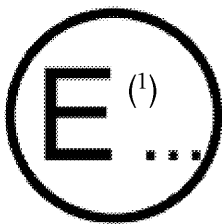
- 6.4.5. If the applicant has not asked for special mounting positions, the system or part(s) thereof shall be aimed for measurements of paragraphs 6.2 (passing-beam) and 6.3 above (driving-beam) with the relevant adjusting device(s) of the system or part(s) thereof in its mean position. The additional test of paragraph 6.4.3 above shall be made with the system or part(s) thereof, moved into its extreme positions (instead of ± 2 degrees) by means of the relevant adjusting device(s).
- 6.4.6. It shall be stated by means of a form conforming to the model in Annex 1 to this Regulation, which lighting unit(s) provide a 'cut-off' as defined in Annex 8 to this Regulation, that projects into a zone extending from 6 degrees left to 4 degrees right and upwards from a horizontal line positioned at 0,8 degree down.
- 6.4.7. It shall be stated by means of a form conforming to the model in Annex 1 to this Regulation, which Class E passing-beam mode(s), if any, comply with a 'data set' of Table 6 of Annex 3 to this Regulation.
7. COLOUR
- 7.1. The colour of the light emitted shall be white.
- C. FURTHER ADMINISTRATIVE PROVISIONS
8. MODIFICATION OF THE SYSTEM TYPE AND EXTENSION OF APPROVAL
- 8.1. Every modification of the system type shall be notified to the Type Approval Authority which approved the system type. The said Authority may then either:
- 8.1.1. Consider that the modifications made are unlikely to have appreciable adverse effects and that in any event the system still complies with the requirements; or
- 8.1.2. Require a further test report from the Technical Service responsible for conducting the tests.
- 8.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 4.1.4 above to the Contracting Parties to the Agreement which apply this Regulation.
- 8.3. The Type Approval Authority issuing the extension of approval shall assign a series number to each communication form drawn up for such an extension and inform thereof the other Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.
9. CONFORMITY OF PRODUCTION
- The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2) with the following requirements:
- 9.1. A system approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraphs 6 and 7 above.
- 9.2. The minimum requirements for conformity of production control procedures set forth in Annex 5 to this Regulation shall be complied with.
- 9.3. The minimum requirements for sampling by an inspector set forth in Annex 7 to this Regulation shall be complied with.
- 9.4. The Type Approval Authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be once every two years.
- 9.5. Systems or part(s) thereof with apparent defects are disregarded.
- 9.6. The reference mark is disregarded.
10. PENALTIES FOR NON-CONFORMITY OF PRODUCTION
- 10.1. The approval granted in respect of a type of system pursuant to this Regulation may be withdrawn if the requirements are not complied with or if a system or part(s) thereof bearing the approval mark does not conform to the type approved.
- 10.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

11. PRODUCTION DEFINITELY DISCONTINUED
 - 11.1. If the holder of the approval completely ceases to manufacture a type of system approved in accordance with this Regulation, he shall so inform the Type Approval Authority, which granted the approval. Upon receiving the relevant communication, that Authority shall inform thereof the other Contracting Parties to the 1958 agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.
 12. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF TYPE APPROVAL AUTHORITIES
 - 12.1. The Contracting Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, or production definitively discontinued, issued in other countries, are to be sent.
 13. TRANSITIONAL PROVISIONS
 - 13.1. From the date of entry into force of the 01 series of amendments to this Regulation, no Contracting Party applying it shall refuse to grant approvals under this Regulation as amended by the 01 series of amendments.
 - 13.2. Until 60 months after the date of entry into force of the 01 series of amendments to this Regulation with regard to the changes introduced by the 01 series of amendments concerning the photometric testing procedures involving the use of the spherical coordinate system and the specification of luminous intensity values, and in order to allow the Technical Services to update their testing equipment, no Contracting Party applying this Regulation shall refuse to grant approvals under this Regulation as amended by the 01 series of amendments where existing testing equipment is used with suitable conversion of the values, to the satisfaction of the authority responsible for type approval.
 - 13.3. As from 60 months after the date of entry into force of the 01 series of amendments, Contracting Parties applying this Regulation shall grant approvals only if the system meets the requirements of this Regulation as amended by the 01 series of amendments.
 - 13.4. Existing approvals for systems already granted under this Regulation before the date of entry into force of the 01 series of amendments shall remain valid indefinitely.
 - 13.5. Contracting Parties applying this Regulation shall not refuse to grant extensions of approvals to the preceding series to this Regulation.
-

ANNEX 1

COMMUNICATION

(Maximum format: A4 (210 × 297 mm))



issued by: Name of administration

.....

.....

.....

Concerning ⁽²⁾: Approval granted

Approval extended

Approval refused

Approval withdrawn

Production definitively discontinued

of a type of system pursuant to Regulation No 123

Approval No Extension No

1. Trade name or mark of the system:
2. Manufacturer's name for the type of system:
3. Manufacturer's name and address:
4. If applicable, name and address of manufacturer's representative:
5. Submitted for approval on:
6. Technical Service responsible for conducting approval tests:
7. Date of report issued by that Service:
8. Number of report issued by that Service:
9. Brief description:
- 9.1. Category as described by the relevant marking ⁽³⁾
- 9.2. Number and category(ies) of replaceable light sources
- 9.2.1. Number and specific identification code(s) of LED module(s) and for each LED module a statement whether it is replaceable or not:

Number	Identification	Replaceable
		Yes/No ⁽²⁾

- 9.2.2. Number and specific identification code(s) of electronic light source control gear(s), if applicable.....
- 9.2.3. Total objective luminous flux as described in paragraph 5.1.3 exceeds 2 000 lumens: yes/no ⁽²⁾
- 9.3. (a) Indications according to paragraph 6.4.6 of this Regulation (which lighting unit(s) provide a 'cut-off' as defined in Annex 8 to this Regulation, that projects into a zone extending from 6 degrees left to 4 degrees right and upwards from a horizontal line positioned at 0,8 degree down)

- (b) The adjustment of the 'cut-off' has been determined at 10 m/25 m².
- (c) The determination of the minimum sharpness of the 'cut-off' has been carried out at 10 m/25 m².
- 9.4. The vehicle(s) for which the system is intended as original equipment
- 9.5. Whether approval is sought for a system which is not intended to be included as part of the approval of a vehicle type according to Regulation No 48: yes/no ⁽²⁾
- 9.5.1. If in the affirmative: information sufficient to identify the vehicle(s) for which the system is intended
- 9.6. Indications according to paragraph 6.4.7 of this Regulation (which Class E passing-beam mode(s), if any, comply with a 'data set' of Table 6 of Annex 3 to this Regulation)
- 9.7. Whether approval is sought for a system intended to be installed on vehicles only, which provide means for a stabilization/limitation of the system's supply: yes/no ⁽²⁾
- 9.8. The adjustment of the 'cut-off' has been determined at 10 m/25 m².
The determination of the minimum sharpness of the 'cut-off' has been carried out at 10 m/25 m².
10. Approval mark(s) position(s):
11. Reason(s) for extension of approval:
12. Approval granted/extended/refused/withdrawn ⁽²⁾
13. Place:
14. Date:
15. Signature:
16. The list of documents deposited with the Type Approval Authority, which has granted approval is annexed to this communication and may be obtained on request.
17. The system is designed to provide passing-beams of ⁽⁴⁾:
- 17.1. Class C ☐ Class V ☐ Class E ☐ Class W ☐
- 17.2. With the following mode(s), identified by the designation(s), if it applies ⁽⁵⁾
- | | | | |
|---------------|---------------|---------------|---------------|
| Mode No C 1 | Mode No V ... | Mode No E ... | Mode No W ... |
| Mode No C ... | Mode No V ... | Mode No E ... | Mode No W ... |
| Mode No C ... | Mode No V ... | Mode No E ... | Mode No W ... |
- 17.3. Where the lighting units, indicated below are energized ⁽⁴⁾ ⁽⁵⁾ ⁽⁶⁾ for the mode No
- (a) If no bend lighting applies:
- | | | | | | | |
|------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Left side | No 1 ☐ | No 3 ☐ | No 5 ☐ | No 7 ☐ | No 9 ☐ | No 11 ☐ |
| Right side | No 2 ☐ | No 4 ☐ | No 6 ☐ | No 8 ☐ | No 10 ☐ | No 12 ☐ |
- (b) If bend lighting of category 1 applies:
- | | | | | | | |
|------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Left side | No 1 ☐ | No 3 ☐ | No 5 ☐ | No 7 ☐ | No 9 ☐ | No 11 ☐ |
| Right side | No 2 ☐ | No 4 ☐ | No 6 ☐ | No 8 ☐ | No 10 ☐ | No 12 ☐ |
- (c) If bend lighting of category 2 applies:
- | | | | | | | |
|------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Left side | No 1 ☐ | No 3 ☐ | No 5 ☐ | No 7 ☐ | No 9 ☐ | No 11 ☐ |
| Right side | No 2 ☐ | No 4 ☐ | No 6 ☐ | No 8 ☐ | No 10 ☐ | No 12 ☐ |
- Note: Indications according to subparagraphs 17.3(a) through 17.3(c) above are needed additionally for each further mode.
- 17.4. The lighting units marked below are energized, when the system is in its neutral state ⁽⁴⁾ ⁽⁶⁾
- | | | | | | | |
|------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|
| Left side | No 1 ☐ | No 3 ☐ | No 5 ☐ | No 7 ☐ | No 9 ☐ | No 11 ☐ |
| Right side | No 2 ☐ | No 4 ☐ | No 6 ☐ | No 8 ☐ | No 10 ☐ | No 12 ☐ |
- 17.5. The lighting units marked below are energized, when the system is in its traffic change function ⁽⁴⁾ ⁽⁵⁾ ⁽⁶⁾

(a) If no bend lighting applies:

Left side	No 1 ☐	No 3 ☐	No 5 ☐	No 7 ☐	No 9 ☐	No 11 ☐
Right side	No 2 ☐	No 4 ☐	No 6 ☐	No 8 ☐	No 10 ☐	No 12 ☐

(b) If bend lighting of category 1 applies:

Left side	No 1 ☐	No 3 ☐	No 5 ☐	No 7 ☐	No 9 ☐	No 11 ☐
Right side	No 2 ☐	No 4 ☐	No 6 ☐	No 8 ☐	No 10 ☐	No 12 ☐

(c) If bend lighting of category 2 applies:

Left side	No 1 ☐	No 3 ☐	No 5 ☐	No 7 ☐	No 9 ☐	No 11 ☐
Right side	No 2 ☐	No 4 ☐	No 6 ☐	No 8 ☐	No 10 ☐	No 12 ☐

18. The system is designed to provide a main beam ⁽⁴⁾ ⁽⁵⁾ ⁽⁶⁾:

18.1. Yes ☐ No ☐

18.2. With the following mode(s), identified by the designation(s), if it applies:

Main beam mode No M 1

Main beam mode No M ...

Main beam mode No M ...

18.3. Where the lighting units marked below are energized, for mode No

(a) If no bend lighting applies:

Left side	No 1 ☐	No 3 ☐	No 5 ☐	No 7 ☐	No 9 ☐	No 11 ☐
Right side	No 2 ☐	No 4 ☐	No 6 ☐	No 8 ☐	No 10 ☐	No 12 ☐

(b) If bend lighting applies:

Left side	No 1 ☐	No 3 ☐	No 5 ☐	No 7 ☐	No 9 ☐	No 11 ☐
Right side	No 2 ☐	No 4 ☐	No 6 ☐	No 8 ☐	No 10 ☐	No 12 ☐

Note: Indications according to subparagraphs 18.3(a) and 18.3(b) above are needed additionally for each further mode.

18.4. The lighting units marked below are energized, when the system is in its neutral state ⁽⁴⁾ ⁽⁶⁾

Left side	No 1 ☐	No 3 ☐	No 5 ☐	No 7 ☐	No 9 ☐	No 11 ☐
Right side	No 2 ☐	No 4 ☐	No 6 ☐	No 8 ☐	No 10 ☐	No 12 ☐

18.5. The system is designed to provide an adaptation of the driving-beam for:

Right-hand and left-hand traffic:	☐ yes	☐ no
Right-hand and left-hand traffic (symmetrical beam):	☐ yes	☐ no
Right-hand traffic only:	☐ yes	☐ no
Left-hand traffic only:	☐ yes	☐ no

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

⁽²⁾ Strike out what does not apply.

⁽³⁾ Indicate the appropriate marking as foreseen according to this Regulation for each installation unit or assembly of installation units.

⁽⁴⁾ Mark with an X where applicable.

⁽⁵⁾ To be extended if more modes are provided.

⁽⁶⁾ To be continued if more units are provided.

ANNEX 2

EXAMPLES OF ARRANGEMENTS OF APPROVAL MARKS

Example 1

$a \geq 8 \text{ mm}$ (on glass)
 $a \geq 5 \text{ mm}$ (on plastic material)

Figure 1

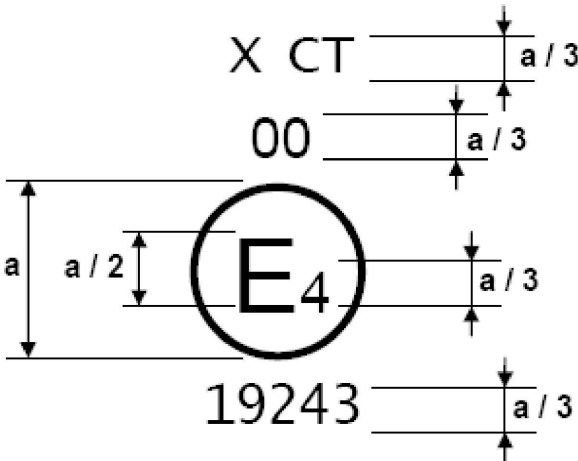
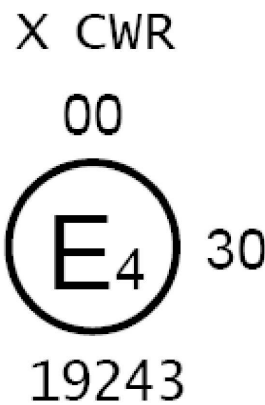


Figure 2



The installation unit of a system, bearing one of the above approval marks has been approved in the Netherlands (E 4) pursuant to this Regulation under approval number 19243, meeting the requirements of this Regulation in its original form (00). The passing-beam is designed for right-hand traffic only. The letters 'CT' (Figure 1) indicate that it concerns a passing-beam with bending mode and the letters 'CWR' (Figure 2) indicate that it concerns a Class C passing-beam and a Class W passing-beam and a driving-beam.

