

Regulation No. 112

Uniform provisions concerning the approval of motor vehicle headlamps emitting an asymmetrical passing-beam or a driving-beam or both and equipped with filament lamps and/or light-emitting diode (LED) modules

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A. Administrative provisions

Scope¹

This Regulation applies to headlamps for vehicles of categories L, M, N and T².

1. Definitions

For the purpose of this Regulation:

The definitions including the definition of type etc. given in the Horizontal Reference Document (HRD) shall apply to this Regulation;

2. Application for approval of a headlamp

- 2.1. The applicant shall follow instructions stated in paragraph 3. of the HRD.
- 2.2. The drawings required by paragraph 3. of the HRD shall also identify the illuminating surface of the device.
 - 2.2.2. A brief technical description including, in the case where headlamps are used to produce bend lighting, the extreme positions according to paragraph 6.2.7. below. In the case of LED module(s) this shall include:
 - (a) A brief technical specification of the LED module(s);
 - (b) 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;
 - (c) In case of electronic light source control gear, information on the electrical interface necessary for approval testing;
 - 2.2.3. Two samples of each type of headlamp, one sample intended for the installation on the left side of the vehicle and one sample intended for the installation of the right side of the vehicle.
 - 2.2.4. For the test of plastic material of which the lenses are made:

Annex 11 of the HRD shall apply.

¹ Nothing in this Regulation shall prevent a Party to the Agreement applying this Regulation from prohibiting the combination of a headlamp incorporating a lens of plastic material approved under this Regulation with a mechanical headlamp-cleaning device (with wipers).

² As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.2, para. 2.

3. Markings

The applicant shall follow instructions stated in paragraph 4. of the HRD.

4. Approval

4.1. General

The applicant shall follow instructions stated in paragraph 5. of the HRD.

4.2. Composition of the approval mark

4.2.1. The applicant shall follow instructions stated in paragraph 5.. of the HRD.

4.2.2. The following additional symbol (or symbols):

4.2.2.1. On headlamps meeting left-hand traffic requirements only, a horizontal arrow pointing to the right of an observer facing the headlamp, i.e. to the side of the road on which the traffic moves;

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

4.2.2.3. On headlamps meeting the requirements of this Regulation in respect of the passing-beam only, the letters "C" for Class A headlamp or "HC" for Class B headlamp;

4.2.2.4. On headlamps meeting the requirements of this Regulation in respect of the driving-beam only, the letters "R" for Class A headlamp or "HR" for Class B headlamp;

4.2.2.5. On headlamps meeting the requirements of this Regulation in respect of both the passing-beam and the driving-beam, the letters "CR" for Class A headlamp or "HCR" for Class B headlamp;

4.2.2.6. On headlamps incorporating a lens of plastic material, the group of letters "PL" to be affixed near the symbols prescribed in paragraphs 4.2.2.3. to 4.2.2.5. above;

4.2.2.7. On headlamps meeting the requirements of this Regulation in respect of the driving-beam, an indication of the maximum luminous intensity expressed by a reference mark, as defined in paragraph 6.3.4. below, placed near the circle surrounding the letter "E";

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

4.3. Arrangement of the approval mark

Follow the corresponding instructions in paragraph 5.3. and Annex 1 of the HRD.

Annex 2, to this Regulation and in addition Annex 1 of the HRD gives examples specific to this regulation of arrangements of approval marks for grouped, combined or reciprocally incorporated lamps with all the above-mentioned additional symbols.

B. Technical requirements for headlamps³

5. General specifications

Follow instructions in paragraph 6. and 8 of the HRD.

6. Illumination

6.1. General provisions

Follow instructions in Annex 6 of the HRD.

6.2. Provisions concerning passing-beams

Follow instructions in Annex 9 of the HRD.

6.2.1. When so aimed, the headlamp, if its approval is sought solely for provision of a passing-beam⁴, need comply only with the requirements set out in paragraphs **6.2.2. to 6.2.4.** below; if it is intended to provide both a passing-beam and a driving-beam, it shall comply with the requirements set out in paragraphs **6.2.2. to 6.2.4.** and 6.3.

6.2.2. The passing-beam shall meet the luminous intensities at the test points referred to in the tables below and in Annex 3 Figure B (or mirrored about the VV line for left-hand traffic):

³ Technical requirements for filament lamps: see Regulation No. 37.