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

Note: The approval number and additional symbols shall be placed close to the circle surrounding the letter 'E' and either above or below that letter 'E', or to the right or left of that letter. The digits of the approval number shall be on the same side of that letter 'E' and face in the same direction.

The use of Roman numerals as approval numbers should be avoided so as to prevent any confusion with other symbols.

Example 2

Figure 3

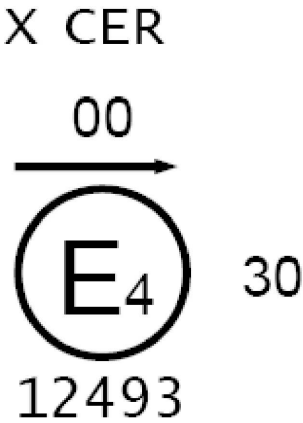


Figure 4a

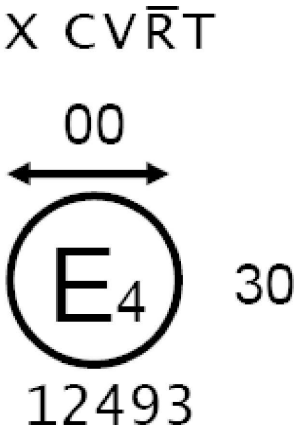
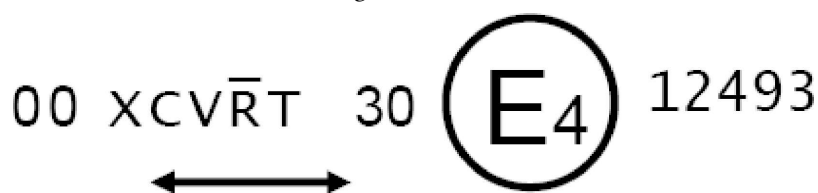


Figure 4b



The installation unit of a system, bearing the above approval mark, meets the requirements of this Regulation in respect of both the passing-beam and the driving-beam and is designed:

Figure 3: Class C passing-beam with Class E passing-beam for left-hand traffic only.

Figures 4a and 4b: Class C passing-beam with Class V passing-beam for both traffic systems by means of an appropriate adjustment of the setting of the optical element or the light source on the vehicle, and a driving-beam. Class C passing-beam, Class V passing-beam and driving-beam comply to bending lighting provisions, as indicated by the letter 'T'. The score above the letter 'R' indicates that the driving-beam function is provided by more than one installation unit on that side of the system.

Example 3

Figure 5

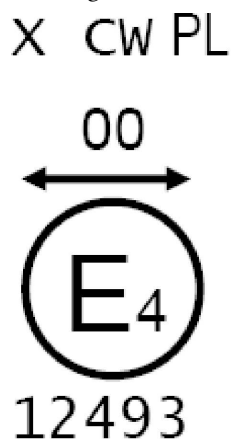
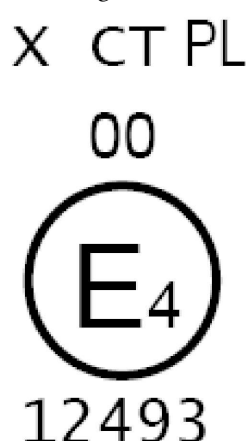


Figure 6



The installation unit, bearing the above approval mark is incorporating a lens of plastic material and meeting the requirements of this Regulation in respect of the passing-beam only and is designed:

Figure 5: Class C passing-beam and Class W passing-beam for both traffic systems.

Figure 6: Class C passing-beam with bending mode for right-hand traffic only.

Example 4

Figure 7

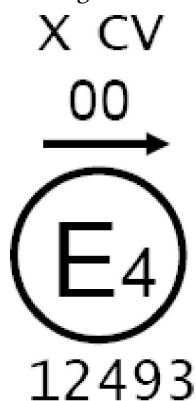


Figure 8

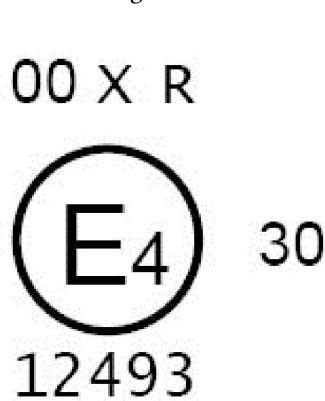


Figure 7: The installation unit, bearing this approval mark is meeting the requirements of this Regulation in respect of the Class C passing-beam with Class V passing-beam and designed for left-hand traffic only.

Figure 8: The installation unit, bearing this approval mark is a (separate) installation unit of a system, meeting the requirements of this Regulation in respect of the driving-beam only.

Example 5

Identification of an installation unit incorporating a lens of plastic material meeting the requirements of this Regulation.

Figure 9

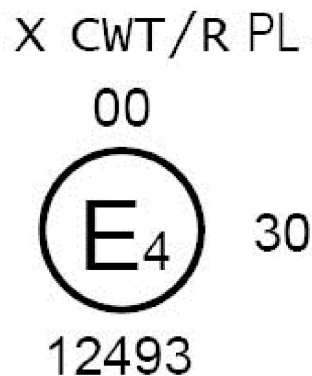


Figure 10

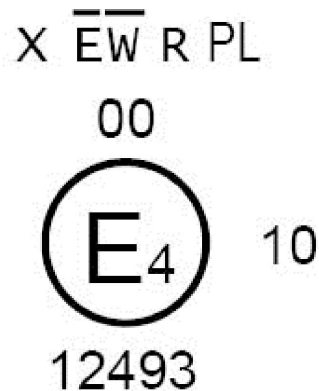


Figure 9: In respect to the Class C passing-beam, the Class W passing-beam both with bending modes and a driving-beam, and designed for right-hand traffic only.

The passing-beam and its modes shall not be operated simultaneously with the driving-beam in and/or another reciprocally incorporated headlamp.

Figure 10: In respect to the Class E passing-beam, the Class W passing-beam, designed for right-hand traffic only and a driving-beam. The score above the letters 'E' and 'W' indicates that these passing-beam classes are provided on that side of the system by more than this installation unit.

Example 6

Simplified marking for grouped, combined or reciprocally incorporated lamps, when approved according to other than this Regulation (Figure 11). (The vertical and horizontal lines schematise the shape of the light-signalling device. They are not part of the approval mark.)

These two examples correspond to two installation units on one side of a system, bearing an approval mark comprising (Model A and B):

Installation unit 1

A front position lamp approved in accordance with the 02 series of amendments of Regulation No 7;

One or more lighting unit(s), with a Class C passing-beam with bending mode provided to work with one or more other installation unit(s) on the same side of the system (as indicated by the score above the letter 'C') and a Class V passing-beam, both designed for right- and left-hand traffic and a driving-beam with a maximum intensity comprised between 123 625 and 145 125 candelas approved in accordance with the requirements of this Regulation in its original form (00) and incorporating a lens of plastic material;

A daytime running light approved in accordance with the original version of Regulation No 87;

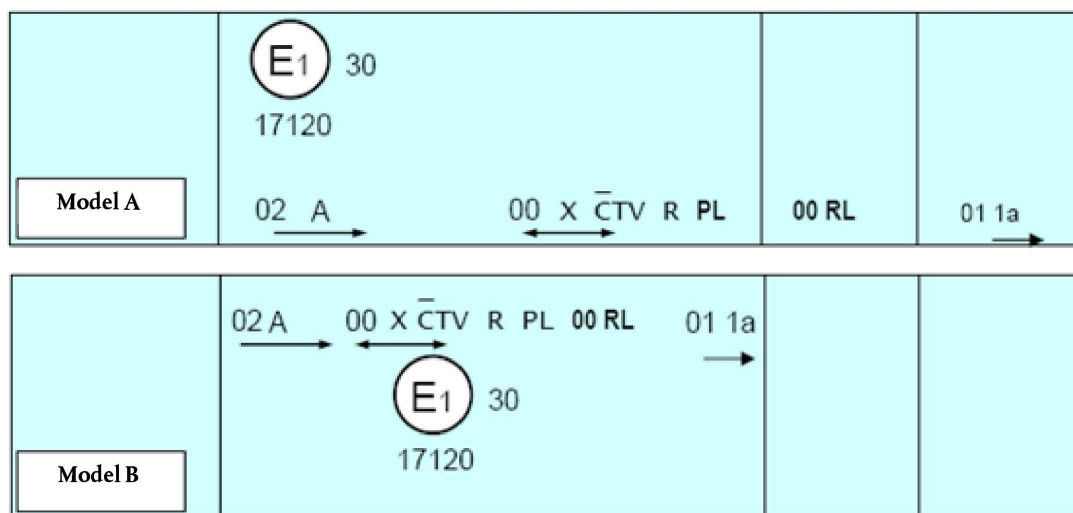
A front direction indicator lamp of category 1a approved in accordance with the 01 series of amendments to Regulation No 6.

Installation unit 3

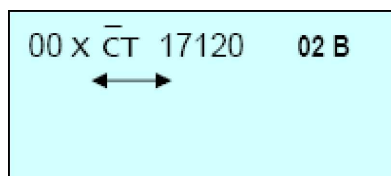
A front fog lamp approved in accordance with the 02 series of amendments to Regulation No 19, or a Class C passing-beam with bending mode, designed for right- and left-hand traffic, provided to work with one or more other installation unit(s) on that side of the system, as indicated by the score above the letter 'C'.

Figure 11

Installation unit 1 of the system

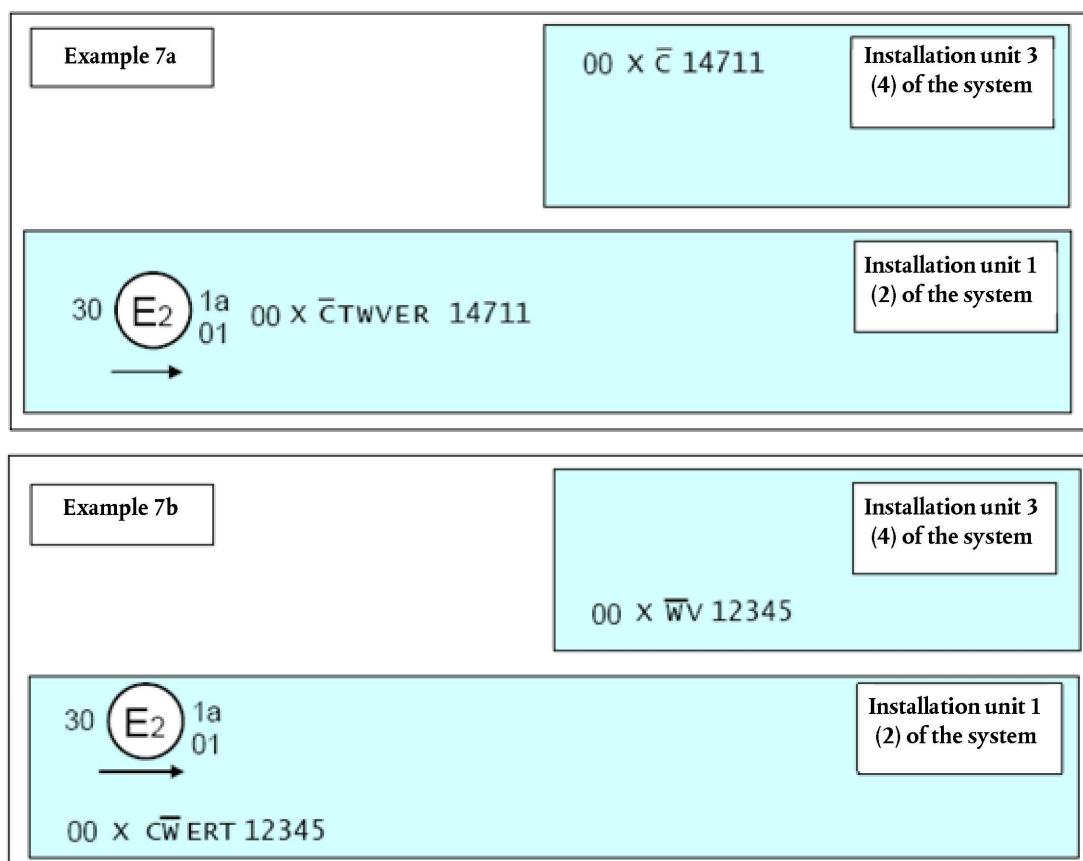


Installation unit 3 of the system

**Example 7**

Arrangement of approval marks relative to a system (Figure 12)

Figure 12



These two examples correspond to an adaptive front-lighting system composed of two installation units (providing the same functions) per side of the system (units 1 and 3 for the left side, and units 2 and 4 for the right side).

The installation unit 1 (or 2) of the system bearing the above approval marks meeting the requirements of this Regulation (00 series of amendments) in respect of both a Class C passing-beam for left-hand traffic and a driving-beam with a maximum luminous intensity comprised between 123 625 and 145 125 candelas (indicated by the number 30), grouped with a front direction indicator lamp of category 1a, approved in accordance with the 01 series of amendments of Regulation No 6.

In example 7a: the installation unit 1 (or 2) of the system comprises a Class C passing-beam with bending mode, a Class W passing-beam, a Class V passing-beam and a Class E passing-beam. The score above the letter 'C' indicates that the Class C passing-beam is provided by two installation units on that side of the system.

The installation unit 3 (or 4) is designed to provide a second part of the Class C passing-beam on that side of the system as indicated by the score above 'C'.

In example 7b: the installation unit 1 (or 2) of the system is designed to provide a Class C passing-beam, a Class W passing-beam and a Class E passing-beam. The score above the letter 'W' indicates that the Class W passing-beam is provided by two installation units on that side of the system. The letter 'T' to the right, following the listed symbols (and left of the approval number) indicates that each, the Class C passing-beam, the Class W passing-beam, the Class E passing-beam, and the driving-beam are providing a bending mode.

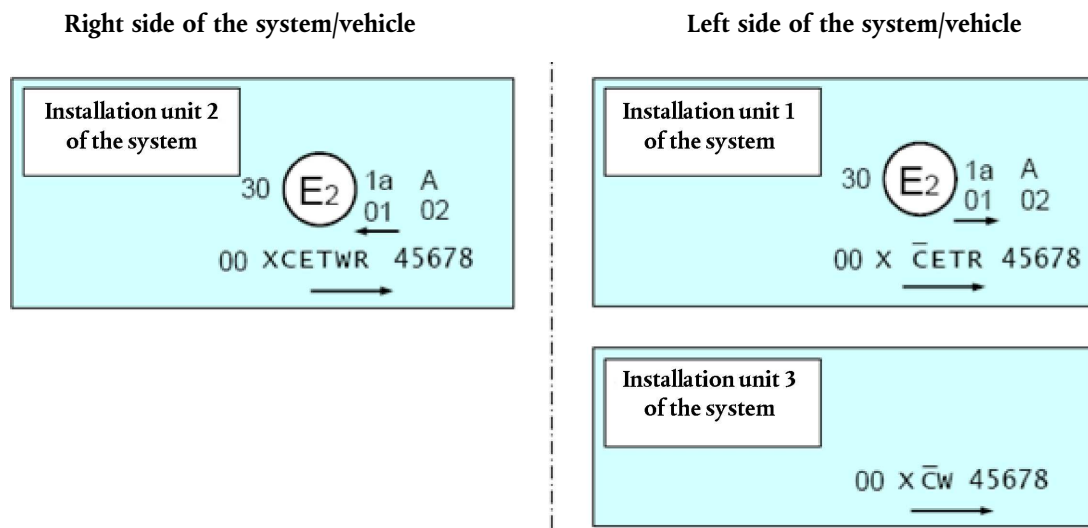
The installation unit 3 (or 4) of the system is designed to provide the second part of the Class W passing-beam on that side of the system (as indicated by the score above the letter 'W'), and the Class V passing-beam.

Example 8

Arrangement of approval marks relative to both sides of a system (Figure 13)

This example corresponds to an adaptive front-lighting system composed of two installation units for the left side of the vehicle and one installation unit for the right side.

Figure 13



The system bearing the above approval marks meets the requirements of this Regulation (original version of the Regulation) in respect of both a passing-beam for left-hand traffic and a driving-beam with a maximum intensity comprised between 86 250 and 101 250 candelas (as indicated by the number 30) grouped with a front direction indicator lamp of category 1a, approved in accordance with the 01 series of amendments of Regulation No 6 and a front position lamp approved in accordance with the 02 series of amendments of Regulation No 7.

The installation unit 1 of the system (left side) is designed to contribute to the Class C passing-beam and the Class E passing-beam. The score above the letter 'C' indicates that on that side more than one installation unit contributes to the Class C passing-beam. The letter 'T' to the right following the listed symbols indicates that each, the Class C passing-beam and the Class E passing-beam are providing a bending mode.

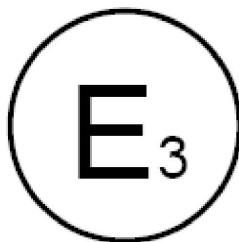
The installation unit 3 of the system (left side) is designed to provide the second part of the Class C passing-beam of that side (as indicated by the score above the letter 'C') and a Class W passing-beam.

The installation unit 2 of the system (right side) is designed to contribute to the Class C passing-beam, a Class E passing-beam, both with bending mode and a Class W passing-beam.

Note: In the above examples Nos 6 and 7, the different installation units of the system shall bear the same approval number.

Figure 14

LED modules



MD E3 17325

The LED module bearing the light source module identification code shown above has been approved together with an AFS initially approved in Italy (E 3) under approval number 17325.

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ANNEX 3

PASSING-BEAM PHOTOMETRIC REQUIREMENTS (*)

For the purpose of this annex:

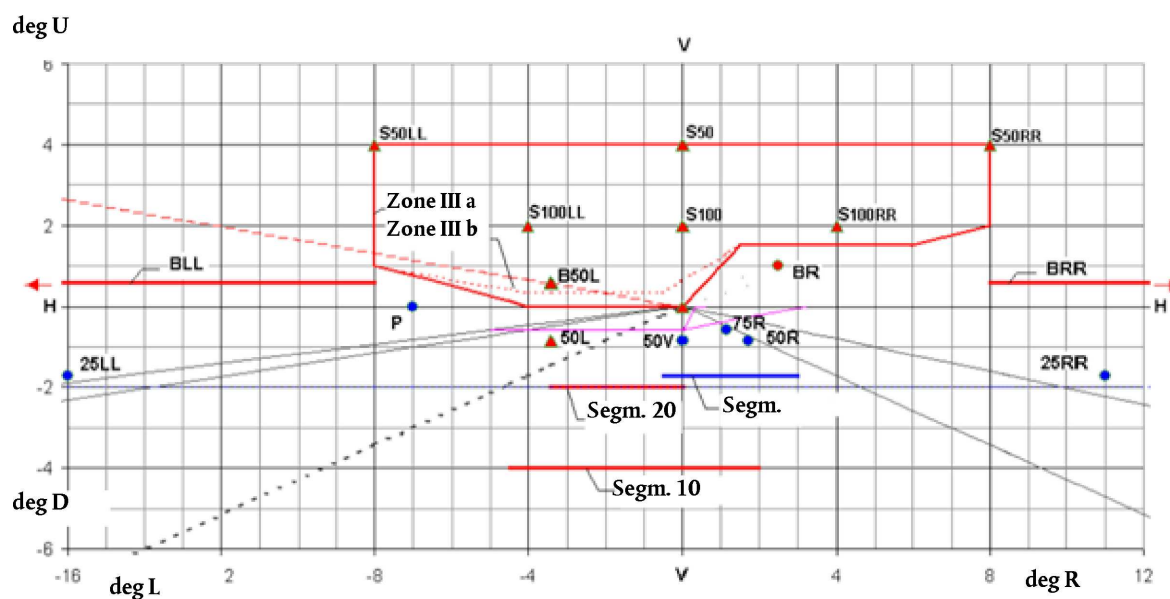
‘above it’ means vertically above, only;

‘below it’ means vertically below, only.

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

Figure 1

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



(*) Note: Measurement procedure prescribed in Annex 9 to this Regulation.

Table 1

Passing-beam photometric requirements

Tabled requirements expressed in cd		Position/deg				Passing-beam							
		horizontal			vertical	Class C		Class V		Class E		Class W	
No	Element	at/	from	to	at	min	max	min	max	min	max	min	max
1	B50L	L	3,43		U 0,57	50 ⁽⁴⁾	350	50	350	50	625 ⁽⁷⁾	50	625
2	HV	V			H	50 ⁽⁴⁾	625	50	625	50		50	
3	BR	R	2,5		U 1	50 ⁽⁴⁾	1 750	50	880	50	1 750	50	2 650
4	Segment BRR	R	8	R 20	U 0,57	50 ⁽⁴⁾	3 550		880		3 550		5 300
5	Segment BLL	L	8	L 20	U 0,57	50 ⁽⁴⁾	625		880		880		880
6	P	L	7		H	63						63	
7	Zone III (as specified by Table 3 of this annex)						625		625		880		880
8a	S50 + S50LL + S50RR ⁽⁵⁾				U 4	190 ⁽⁶⁾				190 ⁽⁶⁾		190 ⁽⁶⁾	
9a	S100 + S100LL + S100RR ⁽⁵⁾				U 2	375 ⁽⁶⁾				375 ⁽⁶⁾		375 ⁽⁶⁾	
10	50 R	R	1,72		D 0,86			5 100					
11	75 R	R	1,15		D 0,57	10 100				15 200		20 300	
12	50 V	V			D 0,86	5 100		5 100		10 100		10 100	
13	50 L	L	3,43		D 0,86	3 550	13 200 ⁽⁸⁾	3 550	13 200 ⁽⁸⁾	6 800		6 800	26 400 ⁽⁸⁾
14	25 LL	L	16		D 1,72	1 180		845		1 180		3 400	
15	25 RR	R	11		D 1,72	1 180		845		1 180		3 400	
16	Segment 20 and below it	L	3,5	V	D 2								17 600 ⁽²⁾
17	Segment 10 and below it	L	4,5	R 2,0	D 4		12 300 ⁽¹⁾		12 300 ⁽¹⁾		12 300 ⁽¹⁾		7 100 ⁽²⁾
18	I _{max} ⁽³⁾					16 900	44 100	8 400	44 100	16 900	79 300 ⁽⁷⁾	29 530	70 500 ⁽²⁾

Part A

Tabled requirements expressed in cd		Position/deg				Passing-beam							
		horizontal			vertical	Class C		Class V		Class E		Class W	
No	Element	at/	from	to	at	min	max	min	max	min	max	min	max

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

Part B	1	B50L	L	3,43		U	0,57	50 ⁽⁴⁾	530		530				790
	2	HV ⁽⁴⁾						50 ⁽⁴⁾	880		880				
	7	Zone III (as specified by Table 3 of this annex)							880		880		880		880
	13	50L	L	3,43		D	0,86	1 700		1 700		3 400		3 400	
	18	I _{max}						10 100	44 100	5 100	44 100	10 100	79 300 ⁽⁷⁾	20 300	70 500 ⁽²⁾

⁽¹⁾ Max 15 900 cd, if the system is designed to provide also a Class W passing-beam.

⁽²⁾ Requirements according to the provisions indicated in Table 4 below apply in addition

⁽³⁾ Requirements according to the provisions of Table 2 below ('Segment I_{max}') apply in addition

⁽⁴⁾ The contribution of each side of the system (for segment BLL and BRR: of at least one point), when measured according to the provisions of Annex 9 to this Regulation shall not be less than 50 cd.

⁽⁵⁾ Position requirements according to the provisions of Table 5 below.

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

⁽⁷⁾ Requirements according to the provisions indicated in Table 6 below apply in addition.

⁽⁸⁾ The max. value may be multiplied by 1,4, if it is guaranteed according to the manufacturer's description that this value will not be exceeded in use, either by means of the system or, if the system's use is confined to vehicles, providing a corresponding stabilization/limitation of the system's supply, as indicated in the communication form.

Table 2

Passing beam elements angular position/extend, additional requirements

No	Beam part designation and requirement	Class C passing-beam		Class V passing-beam		Class E passing-beam		Class W passing-beam	
		horizontal	vertical	horizontal	vertical	horizontal	vertical	horizontal	vertical
2.1.	Angular position/extend in deg for segment $I_{\max}$ The maximum luminous intensity in 'Segment $I_{\max}$ ' as indicated in this table shall be within the limits as prescribed in Table 1, Line No 18.	0,5 L to 3 R	0,3 D to 1,72 D		0,3 D to 1,72 D	0,5 L to 3 R	0,1 D to 1,72 D	0,5 L to 3 R	0,3 D to 1,72 D
2.2.	The 'cut-off' and part(s) of shall: (a) comply with the requirements of paragraph 1 of Annex 8 to this Regulation and (b) be positioned with its 'flat horizontal part'								
			at V = 0,57 D		not above 0,57 D not below 1,3 D		not above 0,23 D ⁽¹⁾ not below 0,57 D		not above 0,23 D not below 0,57 D

⁽¹⁾ Requirements according to the provisions indicated in Table 6 below apply in addition.

Table 3

Passing-beam zones III, defining corner points

Angular Position in Deg	Corner Point No	1	2	3	4	5	6	7	8
Zone III a for Class C or Class V Passing Beam	horizontal	8 L	8 L	8 R	8 R	6 R	1,5 R	V-V	4 L
	vertical	1 U	4 U	4 U	2 U	1,5 U	1,5 U	H-H	H-H
Zone III b for Class W or Class E Passing Beam	horizontal	8 L	8 L	8 R	8 R	6 R	1,5 R	0,5 L	4 L
	vertical	1 U	4 U	4 U	2 U	1,5 U	1,5 U	0,34 U	0,34 U

Table 4

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

4.1.	Definition and requirements for segments E, F1, F2, and F3 (not shown in Fig. 1 above). Not more than 175 cd is allowed: (a) on a segment E extending at U 10 deg from L 20 to R 20 deg and (b) on three vertical segments F1, F2 and F3 at horizontal positions L10 degrees, V and R 10 degrees, each extending from U 10 to U 60 degrees.
4.2.	Alternative/Additional set of requirements for $I_{\max}$, segment 20 and segment 10: Table 1 Part A or B applies, however with the max requirements in lines No 16, 17 and 18 being replaced by those indicated hereunder. If, according to the applicants specification according to paragraph 2.2.2(e) of this Regulation a Class W passing-beam is designed to produce on segment 20 and below it not more than 8 800 cd and on segment 10 and below it not more than 3 550 cd, the design value for $I_{\max}$ of that beam shall not exceed 88 100 cd.

Table 5

Overhead sign requirements, angular position of measurement points

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

Table 6

Additional provisions for Class E passing-beam

Table 1 Part A or B and Table 2 above apply, however with the lines No 1 and 18 of Table 1 and item 2.2 of Table 2 being replaced as indicated hereunder.

Item	Designation	Line 1 of Table 1 above, Part A or B	Line 18 of Table 1 above, Part A or B	Item 2.2 of Table 2 above
No	Data Set	EB50L in cd	$I_{\max}$ in cd	cut-off flat part aimed in degrees
		max	max	not above
6.1.	E1	530	70 500	0,34 D
6.2.	E2	440	61 700	0,45 D
6.3.	E3	350	52 900	0,57 D

Table 7

Requirements concerning the adaptation of the driving-beam according to paragraph 6.3.7 of this Regulation

Part A	Test point	Position/Deg.		Max. intensity (**)
		Horizontal	Vertical	(cd)
	Line 1 Left Oncoming vehicle at 50 m in the case of right-hand traffic	4,8° L to 2° L	0,57° Up	625
	Line 1 Right Oncoming vehicle at 50 m in the case of left-hand traffic	2° R to 4,8° R	0,57° Up	625
	Line 2 Left Oncoming vehicle at 100 m in the case of right-hand traffic	2,4° L to 1° L	0,3° Up	1 750
	Line 2 Right Oncoming vehicle at 100 m in the case of left-hand traffic	1° R to 2,4° R	0,3° Up	1 750
	Line 3 Left Oncoming vehicle at 200 m in the case of right-hand traffic	1,2° L to 0,5° L	0,15° Up	5 450
	Line 3 Right Oncoming vehicle at 200 m in the case of left-hand traffic	0,5° R to 1,2° R	0,15° Up	5 450

Part A	Test point	Position/Deg.		Max. intensity (**)
		Horizontal	Vertical	(cd)
	Line 4 Preceding vehicle at 50 m in the case of right-hand traffic	1,7° L to 1,0° R	0,3° Up	1 850
		> 1,0° R to 1,7° R		2 500
	Line 4 Preceding vehicle at 50 m in the case of left-hand traffic	1,7° R to 1,0° L		1 850
		> 1,0° L to 1,7° L		2 500
	Line 5 Preceding vehicle at 100 m in the case of right-hand traffic	0,9° L to 0,5° R	0,15° Up	5 300
		> 0,5° R to 0,9° R		7 000
	Line 5 Preceding vehicle at 100 m in the case of left-hand traffic	0,9° R to 0,5° L		5 300
		> 0,5° L to 0,9° L		7 000
	Line 6 Preceding vehicle at 200 m in the case of left-hand traffic and right-hand traffic	0,45° L to 0,45° R	0,1° Up	16 000
Part B	Test Point	Position/degrees (*)		Min, Intensity (**)
		Horizontal	Vertical	(cd)
	50R	1,72 R	D 0,86	5 100
	50V	V	D 0,86	5 100
	50L	3,43 L	D 0,86	2 550
	25LL	16 L	D 1,72	1 180
	25RR	11 R	D 1,72	1 180

(*) Angular positions are indicated for right-hand traffic.