⁴ Such a special "passing-beam" headlamp may incorporate a driving-beam not subject to requirements.

<i>Headlamps for RH Traffic**</i>							<i>Class A Headlamp</i>		<i>Class B Headlamp</i>	
<i>Test point designation</i>			<i>Test point angular coordinates - Degrees</i>				<i>Required luminous intensity cd</i>		<i>Required luminous intensity cd</i>	
							<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>
B 50 L			0.57U, 3.43L				350		350	
BR			1.0 U, 2.5R				1,750		1,750	
75 R			0.57D, 1.15R					5,100		10,100
75 L			0.57D, 3.43L				10,600		10,600	
50 L			0.86D, 3.43L				13,200***		13,200***	
50 R			0.86D, 1.72R					5,100		10,100
50 V			0.86D, 0							5,100
25 L			1.72D, 9.0L					1,250		1,700
25 R			1.72D, 9.0R					1,250		1,700
Any point in zone III (bounded by the following coordinates in degrees)							625		625	
8 L	8 L	8 R	8 R	6 R	1.5 R	V-V				
1 U	4 U	4 U	2 U	1.5 U	1.5 U	H-H				
Any point in zone IV (0.86D to 1.72D, 5.15 L to 5.15 R)								1,700		2,500
Any point in zone I (1.72D to 4D, 9 L to 9 R)							17,600		< 2I*	

Note: In the table:

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

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

Letter U means the point is located above HH line

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

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

** For left-hand traffic, the letter R shall be replaced by letter L and vice versa.

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

<i>Headlamps for RH Traffic**</i>		
<i>Test point</i>	<i>Angular coordinates Degrees</i>	<i>Required luminous intensity- cd Min</i>
1	4U, 8L	Points 1+2+3 190
2	4U, 0	
3	4U, 8R	
4	2U, 4L	Points 4+5+6 375
5	2U, 0	
6	2U, 4R	
7	0, 8L	65
8	0, 4L	125

- 6.2.3. There shall be no lateral variations detrimental to good visibility in any of the zones I, II, III and IV.
- 6.2.4. Headlamps designed to meet the requirements of both right-hand and left-hand traffic must, in each of the two setting positions of the optical unit or LED module(s) producing the principal passing-beam or of the filament lamp, meet the requirements set forth above for the corresponding direction of traffic.
- 6.2.5. The requirements in paragraph 6.2.2. above shall also apply to headlamps designed to provide bend lighting and/or that include the additional light source or LED module(s) referred to in **paragraph 6.2.6.2.** In the case of a headlamp designed to provide bend lighting its alignment may be changed, provided that the axis of the beam is not displaced vertically by more than 0.2°.
- 6.2.5.1. If bend lighting is obtained by:
- 6.2.5.1.1. Swivelling the passing-beam or moving horizontally the kink of the elbow of the cut-off, the measurements shall be carried out after the complete headlamp assembly has been reaimed horizontally, e.g. by means of a goniometer;
- 6.2.5.1.2. Moving one or more optical parts of the headlamp without moving horizontally the kink of the elbow of the cut-off, measurements shall be carried out with these parts being in their extreme operating position;
- 6.2.5.1.3. Means of one additional filament light source or one or more LED module(s) without moving horizontally the kink of the elbow of the cut-off, measurements shall be carried out with this light source or LED module(s) activated.
- 6.2.6. Only one filament light source or one or more LED module(s) are permitted for the principal passing-beam. Additional light sources or LED modules are permitted only as follows (**see Annex 15 of the HRD**):