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

Each of the lines defined in part A of Table 7, in conjunction with the test points as prescribed in part B of Table 7 shall be measured individually corresponding to the signal provided by the signal generator.

In the case where the passing-beam, which meets the requirements of paragraph 6.2 of this Regulation, is continuously operated in conjunction with the adaptation of the driving-beam, the photometric requirements in Part B of the Table 7 shall not be applied.

ANNEX 4

TESTS FOR STABILITY OF PHOTOMETRIC PERFORMANCE OF SYSTEMS IN OPERATION — TESTS ON COMPLETE SYSTEMS

Tests on complete systems

Once the photometric values have been measured according to the prescriptions of this Regulation, in the point of $I_{\max}$ for driving beam and in points 25L, 50V and B50L (or R), whichever applies for passing beam, a complete system sample shall be tested for stability of photometric performance in operation.

For the purpose of this annex:

- (a) 'Complete system' shall be understood to mean the complete right and left side of a system itself including electronic light source control-gear(s) and/or supply and operating device(s) and those surrounding body parts and lamps which could influence its thermal dissipation. Each installation unit of the system and lamp(s) and/or LED module, if any, of the complete system may be tested separately;
- (b) 'Test sample' in the following text means correspondingly either the 'complete system' or the installation unit under test;
- (c) The expression 'light source' shall be understood to comprise also any single filament of a filament lamp, LED modules or light emitting parts of a LED module.

The tests shall be carried out:

- (a) In a dry and still atmosphere at an ambient temperature of $23\text{ °C} \pm 5\text{ °C}$, the test sample being mounted on a base representing the correct installation on the vehicle;
- (b) In case of replaceable light sources: using a mass production filament light source, which has been aged for at least one hour, or a mass production gas-discharge light source, which has been aged for at least 15 hours or a mass production LED module which has been aged for at least 48 hours and cooled down to ambient temperature before starting the tests as specified in this Regulation. The LED modules supplied by the applicant shall be used;
- (c) In the case of a system providing an adaptation of the driving-beam, the driving-beam shall be in the maximum condition if activated.

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

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

1. Test for stability of photometric performance

1.1. Clean test sample

Each test sample shall be operated for 12 hours as described in paragraph 1.1.1 and checked as prescribed in paragraph 1.1.2 below.

1.1.1. Test procedure

1.1.1.1. Test sequence

- (a) In the case where a test sample is designed to provide only one lighting function (driving-beam or passing-beam) and not more than one class in case of passing-beam, the corresponding light source(s) is/are lit for the time ⁽¹⁾ specified in paragraph 1.1 above;

⁽¹⁾ When the 'test sample' is grouped and/or reciprocally incorporated with signalling lamps, the latter shall be lit for the duration of the test, except for a daytime running lamp. In the case of a direction indicator lamp, it shall be lit in flashing operation mode with an on/off time ratio of approximately one to one.

- (b) In the case where a test sample provides more than one function or class of passing-beam according to this Regulation: if the applicant declares that each specified function or class of passing-beam of the test sample has its own light source(s), being exclusively lit ⁽²⁾ at a time, the test shall be carried out in accordance with this condition, activating ⁽³⁾ the most power consuming mode of each specified function or class of passing-beam successively for the same (equally divided) part of the time specified in paragraph 1.1 above.

In all other cases ⁽³⁾ ⁽²⁾, the test sample shall be subjected to the following cycle test for each, the mode(s) of Class C passing-beam, the Class V passing-beam, the Class E passing-beam and the Class W passing-beam, whatever is provided or partly provided by the test sample, for the same (equally divided) part of the time specified in paragraph 1.1:

15 minutes, first, e.g. Class C passing-beam mode lit with its most power-consuming mode for straight road conditions;

5 minutes, same passing-beam mode lit as before and, additionally, all light sources ⁽⁴⁾ of the test sample, which are possible to be lit at the same time, according to the applicant's declaration;

After having reached the said (equally divided) part of the time specified in paragraph 1.1 above, the above cycle test shall be performed with the second, third and fourth class of passing-beam, if applicable, in the above order;

- (c) In the case where a test sample includes other grouped lighting function(s), all the individual functions shall be lit simultaneously for the time specified in (a) or (b) above for individual lighting functions, according to the manufacturer's specifications;
- (d) In the case of a test sample designed to provide a passing-beam bending mode or a mode or function which is activated for a short time with an additional light source being energized, said light source shall simultaneously be switched on for 1 minute, and switched off for 9 minutes during the activation of the passing-beam only, specified in (a) or (b) above.

1.1.1.2. Test voltage

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

- (a) In case of replaceable filament light source(s) operated directly under vehicle voltage system conditions: the test shall be performed at 6,3 V, 13,2 V or 28,0 V as applicable, except if the applicant specifies that the test sample may be used at a different voltage. In this case, the test shall be carried out with the filament light source operated at the highest voltage that can be used.
- (b) In case of replaceable gas discharge light source(s): The test voltage for the electronic light source control-gear is 13,2 + 0,1 volts for 12 V vehicle voltage system, or otherwise specified in the application for approval.
- (c) In the case of non-replaceable light source operated directly under vehicle voltage system conditions: All measurements on lighting units equipped with non-replaceable light sources (filament light sources and/or others) shall be made at 6,3 V, 13,2 V or 28,0 V or at other voltages according to the vehicle voltage system as specified by the applicant respectively.
- (d) In the case of light sources, replaceable or non-replaceable, being operated independently from vehicle supply voltage and fully controlled by the system, or, in the case of light sources supplied by a supply and operating device, the test voltages as specified above shall be applied to the input terminals of that device. The test laboratory may require from the manufacturer the supply and operating device or a special power supply needed to supply the light source(s).

⁽²⁾ Should additional light sources be simultaneously lit when headlamp flashing is used, this shall not be considered as being normal use of the light sources simultaneously.

⁽³⁾ When the 'test sample' is grouped and/or reciprocally incorporated with signalling lamps, the latter shall be lit for the duration of the test, except for a daytime running lamp. In the case of a direction indicator lamp, it shall be lit in flashing operation mode with an on/off time ratio of approximately one to one.

⁽⁴⁾ All light sources of lighting functions even if no approval is sought according to this Regulation must be taken into account, except those covered by footnote 2.

- (e) LED module(s) shall be measured at 6,3 V, 13,2 V or 28 V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.
- (f) Where signalling lamps are grouped, combined or reciprocally incorporated into the test sample and operating at voltages other than the nominal rated voltages of 6 V, 12 V or 24 V respectively, the voltage shall be adjusted as declared by the manufacturer for the correct photometric functioning of that lamp.

1.1.2. Test results

1.1.2.1. Visual inspection:

Once the test sample has been stabilized to the ambient temperature, the test sample lens and the external lens, if any, shall be cleaned with a clean, damp cotton cloth. It shall then be inspected visually; no distortion, deformation, cracking or change in colour of either the test sample lens or the external lens, if any, shall be noticeable.

1.1.2.2. Photometric test:

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

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

Driving-beam, under neutral state conditions: point of $I_{\max}$.

Another aiming may be carried out to allow for any deformation of the test sample base due to heat (the change of the position of the cut-off line is covered in paragraph 2 of this annex).

Except for points B50L, a 10 per cent discrepancy between the photometric characteristics and the values measured prior to the test is permissible including the tolerances of the photometric procedure. The value measured at point B50L shall not exceed the photometric value measured prior to the test by more than 170 cd.

1.2. Dirty test sample

After being tested as specified in paragraph 1.1 above, the test sample shall be operated for one hour as described in paragraph 1.1.1 for each function or class of passing-beam ⁽⁵⁾, after being prepared as prescribed in paragraph 1.2.1, and checked as prescribed in paragraph 1.1.2; after each test a sufficient cooling down period must be assured.

1.2.1. Preparation of the test sample

Test mixture

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

9 parts by weight of silica sand with a particle size of 0-100 micro meter;

1 part by weight of vegetable carbon dust produced from beech wood with a particle size of 0-100 micro meter;

0,2 parts by weight of NaCMC ⁽⁶⁾, and

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

an appropriate quantity of distilled water with a conductivity of less than 1 $\mu\text{S}/\text{m}$.

⁽⁵⁾ The Class W passing-beam, if any, is disregarded for lighting units providing or contributing to any other passing-beam class or lighting function.

⁽⁶⁾ NaCMC represents the sodium salt of carboxymethylcellulose, customarily referred to as CMC. The NaCMC used in the dirt mixture shall have a degree of substitution (DS) of 0,6-0,7 and a viscosity of 200-300 cP for a 2 per cent solution at 20 °C.

- 1.2.1.2. For a system or parts thereof with the outside lens in plastic material, the mixture of water and polluting agent to be applied to the test sample shall be composed of:
- (a) 9 parts by weight of silica sand with a particle size of 0-100 µm;
 - (b) 1 part by weight of vegetal carbon dust produced from beech wood with a particle size of 0-100 µm;
 - (c) 0,2 part by weight of NaCMC ⁽⁷⁾;
 - (d) 5 parts by weight of sodium chloride (pure at 99 per cent);
 - (e) 13 parts by weight of distilled water with a conductivity of ≤ 1 mS/m;
 - (f) 2 ± 1 drops of surfactant ⁽⁸⁾.

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

1.2.1.4. Application of the test mixture to the test sample

The test mixture shall be uniformly applied to the entire light-emitting surface(s) of the test sample and then left to dry. This procedure shall be repeated until the illuminating value has dropped to 15-20 per cent of the values measured for each following point under the conditions described in this annex:

Point $I_{\max}$ in driving beam, under neutral state conditions;

50V for a class C passing beam, and each specified passing beam mode.

2. Test for change in vertical position of the 'cut-off' line under the influence of heat

This test consists of verifying that the vertical drift of the cut-off line under the influence of heat does not exceed a specified value for a system or part(s) of emitting a Class C (basic) passing-beam, or each specified passing-beam mode.

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

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

If the test sample has a moving optical part, only the position closest to the average vertical angular stroke and/or the initial position according to the neutral state is chosen for this test.

The test is confined to signal input conditions corresponding to a straight road, only.

2.1. Test

For the purpose of this test, the voltage shall be adjusted as specified in paragraph 1.1.1.2 above.

The test sample shall be operated and tested on Class C passing-beam, Class V passing-beam, Class E passing-beam and Class W passing-beam, whatever applies.

The position of the cut-off line in its horizontal part between VV and the vertical line passing through point B50L (or R) shall be verified 3 minutes (r_3) and 60 minutes (r_{60}) respectively after operation.

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

2.2. Test results

2.2.1. The result expressed in milliradians (mrad) shall be considered as acceptable for a passing beam headlamp when the absolute value $\Delta r_1 = |r_3 - r_{60}|$ recorded on the headlamp is not more than 1,0 mrad ($\Delta r_1 \leq 1,0$ mrad) upward and not more than 2,0 mrad ($\Delta r_1 \leq 2,0$ mrad) downwards.

⁽⁷⁾ NaCMC represents the sodium salt of carboxymethylcellulose, customarily referred to as CMC. The NaCMC used in the dirt mixture shall have a degree of substitution (DS) of 0,6-0,7 and a viscosity of 200-300 cP for a 2 per cent solution at 20 °C.

⁽⁸⁾ The tolerance on quantity is due to the necessity of obtaining dirt that correctly spreads out on all types of plastic lens

2.2.2. However, if this value is:

Movement	
Upward	more than 1,0 mrad but not more than 1,5 mrad (1,0 mrad < $\Delta r_l \leq 1,5$ mrad)
Downward	more than 2,0 mrad but not more than 3,0 mrad (2,0 mrad < $\Delta r_l \leq 3,0$ mrad)

A further sample of a headlamp mounted on a test fixture representative of the correct installation on the vehicle shall be tested as described in paragraph 2.1 after being subjected three consecutive times to the cycle as described below, in order to stabilize the position of mechanical parts of the headlamp:

- (a) Operation of the passing beam for one hour (the voltage shall be adjusted as specified in paragraph 1.1.1.2);
- (b) One hour period with the lamp switched off.

After these three cycles, the headlamp type shall be considered as acceptable if the absolute values Δr measured according to paragraph 2.1 above on this further sample meet the requirements in paragraph 2.2.1 above.

ANNEX 5

MINIMUM REQUIREMENTS FOR CONFORMITY OF PRODUCTION CONTROL PROCEDURES

1. GENERAL

1.1. The conformity requirements shall be considered satisfied from a mechanical and a geometrical standpoint, if the differences do not exceed inevitable manufacturing deviations within the requirements of this Regulation. This condition also applies to colour.

1.2. With respect to photometric performances, the conformity of mass-produced systems shall not be contested if, when testing photometric performances of any system chosen at random and equipped with a light source energized, and if applicable corrected, as prescribed in paragraphs 1 and 2 of Annex 9 to this Regulation:

1.2.1. No value measured and corrected according to the prescriptions of paragraph 2 of Annex 9 to this Regulation deviates unfavourably by more than 20 per cent from the value prescribed in this Regulation:

1.2.1.1. For the following values of the passing beam and its modes, the maximum unfavourable deviation may be respectively:

- (a) Maximum values at point B50L 170 cd equivalent 20 per cent and 255 cd equivalent 30 per cent;
- (b) Maximum values at zone III and segment BLL: 255 cd equivalent 20 per cent and 380 cd equivalent 30 per cent;
- (c) Maximum values at segments E, F1, F2 and F3: 170 cd equivalent 20 per cent and 255 cd equivalent 30 per cent;
- (d) Minimum values at BR, P, at the groups S 50+ S 50LL+ S 50RR, S 100+ S 100LL+ S 100RR, and those required by footnote 4 of Table 1 in Annex 3 of this Regulation (B50L, BR, BRR, BLL): half of the required value equivalent 20 per cent and three quarter of the required value equivalent 30 per cent.

1.2.1.2. For the driving-beam, HV being situated within the isolux $0,75 I_{\max}$, a tolerance of +20 per cent for maximum values and -20 per cent for minimum values is observed for the photometric values at any measuring point specified in paragraph 6.3.2 of this Regulation.

1.2.2. If the results of the test described above do not meet the requirements, the alignment of the system may be changed, provided that the axis of the beam is not displaced laterally by more than 0,5 degree to the right or left and not by more than 0,2 degree up and down, each independently and with respect to the first aiming.

These provisions do not apply to lighting units as indicated under paragraph 6.3.1.1 of this Regulation.

1.2.3. If the results of the tests described above do not meet the requirements, tests shall be repeated using another standard (étalon) light source and/or another supply and operating device.

1.3. With respect to the verification of the change in vertical position of the 'cut-off' line for passing-beam under the influence of heat, the following procedure shall be applied:

One of the sampled systems shall be tested according to the procedure described in paragraph 2.1 of Annex 4 after being subjected three consecutive times to the cycle described in paragraph 2.2.2 of Annex 4.

The system shall be considered as acceptable if Δr does not exceed 1,5 mrad.

If this value exceeds 1,5 mrad but is not more than 2,0 mrad, a second sample shall be subjected to the test after which the mean of the absolute values recorded on both samples shall not exceed 1,5 mrad.

1.4. The chromaticity coordinates shall be conformed to.

2. MINIMUM REQUIREMENTS FOR VERIFICATION OF CONFORMITY BY THE MANUFACTURER

For each type of system the holder of the approval mark shall carry out at least the following tests, at appropriate intervals. The tests shall be carried out in accordance with the provision of this Regulation.

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

2.1. Nature of tests

Tests of conformity in this Regulation shall cover the photometric characteristics and the verification of the change in vertical position of the cut-off line for passing-beam under the influence of heat.

2.2. Methods used in tests

2.2.1. Tests shall generally be carried out in accordance with the methods set out in this Regulation.

2.2.2. In any test of conformity carried out by the manufacturer, equivalent methods may be used with the consent of the competent authority responsible for approval tests. The manufacturer is responsible for proving that the applied methods are equivalent to those laid down in this Regulation.

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

2.2.4. In all cases the reference methods shall be those of this Regulation, particular for the purpose of administrative verification and sampling.

2.3. Nature of sampling

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

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

2.4. Measured and recorded photometric characteristics

The sampled headlamps shall be subjected to photometric measurements at the points provided for in the Regulation, the reading being limited:

To points $I_{\max}$, HV ⁽¹⁾, 'HL' and 'HR' ⁽²⁾ in the case of a driving beam;

To points B50L, 50L, 50V, 75R if applicable, and 25LL in the case of the passing beam(s) (see Figure 1 in Annex 3).

2.5. Criteria governing acceptability

The manufacturer is responsible for carrying out a statistical study of the test results and for defining, in agreement with the Type Approval Authority, criteria governing acceptability of his products in order to meet the specification laid down for verification of conformity of products in paragraph 9.1 of this Regulation.

The criteria governing acceptability shall be such that, with a confidence level of 95 per cent, the minimum probability of passing a spot check in accordance with Annex 7 (first sampling) would be 0,95.

⁽¹⁾ When the driving beam is reciprocally incorporated with the passing beam, HV in the case of the driving beam shall be the same measuring point as in the case of the passing beam.

⁽²⁾ 'HL' and 'HR': points on 'H-H' located at 2,6 degrees to the left and to the right of point HV respectively.

ANNEX 6

REQUIREMENTS FOR SYSTEMS INCORPORATING LENSES OF PLASTIC MATERIAL: TESTING OF LENS OR MATERIAL SAMPLES AND COMPLETE SYSTEMS OR PART(S) OF SYSTEMS**1. GENERAL SPECIFICATIONS**

- 1.1. The samples supplied pursuant to paragraph 2.2.4 of this Regulation shall satisfy the specifications indicated in paragraphs 2.1 to 2.5 below.
- 1.2. The set of samples of complete systems or part thereof supplied pursuant to paragraph 2.2.3 of this Regulation and incorporating lenses of plastic material shall, with regard to the lens material, satisfy the specifications indicated in paragraph 2.6 below.
- 1.3. The samples of lenses of plastic material or samples of material shall be subjected, with the reflector to which they are intended to be fitted (where applicable), to approval tests in the chronological order indicated in Table A reproduced in Appendix 1 to this annex.
- 1.4. However, if the system manufacturer can prove that the product has already passed the tests prescribed in paragraphs 2.1 to 2.5 below, or the equivalent tests pursuant to another Regulation, those tests do not need to be repeated; only the tests prescribed in Appendix 1, Table B, shall be mandatory.
- 1.5. If the system or part thereof is designed for right-hand installation only, or for left-hand installation only, tests pursuant to this annex may be done on one sample only, at the choice of the applicant.

2. TESTS**2.1. Resistance to temperature changes****2.1.1. Tests**

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

3 hours at $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and 85-95 per cent RH;

1 hour at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and 60-75 per cent RH;

15 hours at $-30\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$;

1 hour at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and 60-75 per cent RH;

3 hours at $80\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$;

1 hour at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and 60-75 per cent RH;

Before this test, the samples shall be kept at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and 60-75 per cent RH for at least four hours.

Note: The periods of one hour at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ shall include the periods of transition from one temperature to another which are needed in order to avoid thermal shock effects.

2.1.2. Photometric measurements**2.1.2.1. Method**

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

These measurements shall be made according to Annex 9 to this Regulation, at the following points:

B50L and 50V for the class C passing beam lighting;

I_{max} for the driving beam of a system.

2.1.2.2. Results

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

2.2. Resistance to atmospheric and chemical agents

2.2.1. Resistance to atmospheric agents

Three new samples (lenses or samples of material) shall be exposed to radiation from a source having a spectral energy distribution similar to that of a black body at a temperature between 5 500 K and 6 000 K. Appropriate filters shall be placed between the source and the samples so as to reduce as far as possible radiation with wave lengths smaller than 295 nm and greater than 2 500 nm. The samples shall be exposed to an energetic illumination of $1\,200\text{ W/m}^2 \pm 200\text{ W/m}^2$ for a period such that the luminous energy that they receive is equal to $4\,500\text{ MJ/m}^2 \pm 200\text{ MJ/m}^2$. Within the enclosure, the temperature measured on the black panel placed on a level with the samples shall be $50\text{ °C} \pm 5\text{ °C}$. In order to ensure a regular exposure, the samples shall revolve around the source of radiation at a speed between 1 and 5 min^{-1} .

The samples shall be sprayed with distilled water of conductivity lower than 1 mS/m at a temperature of $23\text{ °C} \pm 5\text{ °C}$, in accordance with the following cycle:

Spraying: 5 minutes; drying: 25 minutes.

2.2.2. Resistance to chemical agents

After the test described in paragraph 2.2.1 above and the measurement described in paragraph 2.2.3.1 below have been carried out, the outer face of the said three samples shall be treated as described in paragraph 2.2.2.2 with the mixture defined in paragraph 2.2.2.1 below.

2.2.2.1. Test mixture

The test mixture shall be composed of 61,5 per cent n-heptane, 12,5 per cent toluene, 7,5 per cent ethyl tetrachloride, 12,5 per cent trichloroethylene and 6 per cent xylene (volume per cent).

2.2.2.2. Application of the test mixture

Soak a piece of cotton cloth (as per ISO 105) until saturation with the mixture defined in paragraph 2.2.2.1 above and, within 10 seconds, apply it for 10 minutes to the outer face of the sample at a pressure of 50 N/cm², corresponding to an effort of 100 N applied on a test surface of 14 × 14 mm.

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

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

2.2.2.3. Cleaning

At the end of the application of the test mixture, the samples shall be dried in the open air and then washed with the solution described in paragraph 2.3 (Resistance to detergents and hydrocarbons) at $23\text{ °C} \pm 5\text{ °C}$. Afterwards the samples shall be carefully rinsed with distilled water containing not more than 0,2 per cent impurities at $23\text{ °C} \pm 5\text{ °C}$ and then wiped off with a soft cloth.

2.2.3. Results

2.2.3.1. After the test of resistance to atmospheric agents, the outer face of the samples shall be free from cracks, scratches, chipping and deformation, and the mean variation in transmission $\Delta t = (T_2 - T_3)/T_2$ measured on the three samples according to the procedure described in Appendix 2 to this annex shall not exceed 0,020 ($\Delta t_m < 0,020$).

2.2.3.2. After the test of resistance to chemical agents, the samples shall not bear any traces of chemical staining likely to cause a variation of flux diffusion, whose mean variation $\Delta d = (T_5 - T_4)/T_2$ measured on the three samples according to the procedure described in Appendix 2 to this annex shall not exceed 0,020 ($\Delta d_m < 0,020$).

2.2.4. Resistance to light source radiation

If necessary the following test shall be done:

Flat samples of each light transmitting plastic component of the system are exposed to the light of the light source. The parameters such as angles and distances of those samples shall be the same as in the system. These samples shall have the same colour and surface treatment, if any, as the parts of the system.

After 1 500 hours of continuous exposure, the colorimetric specification of the transmitted light must be met with a new light source, and the surface of the samples shall be free of cracks, scratches, scaling or deformation.

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

2.3. Resistance to detergents and hydrocarbons

2.3.1. Resistance to detergents

The outer face of three samples (lenses or samples of material) shall be heated to $50\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and then immersed for five minutes in a mixture maintained at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ and composed of 99 parts distilled water containing not more than 0,02 per cent impurities and one part alkylaryl sulphonate.

At the end of the test, the samples shall be dried at $50\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. The surface of the samples shall be cleaned with a moist cloth.

2.3.2. Resistance to hydrocarbons

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

2.3.3. Results

After the above two tests have been performed successively, the mean value of the variation in transmission $\Delta t = (T_2 - T_3)/T_2$ measured on the three samples according to the procedure described in Appendix 2 to this annex shall not exceed 0,010 ($\Delta t_m \leq 0,010$).

2.4. Resistance to mechanical deterioration

2.4.1. Mechanical deterioration method

The outer face of the three new samples (lenses) shall be subjected to the uniform mechanical deterioration test by the method described in Appendix 3 to this annex.

2.4.2. Results

After this test, the variations:

In transmission: $\Delta t = (T_2 - T_3)/T_2$

And in diffusion: $\Delta d = (T_5 - T_4)/T_2$

Shall be measured according to the procedure described in Appendix 2 in the area specified in paragraph 2.2.4.1.1 of this Regulation. The mean value of the three samples shall be such that:

$\Delta t_m \leq 0,100$; $\Delta d_m \leq 0,050$.

2.5. Test of adherence of coatings, if any

2.5.1. Preparation of the sample

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

2.5.2. Description of the test

Use an adhesive tape with a force adhesion of $2\text{ N}/(\text{cm of width}) \pm 20\text{ per cent}$ measured under the standardized conditions specified in Appendix 4 to this annex. This adhesive tape, which shall be at least 25 mm wide, shall be pressed for at least five minutes to the surface prepared as prescribed in paragraph 2.5.1 above.

Then the end of the adhesive tape shall be loaded in such a way that the force of adhesion to the surface considered is balanced by a force perpendicular to that surface. At this stage, the tape shall be torn off at a constant speed of $1,5\text{ m/s} \pm 0,2\text{ m/s}$.

2.5.3. Results

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

2.6. Tests of the complete system incorporating a lens of plastic material

2.6.1. Resistance to mechanical deterioration of the lens surface

2.6.1.1. Tests

The lens of system sample No 1 shall be subjected to the test described in paragraph 2.4.1 above.

2.6.1.2. Results

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

2.6.2. Test of adherence of coatings, if any

The lens of installation unit sample No 2 shall be subjected to the test described in paragraph 2.5 above.

3. VERIFICATION OF THE CONFORMITY OF PRODUCTION

3.1. With regard to the materials used for the manufacture of lenses, the installation units of a series shall be recognized as complying with this Regulation if:

3.1.1. After the test for resistance to chemical agents and the test for resistance to detergents and hydrocarbons, the outer face of the samples exhibits no cracks, chipping or deformation visible to the naked eye (see paragraphs 2.2.2, 2.3.1 and 2.3.2 of this annex);

3.1.2. After the test described in paragraph 2.6.1.1 above, the photometric values at the points of measurement considered in paragraph 2.6.1.2 are within the limits prescribed for conformity of production by this Regulation.

3.2. If the test results fail to satisfy the requirements, the tests shall be repeated on another sample of systems selected at random.

Appendix 1

CHRONOLOGICAL ORDER OF APPROVAL TESTS

A. TESTS ON PLASTIC MATERIALS (LENSES OR SAMPLES OF MATERIAL SUPPLIED PURSUANT TO PARAGRAPH 2.2.4 OF THIS REGULATION)

Samples	Lenses or samples of material										Lenses			
Tests	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.1. Limited photometry (para. 2.1.2)											X	X	X	
1.1.1. Temperature change (para. 2.1.1)											X	X	X	
1.2. Limited photometry (para. 2.1.2)											X	X	X	
1.2.1. Transmission measurement	X	X	X	X	X	X	X	X	X					
1.2.2. Diffusion measurement	X	X	X				X	X	X					
1.3. Atmospheric agents (para. 2.2.1)	X	X	X											
1.3.1. Transmission measurement	X	X	X											
1.4. Chemical agents (para. 2.2.2)	X	X	X											
1.4.1. Diffusion measurement	X	X	X											
1.5. Detergents (para. 2.3.1)				X	X	X								
1.6. Hydrocarbons (para. 2.3.2)				X	X	X								
1.6.1. Transmission measurement				X	X	X								
1.7. Deterioration (para. 2.4.1)							X	X	X					
1.7.1. Transmission measurement							X	X	X					
1.7.2. Diffusion measurement							X	X	X					
1.8. Adherence (para. 2.5)														X
1.9. Resistance to light source radiation (para. 2.2.4)										X				

B. TESTS ON COMPLETE SYSTEMS OR PART(S) THEREOF (SUPPLIED PURSUANT TO PARAGRAPH 2.2.3 OF THIS REGULATION).

Tests	Complete systems	
	Sample No	
	1	2
2.1. Deterioration (para. 2.6.1.1)	X	
2.2. Photometry (para. 2.6.1.2)	X	X
2.3. Adherence (para. 2.6.2)		

Appendix 2

METHOD OF MEASUREMENT OF THE DIFFUSION AND TRANSMISSION OF LIGHT

1. EQUIPMENT (see Figure 1 below)

The beam of a collimator K with a half divergence $\beta/2 = 17,4 \times 10^{-4}$ rad is limited by a diaphragm D_i with an opening of 6 mm against which the sample stand is placed.