- 6.2.6.1. One additional light source according to Regulation No. 37 or one or more additional LED module(s) may be used inside the passing-beam headlamp to contribute to bend lighting;
- 6.2.6.2. One additional light source according to Regulation No. 37 and/or one or more LED module(s), inside the passing-beam headlamp, may be used for the purposes of generating infrared radiation. It/they shall only be activated at the same time as the principal light source or LED module(s). In the event that the principal light source or (one of) the principal LED module(s) fails, this additional light source and/or LED module(s) shall be automatically switched off;
- 6.2.6.3. In the event of failure of an additional filament light source or one or more additional LED module(s), the headlamp shall continue to fulfil the requirements of the passing-beam.
- 6.3. Provisions concerning driving-beams
- 6.3.1. In the case of a headlamp designed to provide a driving-beam and a passing-beam, measurements of the luminous intensity of the driving-beam shall be taken with the same headlamp alignment as for measurements under **paragraphs 6.2.2. to 6.2.4.** above; in the case of a headlamp providing a driving-beam only, it shall be so adjusted that the area of maximum luminous intensity is centred on the point of intersection of lines H-H and V-V; such a headlamp need meet only the requirements referred to in paragraph 6.3. Where more than one light source is used to provide the driving-beam, the combined functions shall be used to determine the maximum value of the luminous intensity (I_M).
- 6.3.2. Irrespective of the type of light source (LED module(s) or filament light source(s)) used to produce the principal passing-beam, several light sources:
- (a) Either filament light sources listed in Regulation No. 37; or
 - (b) LED module(s) may be used for each individual driving-beam.
- 6.3.3. Referring to Annex 3, Figure C and the table below, the luminous intensity distribution of the driving-beam shall meet the following requirements:

		<i>Class A Headlamp</i>	<i>Class B Headlamp</i>
<i>Test point</i>	<i>Angular coordinates - Degrees</i>	<i>Required luminous intensity cd</i>	<i>Required luminous intensity cd</i>
		<i>Min</i>	<i>Min</i>
I_{max}		27,000	40,500
H-5L	0.0, 5.0 L	3,400	5,100
H-2.5L	0.0, 2.5 L	13,500	20,300
H-2.5R	0.0, 2.5 R	13,500	20,300
H-5R	0.0, 5.0 R	3,400	5,100

- 6.3.3.1. 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})
- 6.3.3.2. The maximum value (I_M) shall in no circumstances exceed 215,000 cd.
- 6.3.4. The reference mark (I'_M) of the maximum luminous intensity, referred to in paragraph 6.3.3.2. above, shall be obtained by the ratio:

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

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

- 6.4. In the case of headlamps with adjustable reflector the requirements of paragraphs 6.2. and 6.3. are applicable for each mounting position indicated according to paragraph 2.1.3. 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 the light source and point HV on a aiming screen. The adjustable reflector is then moved into such a position that the light pattern on the screen corresponds to the aiming prescriptions of paragraphs 6.2.1. to 6.2.2.3. and/or 6.3.1.;
- 6.4.2. With the reflector initially fixed according to paragraph 6.4.1., the headlamp must meet the relevant photometric requirements of paragraphs 6.2. and 6.3.;
- 6.4.3. Additional tests are made after the reflector has been moved vertically $\pm 2^\circ$ or at least into the maximum position, if less than 2° , from its initial position by means of the headlamps adjusting device. Having re-aimed the headlamp 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:
- passing-beam : points HV and 75 R (75 L respectively);
driving-beam : I_M and point HV (percentage of I_M).
- 6.4.4. If the applicant has not indicated more than one mounting position, the procedure of paragraphs 6.4.1. to 6.4.3. shall be repeated for all other positions;
- 6.4.5. If the applicant has not asked for special mounting positions, the headlamp shall be aimed for measurements of paragraphs 6.2. and 6.3. with the headlamps adjusting device in its mean position. The additional test of paragraph 6.4.3. shall be made with the reflector moved into its extreme positions (instead of $\pm 2^\circ$) by means of the headlamps adjusting device.

7. Colour

- 7.1. The colour of the light emitted shall be white.

8. Gauging of discomfort

The discomfort caused by the passing-beam of headlamps shall be gauged⁵.

⁵ This requirement will be the subject of a recommendation to administrations.

C. Further administrative provisions

9. Modification of the headlamp type and extension of approval

Follow instructions in paragraph 10 of the HRD.

10. Conformity of production

10.1 Devices approved in accordance with this Regulation and the referred HDR shall be so manufactured as to conform to the type approved and to meet the requirements set forth by this Regulation and the Horizontal Reference Document as described in paragraph 11 of the HRD

10.2. Headlamps with apparent defects are disregarded.

10.3. The reference mark is disregarded.

10.4. The measuring points 1 to 8 from paragraph 6.2.4. of this Regulation are disregarded.

11. Penalties for non-conformity of production

See paragraph 12. of the HDR.

12. Production definitively discontinued

See paragraph 13. of the HDR.

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

See paragraph 14. of the HDR.

14. Transitional provisions

14.1. 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.