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

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

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

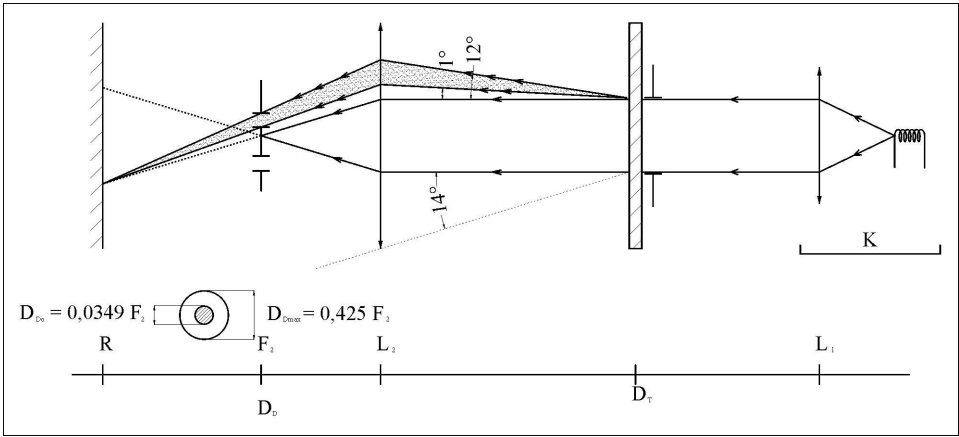
The distance $L_2 D_i$ and the focal length F_2 of the lens L_2 shall be so chosen that the image of D_i completely covers the receiver R.

For L_2 it is recommended to use a focal distance of about 80 mm.

When the initial incident flux is referred to 1 the absolute precision of each reading shall be better than 0,001.

Figure 1

Optical set up for measurement of variations in diffusion and transmission



2. MEASUREMENTS

The following readings shall be taken:

Reading	With sample	With central part of D_D	Quantity represented
T_1	No	No	Incident flux in initial reading
T_2	Yes (before test)	No	Flux transmitted by the new material in a field of 24 degrees
T_3	Yes (before test)	No	Flux transmitted by the tested material in a field of 24 degrees
T_4	Yes (before test)	Yes	Flux diffused by the new material
T_5	Yes (before test)	Yes	Flux diffused by the tested material

*Appendix 3***SPRAY TESTING METHOD****1. TEST EQUIPMENT****1.1. Spray gun**

The spray gun used shall be equipped with a nozzle 1,3 mm in diameter allowing a liquid flow rate of $0,24 \pm 0,02$ l/minute at an operating pressure of 6,0 bars – 0/+ 0,5 bar.

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

1.2. Test mixture

The test mixture shall be composed of:

Silica sand of hardness 7 on the Mohs scale, with a grain size between 0 and 0,2 mm and an almost normal distribution, with an angular factor of 1,8 to 2;

Water of hardness not exceeding 205 g/m^3 for a mixture comprising 25 g of sand per litre of water.

2. TEST

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

The deterioration shall be checked by means of one or more samples of glass placed as a reference near the lenses to be tested. The mixture shall be sprayed until the variation in the diffusion of light on the sample or samples measured by the method described in Appendix 2, is such that: $\Delta d = (T_5 - T_4)/T_2 = 0,0250 \pm 0,0025$.

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

*Appendix 4***ADHESIVE TAPE ADHERENCE TEST****1. PURPOSE**

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

2. PRINCIPLE

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

3. SPECIFIED ATMOSPHERIC CONDITIONS

The ambient conditions shall be at $23\text{ °C} \pm 5\text{ °C}$ and 65 ± 15 per cent relative humidity.

4. TEST PIECES

Before the test, the sample roll of adhesive tape shall be conditioned for 24 hours in the specified atmosphere (see paragraph 3 above).

Five test pieces each 400 mm long shall be tested from each roll. These test pieces shall be taken from the roll after the first three turns were discarded.

5. PROCEDURE

The test shall be performed under the ambient conditions specified in paragraph 3 above.

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

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

Leave the assembly in the specified atmospheric conditions for 10 minutes.

Unstick about 25 mm of the test piece from the plate in a plane perpendicular to the axis of the test piece.

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

Pull to unstick at a speed of $300\text{ mm/s} \pm 30\text{ mm/s}$ and record the force required.

6. RESULTS

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

ANNEX 7

MINIMUM REQUIREMENTS FOR SAMPLING BY AN INSPECTOR

1. GENERAL

- 1.1. The conformity requirements shall be considered satisfied from a mechanical and a geometrical standpoint, if the differences do not exceed inevitable manufacturing deviations within the requirements of this Regulation. This condition also applies to colour.
- 1.2. With respect to photometric performances, the conformity of mass-produced systems shall not be contested if, when testing photometric performances of any system chosen at random and equipped with a light source energized, and if applicable corrected, as prescribed in paragraphs 1 and 2 of Annex 9 to this Regulation:
- 1.2.1. No value deviates unfavourably by more than 20 per cent from the value prescribed in this Regulation;
- 1.2.1.1. For the following values of the passing beam and its modes, the maximum unfavourable deviation may be respectively:
- (a) Maximum values at point B50L 170 cd equivalent 20 per cent and 255 cd equivalent 30 per cent;
 - (b) Maximum values at zone III and segment BLL: 255 cd equivalent 20 per cent and 380 cd equivalent 30 per cent;
 - (c) Maximum values at segments E, F1, F2 and F3: 170 cd equivalent 20 per cent and 255 cd equivalent 30 per cent;
 - (d) Minimum values at BR, P, at the groups S50 + S50LL + S50RR, S100 + S100LL + S100RR, and those required by footnote 4 of Table 1 in Annex 3 of this Regulation (B50L, BR, BRR, BLL): half of the required value is equivalent to 20 per cent and three quarters of the required value equivalent to 30 per cent.
- 1.2.1.2. For the driving-beam, HV being situated within the isolux $0,75 I_{\max}$, a tolerance of + 20 per cent for maximum values and -20 per cent for minimum values is observed for the photometric values at any measuring point specified in paragraph 6.3.2 of this Regulation.
- 1.2.2. If the results of the test described above do not meet the requirements, the alignment of the system may be changed, provided that the axis of the beam is not displaced laterally by more than 0,5 degree to the right or left and not by more than 0,2 degree up and down. These provisions do not apply to lighting units as indicated under paragraph 6.3.1.1 of this Regulation.
- 1.2.3. If the results of the tests described above do not meet the requirements, tests shall be repeated using another standard (étalon) light source and/or another supply and operating device.
- 1.2.4. Systems with apparent defects are disregarded.
- 1.2.5. The reference mark is disregarded.

2. FIRST SAMPLING

In the first sampling four systems are selected at random. The first sample of two is marked A, the second sample of two is marked B.

2.1. The conformity is not contested

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

2.1.1.1. Sample A

A1:	one system		0 per cent
	one system	not more than	20 per cent
A2:	both systems	more than	0 per cent
		but not more than	20 per cent

Go to sample B

2.1.1.2. Sample B

B1:	both systems	0 per cent
-----	--------------	------------

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

2.2. The conformity is contested

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

2.2.1.1. Sample A

A3:	one system	not more than	20 per cent
	one system	more than	20 per cent
		but not more than	30 per cent

2.2.1.2. Sample B

B2:	in the case of A2		
	one system	more than	0 per cent
		but not more than	20 per cent
	one system	not more than	20 per cent
B3:	in the case of A2		
	one system		0 per cent
	one system	more than	20 per cent
		but not more than	30 per cent

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

2.3. Approval withdrawn

Conformity shall be contested and paragraph 10 of this Regulation applied if, following the sampling procedure shown in Figure 1 of this annex, the deviations of the measured values of the systems are:

2.3.1. Sample A

A4:	one system	not more than	20 per cent
	one system	more than	30 per cent
A5:	Both systems	more than	20 per cent

2.3.2. Sample B

B4:	in the case of A2		
	one system	more than	0 per cent
		but not more than	20 per cent
	one system	more than	20 per cent
B5:	in the case of A2		
	both systems	more than	20 per cent
B6:	in the case of A2		
	one system		0 per cent
	one system	more than	30 per cent

2.3.3. Or if the conditions of paragraph 1.2.2 above for samples A and B are not fulfilled.

3. REPEATED SAMPLING

In the case of A3, B2, B3 a repeated sampling, third sample C of two systems and fourth sample D of two systems, selected from stock manufactured after alignment, is necessary within two months' time after the notification.

3.1. The conformity is not contested

3.1.1. Following the sampling procedure shown in Figure 1 of this annex the conformity of mass-produced shall not be contested if the deviations of the measured values of the systems are:

3.1.1.1. Sample C

C1:	one system		0 per cent
	one system	not more than	20 per cent
C2:	both systems	more than	0 per cent
		but not more than	20 per cent

Go to sample D

3.1.1.2. Sample D

D1:	in the case of C2		
	both systems		0 per cent

3.1.2. Or if the conditions of paragraph 1.2.2 above for sample C are fulfilled.

3.2. The conformity is contested

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

3.2.1.1. Sample D

D2:	in the case of C2		
	one system	more than	0 per cent
		but not more than	20 per cent
	one system	not more than	20 per cent

3.2.1.2. Or if the conditions of paragraph 1.2.2 for sample C are not fulfilled.

3.3. Approval withdrawn

Conformity shall be contested and paragraph 10. of this Regulation applied if, following the sampling procedure shown in Figure 1 of this annex, the deviations of the measured values of the systems are:

3.3.1. Sample C

C3:	one system	not more than	20 per cent
	one system	more than	20 per cent
C4:	both systems	both systems	both systems

3.3.2. Sample D

D3:	in the case of C2		
	one system		0 per cent
		or more than	0 per cent
	one system	more than	20 per cent

3.3.3. Or if the conditions of paragraph 1.2.2 above for samples C and D are not fulfilled.

4. CHANGE OF THE VERTICAL POSITION OF THE CUT-OFF LINE FOR PASSING-BEAM

With respect to the verification of the change in vertical position of the cut-off line for passing-beam under the influence of heat, the following procedure shall be applied:

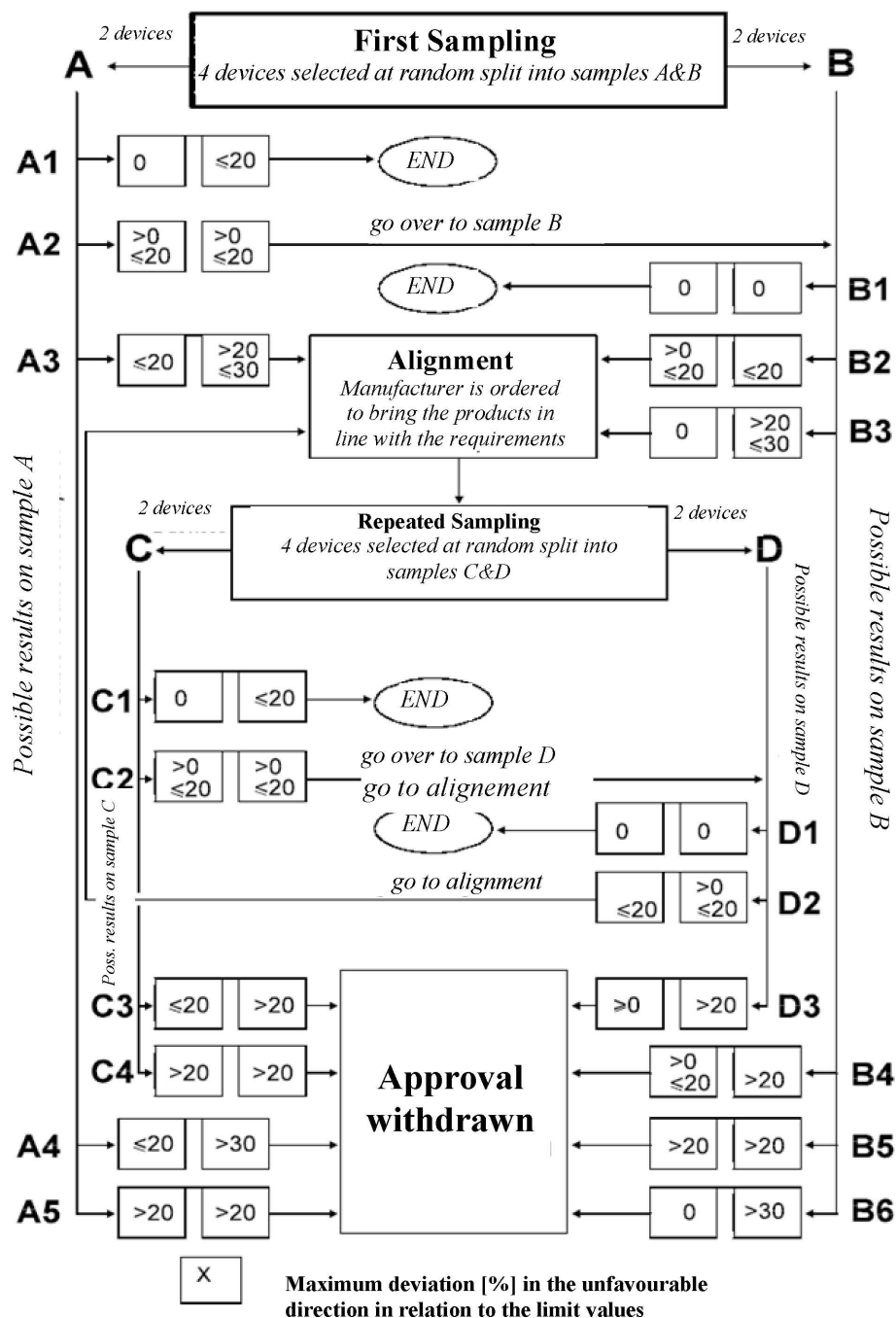
One of the systems of sample A after sampling procedure in Figure 1 of this annex shall be tested according to the procedure described in paragraph 2.1 of Annex 4 after being subjected three consecutive times to the cycle described in paragraph 2.2.2 of Annex 4.

The system shall be considered as acceptable if Δr does not exceed 1,5 m rad upwards and does not exceed 2,5 mrad downwards.

If this value exceeds 1,5 mrad but is not more than 2,0 mrad upwards or exceeds 2,5 mrad but is not more than 3,0 mrad downwards, the second system of sample A shall be subjected to the test after which the mean of the absolute values recorded on both samples shall not exceed 1,5 m rad upwards and shall not exceed 2,5 mrad downwards.

However, if this value of 1,5 mrad upwards and 2,5 mrad downwards on sample A is not complied with, the two systems of sample B shall be subjected to the same procedure and the value of Δr for each of them shall not exceed 1,5 mrad upwards and shall not exceed 2,5 mrad downwards.

Figure 1



Note: 'device' in this figure means 'system'.

- (ii) On the line 0,2° D or below its 'shoulder' should cross the line A, and
- (iii) The kink of the 'elbow' is basically located within +/- 0,5 degree to the left or right of the V-V line.

Or

For left hand traffic:

- (b) From left to right and shall be horizontally positioned after its movement so that:
 - (i) Above the line 0,2° D its 'shoulder' shall not exceed the line A to the right, and
 - (ii) On the line 0,2° D or below its 'shoulder' should cross the line A, and
 - (iii) The kink of the 'elbow' is basically located within +/- 0,5 degree to the left or right of the V-V line.

- 2.5. Where a headlamp so aimed does not meet the requirements set out in Annex 3 its alignment may be changed, provided that the axis of the beam is not displaced:

Horizontally, from line A by more than: 0,5° to the left or 0,75° to the right;

Vertically not more than 0,25° up or down from line B.

- 2.6. If, however, vertical adjustment cannot be performed repeatedly to the required position within the tolerances described in paragraph 2.5 above, the instrumental method described in paragraph 3 below shall be applied to test compliance with the required minimum quality of the 'cut-off' (as defined in paragraph 2.7 below) and to perform the vertical and horizontal adjustment of the beam.

- 2.7. Measurement of the quality of the 'cut-off'

To determine the minimum sharpness, measurements shall be performed by vertically scanning through the horizontal part of the 'cut-off' in angular steps of 0,05° at either a measurement distance of:

- (a) 10 m with a detector having a diameter of approximately 10 mm or
- (b) 25 m with a detector having a diameter of approximately 30 mm.

The measuring distance at which the test was carried out shall be recorded in item 9.8 of the communication form (see Annex 1 to this Regulation).

To determine the maximum sharpness, measurements shall be performed by vertically scanning through the horizontal part of the 'cut-off' in angular steps of 0,05° exclusively at a measurement distance of 25 m and with a detector having a diameter of approximately 30 mm.

The 'cut-off' quality shall be considered acceptable if the requirements of paragraph 2.1 to 2.3 above comply with at least one set of measurements.

- 2.7.1. Not more than one 'cut-off' shall be visible ⁽¹⁾.

- 2.7.2. Sharpness of 'cut-off'

The sharpness factor G is determined by scanning vertically through the horizontal part of the 'cut-off' at 2,5° from the V-V where:

$G = (\log E_{\beta} - \log E_{(\beta + 0,1^\circ)})$ where β = the vertical position in degrees.

The value of G shall not be less than 0,13 (minimum sharpness) and not greater than 0,40 (maximum sharpness).

- 2.7.3. Linearity

The part of the horizontal 'cut-off' that serves for vertical adjustment shall be horizontal between 1,5° and 3,5° from the V-V line (see Figure 1a of paragraph 3 below):

- (a) The inflection points of the 'cut-off' gradient at the vertical lines at 1,5°, 2,5° and 3,5° shall be determined by the equation:

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

- (b) The maximum vertical distance between the inflection points determined shall not exceed 0,2°.

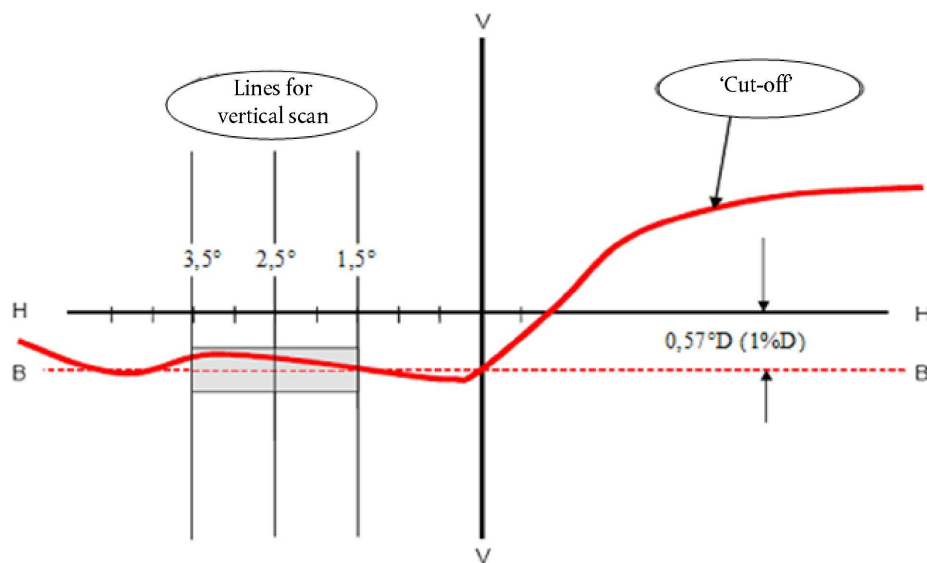
⁽¹⁾ This paragraph should be amended when an objective test method is available.

- 2.8. If a partial beam provides a horizontal 'cut-off' only: no special requirements for horizontal adjustment apply if not specified by the applicant.
 - 2.9. Any 'cut-off' of a lighting unit not designed to be separately aimed, according to the applicants specification, must comply with the relevant requirements.
 - 2.10. Lighting units when aimed using a method specified by the applicant in accordance with the provisions of the paragraphs 5.2 and 6.2.1.1 of this Regulation: the shape and position of the 'cut-off', if any, shall comply with the respective requirements of Table 2 of Annex 3 to this Regulation.
 - 2.11. For each further mode of passing-beam, the shape and position of the 'cut-off', if any, shall comply automatically with the respective requirements of Table 2 of Annex 3. to this Regulation.
 - 2.12. A separate initial aiming and/or adjustment process according to the applicant's specification, based on the provisions of paragraphs 2.1 through 2.6 above, may apply to lighting units intended to be installed separately.
3. VERTICAL AND HORIZONTAL ADJUSTMENT

If the 'cut-off' complies with the quality requirements of paragraph 2 of this Annex, the beam adjustment may be performed instrumentally.

Figure 1a

Measurement of 'cut-off' quality



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

3.1. Vertical adjustment

Moving upward from below the line B (see Figure 2 below), a vertical scan is carried out through the horizontal part of the 'cut-off' at 2,5° from V-V. The inflection point (where $d^2 (\log E)/dv^2 = 0$) is determined and positioned on the line B situated one per cent below H-H.

3.2. Horizontal adjustment

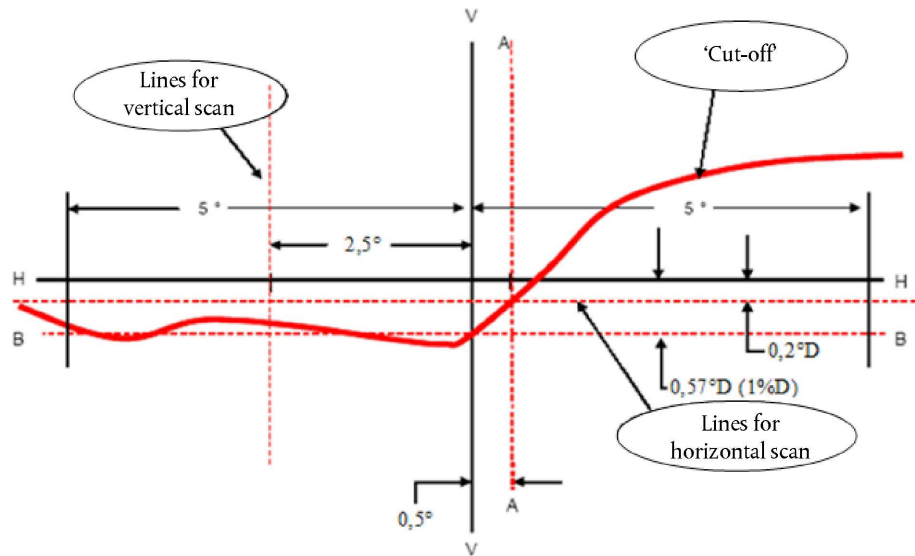
The applicant shall specify one of the following horizontal aim methods:

- (a) The '0,2 D line' method (see Figure 2 below).

A single horizontal line at 0,2° D shall be scanned from 5° left to 5° right after the lamp has been aimed vertically. The maximum gradient 'G' determined using the formula $G = (\log E_{\beta} - \log E_{\beta + 0,1})$ where β is the horizontal position in degrees, shall not be less than 0,08.

The inflection point found on the 0,2 D line shall be positioned on the line A.

Figure 2

Instrumental vertical and horizontal adjustment — Horizontal line scan method

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

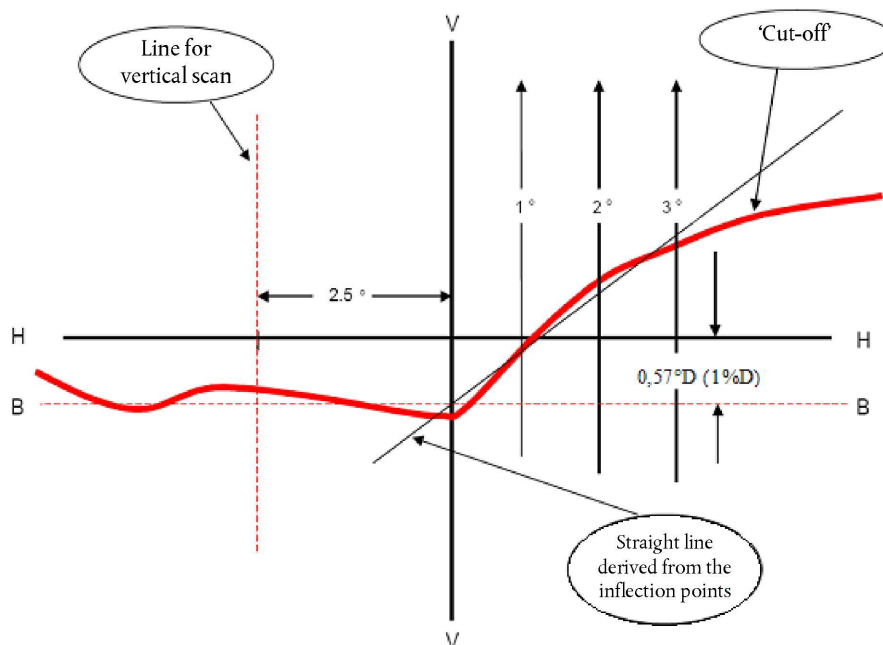
(b) The '3 line' method (see Figure 3 below)

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

$$G = (\log E_{\beta} - \log E_{\beta + 0,1^{\circ}})$$

Where β is the vertical position in degrees shall not be less than 0,08. The inflection points found on the three lines shall be used to derive a straight line. The intersection of this line and the line B found while performing vertical aim shall be placed on the V line.

Figure 3

Instrumental vertical and horizontal adjustment — Three line scan method

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

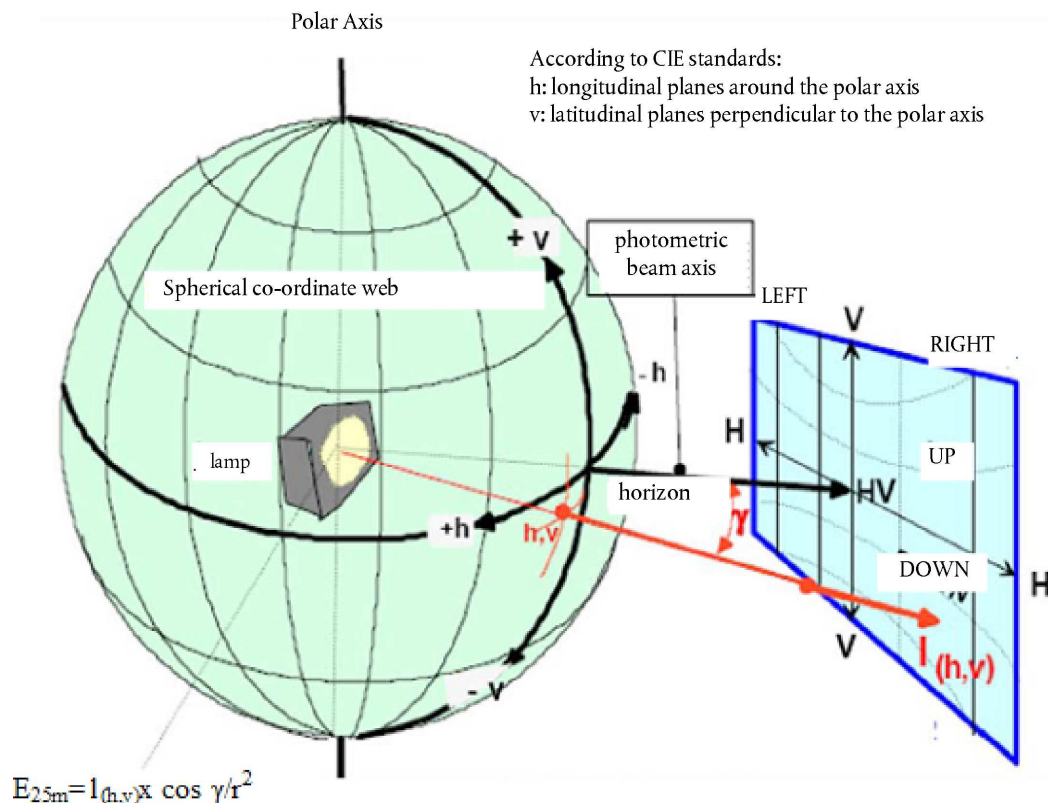
ANNEX 9

PHOTOMETRIC MEASUREMENT PROVISIONS

1. GENERAL PROVISIONS

- 1.1. The system or part(s) thereof shall be mounted on a gonio(photo)meter system.
- 1.2. The luminous intensity values shall be determined by means of a photoreceptor contained within a square of 65 mm side and set up to a distance of at least 25 m forward of the centre of reference of each lighting unit perpendicular to the measurement axis from the origin of the gonio(photo)meter system.
- 1.3. During photometric measurements, stray reflections should be avoided by appropriate masking.
- 1.4. The luminous intensities are measured at a nominal distance of 25 m.
- 1.5. The angular coordinates are specified in degrees on a sphere corresponding to a gonio(photo)meter system as defined in Regulation No 48 (see Diagram 1).

Diagram 1



- 1.6. Any equivalent photometric method is acceptable, if the accordingly applicable correlation is observed.
- 1.7. Any offset of the centre of reference of each lighting unit, with respect to the goniometer rotation axes, should be avoided. This applies especially to the vertical direction and to lighting units producing a 'cut-off'.

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

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

- 1.8.1. However in those cases where a provision is specified for one side only, the division by the factor of 2 does not apply. These cases are: paragraphs 6.2.5.2, 6.2.8.1, 6.3.2.1.1, 6.3.2.1.2, 6.3.4.1, 6.4.6 and footnote 4 of Table 1 of Annex 3.
- 1.9. The lighting units of the system shall be measured individually; however, simultaneous measurements may be performed on two or more lighting units of an installation unit, being equipped with the same light source types with respect to their power supply (either power controlled or not), if they are sized and situated such, that their illuminating surfaces are completely contained in a rectangle of not more than 300 mm in horizontal extend and not more than 150 mm vertical extend, and, if a common centre of reference is specified by the manufacturer.
- 1.10. The system shall prior to the subsequent test procedures be set to the neutral state.
- 1.11. The system or part(s) thereof shall be so aimed before starting the measurements that the position of the 'cut-off' complies with the requirements indicated in the Table 2 of Annex 3 to this Regulation. Parts of a system measured individually and having no 'cut-off' shall be installed on the goniometer under the conditions (mounting position) specified by the applicant.

2. MEASUREMENT CONDITIONS WITH RESPECT TO LIGHT SOURCES

- 2.1. In the case of replaceable filament lamps operated directly under vehicle voltage system conditions:

The system or parts thereof shall be checked by means of an uncoloured standard (étalon) filament lamp(s) designed for a rated voltage of 12 V. During checking of the system or part of, the voltage at the terminals of the filament lamp(s) shall be regulated so as to obtain the reference luminous flux 13,2 volts as indicated at the relevant data sheet of Regulation No 37.

For the measurements, the flux of this filament lamp may differ from the reference luminous flux at 13,2 V specified in Regulation No 37. In this case, the luminous intensity shall be corrected accordingly by the individual factor of the standard (étalon) filament lamp ($F = \Phi_{obj} / \Phi \text{ (Voltage)}$).

The system or parts thereof shall be considered acceptable if the requirements of paragraph 6. of this Regulation are met with at least one standard (étalon) filament lamp, which may be submitted with the system.

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

The voltage applied at the terminals of the ballast(s) or at the terminals of the light source(s) in case the ballast is integrated with the light source, is 13,2 V +/- 0,1 for 12 V systems.

The system or parts thereof using a replaceable gas-discharge light source shall comply with the photometric requirements set out in the relevant paragraphs of this Regulation with at least one standard (étalon) light source, which has been aged during at least 15 cycles, as specified in Regulation No 99. The luminous flux of this gas-discharge light source may differ from the objective luminous flux specified in Regulation No 99.

In this case, the measured photometric values shall be corrected accordingly.

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

All measurements on lamps equipped with non-replaceable light sources (filament lamps and other) shall be made at 6,3 V, 13,2 V or 28,0 V, or at a voltage as specified by the applicant with respect to any other vehicle voltage system.

- 2.4. In the case of a light source, replaceable or non-replaceable, which is operated independently from vehicle supply voltage and fully controlled by the system, or in the case of a light source supplied by a special power supply, the test voltage as specified in paragraph 2.3 above shall be applied to the input terminals of that system/power supply. The test laboratory may require from the manufacturer this special power supply needed to supply the light sources.
- 2.5. LED module(s) shall be measured at 6,3 V, 13,2 V or 28,0 V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant.

3. MEASUREMENT CONDITIONS WITH RESPECT TO BENDING MODES

- 3.1. In the case of a system or part(s) thereof, which provide a bending mode, the requirements of paragraphs 6.2 (passing-beam), and/or 6.3 (driving-beam) of this Regulation apply for all states, corresponding to the turn radius of the vehicle. For verification with respect to the passing-beam and the driving-beam the following procedure shall be used:
- 3.1.1. The system shall be tested in the neutral state (central/straight), and, in addition in the state(s) corresponding to the smallest turn radius of the vehicle in both directions using the signal generator, if applicable.
- 3.1.1.1. Compliance with the requirements of paragraphs 6.2.5.2 and 6.2.5.4.1 of this Regulation shall be checked for both Category 1 and Category 2 bending modes without additional horizontal re-aim.
- 3.1.1.2. Compliance with the requirements of paragraphs 6.2.5.1 and 6.3 of this Regulation, whichever applies, shall be checked:
- (a) In case of a category 2 bending mode: without additional horizontal re-aim;
- (b) In case of a category 1 or a driving-beam bending mode: after having horizontally re-aimed the relevant installation unit (by means of the goniometer for example) in the corresponding opposite direction.
- 3.1.2. When testing a category 1 or category 2 bending mode, for a turn radius of the vehicle other than specified in paragraph 3.1.1 above: it shall be observed whether the light distribution is substantially uniform and no undue glare occurs. If this cannot be confirmed the compliance with the requirement laid down in Table 1 of Annex 3 to this Regulation shall be checked.
-

ANNEX 10

DESCRIPTION FORMS

Maximum format: A4 (210 × 297 mm)

ADAPTIVE FRONT-LIGHTING SYSTEM DESCRIPTION FORM NO 1

AFS control signals relevant to the lighting functions, and modes of functions provided by the system

AFS Control Signal	Function/mode(s) of, being influenced by the signal ⁽¹⁾					Technical characteristics ⁽²⁾ (use separate sheet, if needed)
	Class C	Class V	Class E	Class W	Driving-beam	
None/default	☒				☐	
V-Signal	☐	☐	☐	☐	☐	
E-Signal	☐	☐	☐	☐	☐	
W-Signal	☐	☐	☐	☐	☐	
T-Signal	☐	☐	☐	☐	☐	
Other Signals ⁽³⁾	☐	☐	☐	☐	☐	

⁽¹⁾ Mark in the respective box(es) with a cross (X) the combination(s) which apply.⁽²⁾ To be indicated in terms of:

(a) Physical nature (electrical current/voltage, optical, mechanical, hydraulic, pneumatic, ...).

(b) Information type (continuous/analogous, binary, digitally coded, ...).

(c) Time dependent properties (time constant, resolution, ...).

(d) Signal status when the respective conditions according to paragraph 6.22.7.4 of Regulation No 48 are fulfilled.

(e) Signal status in case of failure (with reference to the system input).

⁽³⁾ According to the applicants description; use separate sheet, if needed.

ADAPTIVE FRONT-LIGHTING SYSTEM DESCRIPTION FORM NO 2

Cut-off status, adjustment devices and adjustment procedures relevant to the lighting units

Lighting unit No ⁽¹⁾	Cut-off status ⁽²⁾		Adjustment device				Characteristics & additional provisions (if any) ⁽⁵⁾
	The lighting unit provides or con- tributes to one or more passing- beam cut-off(s),		vertical		horizontal		
	as defined in Annex 8 of this Regulation ⁽³⁾	and provisions of paragraph 6.4.6 of this Regulation apply ⁽³⁾	Individual (‘master’) ⁽³⁾ ⁽⁶⁾	linked to ‘master’ unit No ⁽⁴⁾	Individual (‘master’) ⁽³⁾ ⁽⁶⁾	linked to ‘master’ unit No ⁽⁴⁾	
1	yes/no	yes/no	yes/no		yes/no		
2	yes/no	yes/no	yes/no		yes/no		
3	yes/no	yes/no	yes/no		yes/no		
4	yes/no	yes/no	yes/no		yes/no		
5	yes/no	yes/no	yes/no		yes/no		

Lighting unit No ⁽¹⁾	Cut-off status ⁽²⁾		Adjustment device				Characteristics & additional provisions (if any) ⁽³⁾
	The lighting unit provides or con- tributes to one or more passing- beam cut-off(s),		vertical		horizontal		
	as defined in Annex 8 of this Regulation ⁽³⁾	and provisions of paragraph 6.4.6 of this Regulation apply ⁽³⁾	Individual (‘master’) ⁽³⁾ ⁽⁶⁾	linked to ‘master’ unit No ⁽⁴⁾	Individual (‘master’) ⁽³⁾ ⁽⁶⁾	linked to ‘master’ unit No ⁽⁴⁾	
6	yes/no	yes/no	yes/no		yes/no		
7	yes/no	yes/no	yes/no		yes/no		

⁽¹⁾ Designation of each individual lighting unit of the system as indicated in Annex 1 to this Regulation and as shown in the drawing according to paragraph 2.2.1 of this Regulation; use separate sheet(s) if needed.

⁽²⁾ Relevant to provisions of paragraph 6.22.6.1.2 of Regulation No 48.

⁽³⁾ Strike out what does not apply.

⁽⁴⁾ Indicate corresponding lighting unit(s) number(s), if applicable.

⁽⁵⁾ Information such as e.g.: the order of adjustment of lighting units or assemblies of lighting units, any additional provisions for the adjustment process.

⁽⁶⁾ The adjustment of a 'master' lighting unit may also adjust (an) other lighting unit(s).

ANNEX 11

REQUIREMENTS FOR LED MODULES AND ADAPTATIVE FRONT-LIGHTING (AFS) INCLUDING LED MODULES**1. GENERAL SPECIFICATIONS**

- 1.1. Each LED module sample submitted shall conform to the relevant specifications of this Regulation when tested with the supplied electronic light source control-gear(s), if any.
- 1.2. LED module(s) shall be so designed as to be and to remain in good working order when in normal use. They shall moreover exhibit no fault in design or manufacture. A LED module shall be considered to have failed if any one of its LEDs has failed.
- 1.3. LED module(s) shall be tamperproof.
- 1.4. The design of removable LED module(s) shall be such that:
 - 1.4.1. When the LED module is removed and replaced by another module provided by the applicant and bearing the same light source module identification code, the photometric specifications of the AFS shall be met;
 - 1.4.2. LED modules with different light source module identification codes within the same lamp housing, shall not be interchangeable.

2. MANUFACTURE

- 2.1. The LED(s) on the LED module shall be equipped with suitable fixation elements.
- 2.2. The fixation elements shall be strong and firmly secured to the LED(s) and the LED module.

3. TEST CONDITIONS**3.1. Application**

- 3.1.1. All samples shall be tested as specified in paragraph 4. below.
- 3.1.2. The kind of light sources on a LED MODULE shall be light-emitting diodes (LED) as defined in Regulation No 48 paragraph 2.7.1 in particular with regard to the element of visible radiation. Other kinds of light sources are not permitted.

3.2. Operating conditions**3.2.1. LED module operating conditions**

All samples shall be tested under the conditions as specified in paragraph 2.5 of Annex 9. to this Regulation. If not specified differently in this annex LED modules shall be tested inside the AFS as submitted by the manufacturer.

3.2.2. Ambient temperature

For the measurement of electrical and photometric characteristics, the AFS shall be operated in a dry and still atmosphere at an ambient temperature of $23\text{ °C} \pm 5\text{ °C}$.

3.3. Ageing

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

4. SPECIFIC SPECIFICATIONS AND TESTS

4.1. Colour rendering

4.1.1. Red content

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

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

$$k_{\text{red}} = \frac{\int_{\lambda=610 \text{ nm}}^{780 \text{ nm}} E_e(\lambda) V(\lambda) d(\lambda)}{\int_{\lambda=380 \text{ nm}}^{780 \text{ nm}} E_e(\lambda) V(\lambda) d(\lambda)} \geq 0,05$$

Where:

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

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

λ (unit: nm) is the wavelength.

This value shall be calculated using intervals of one nanometre.

4.2. UV-radiation

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

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

Where:

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

$k_m = 683 \text{ lm/W}$ is the maximum value of the luminous efficacy of radiation.

(For definitions of the other symbols see paragraph 4.1.1 above).

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

Table UV

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

λ	$S(\lambda)$	λ	$S(\lambda)$	λ	$S(\lambda)$
250	0,430	305	0,060	355	0,000 16
255	0,520	310	0,015	360	0,000 13
260	0,650	315	0,003	365	0,000 11

λ	$S(\lambda)$	λ	$S(\lambda)$	λ	$S(\lambda)$
265	0,810	320	0,001	370	0,000 09
270	1,000	325	0,000 50	375	0,000 077
275	0,960	330	0,000 41	380	0,000 064
280	0,880	335	0,000 34	385	0,000 053
285	0,770	340	0,000 28	390	0,000 044
290	0,640	345	0,000 24	395	0,000 036
295	0,540	350	0,000 20	400	0,000 030
300	0,300				

4.3. Temperature stability

4.3.1. Illuminance

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

Passing-beam: 25 RR

Driving-beam: HV

- 4.3.1.2. Operation of the lighting units mentioned in paragraph 4.3.1.1 above shall then be continued until photometric stability has occurred; this condition is considered to be fulfilled if the variation of the illuminance for the test points indicated in paragraph 4.3.1.1 above is less than 3 per cent within any 15 minutes period. After photometric stability has occurred, aiming for complete photometry shall be performed and the photometric values at all required test points shall be determined.

- 4.3.1.3. The ratio between the photometric values measured after one minute of operation and those measured after photometric stability has occurred shall be calculated for the test points indicated in paragraph 4.3.1.1 above. This ratio shall then be applied to all other applicable test points to determine their photometric values after one minute of operation.

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

4.3.2. Colour

The colour of the light emitted measured after one minute and measured after photometric stability has been obtained, as described in paragraph 4.3.1.2 of this annex, shall both be within the required colour boundaries.

5. THE MEASUREMENT OF THE OBJECTIVE LUMINOUS FLUX OF LED MODULE(S) PRODUCING THE CLASS C (BASIC) PASSING-BEAM SHALL BE CARRIED OUT AS FOLLOWS:

- 5.1. The LED module(s) shall be in the configuration as described in the technical specification as defined in paragraph 2.2.2 of this Regulation. Optical elements (secondary optics) shall be removed by the Technical Service at the request of the applicant by the use of tools. This procedure and the conditions during the measurements as described below shall be described in the test report.

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

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

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

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

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

The flux shall be measured after stability has occurred, as explained in paragraph 4.3.1.2 of this annex.