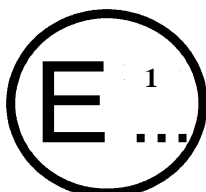
14.2. Until 60 months after the date of entry into force of the 01 series of amendments to this Regulation with regard to the changes introduced by the 01 series of amendments concerning the photometric testing procedures involving the use of the spherical coordinate system and the specification of luminous 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.

- 14.3. 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 headlamp meets the requirements of this Regulation as amended by the 01 series of amendments.
- 14.4. Existing approvals for headlamps already granted under this Regulation before the date of entry into force of the 01 series of amendments shall remain valid indefinitely.
- 14.5. 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 x 297 mm))



issued by: Name of administration:

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

concerning²: Approval granted
Approval extended
Approval refused
Approval withdrawn
Production definitively discontinued

of a type of headlamp pursuant to Regulation No. 112

Approval No Extension No

1. Trade name or mark of the device:
2. Manufacturer's name for the type of device:
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:

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

² Strike out which does not apply.

9. Brief description:
- Category as described by the relevant marking³:
-
- Number and category(s) of filament lamp(s):
-
- Reference luminous flux used for the principal passing-beam (lm):
- Principal passing-beam operated at approximately (V):
- Measures according to paragraph 5.8. of this Regulation:
- Number and specific identification code(s) of LED module(s) and for each LED module a statement whether it is replaceable or not: yes/no²
- Number and specific identification code(s) of electronic light source control gear(s)..
-
- Total objective luminous flux as described in paragraph 5.9. exceeds 2,000 lumens: yes/no/does not apply²
- The adjustment of the cut-off has been determined at: 10 m/25 m/does not apply²
- The determination of the minimum sharpness of the "cut-off" has been carried out at: 10 m/25 m/does not apply²
10. Approval mark position:
11. Reason(s) for extension of approval:
12. Approval granted/extended/refused//withdrawn²
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.

³ Indicate the appropriate marking selected from the list below:

C, C, C, R, R PL, CR, CR, CR, C/R, C/R, C/R, C/, C/, C/,
 → ↔ ↔ → ↔ ↔ → ↔ ↔ → ↔ ↔ → ↔ ↔

C, PL, C PL, C PL, CR PL, CR PL, CR PL, C/R PL, C/R PL, C/R PL,
 → ↔ ↔ → ↔ ↔ → ↔ ↔ → ↔ ↔

C/PL, C/PL, C/PL
 → ↔ ↔

HC, HC, HC, HR, HR PL, HCR, HCR, HCR, HC/R, HC/R, HC/R, HC/, HC/, HC/
 → ↔ ↔ → ↔ ↔ → ↔ ↔ → ↔ ↔ → ↔ ↔

HC PL, HC PL, HC PL, HCR PL, HCR PL, HCR PL, HC/R PL, HC/R PL, HC/R PL,
 → ↔ ↔ → ↔ ↔ → ↔ ↔ → ↔ ↔

HC/PL, HC/PL, HC/PL
 → ↔ ↔

Annex 2

Examples of arrangement of approval marks

Figure 1

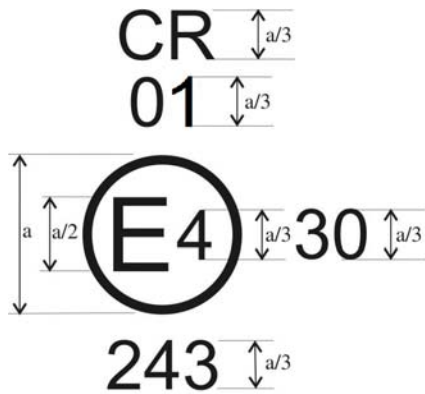
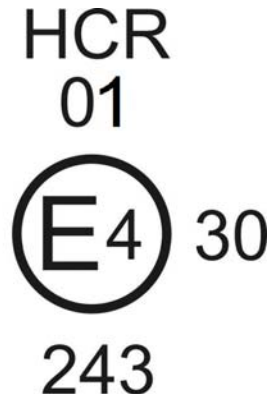


Figure 2



$a \geq 8 \text{ mm}$

The headlamp bearing one of the above approval marks has been approved in the Netherlands (E4) pursuant to Regulation No. 112 under approval number 243, meeting the requirements of this Regulation, as amended by the 01 series of amendments. The passing-beam is designed for right-hand traffic only. The letters CR (Figure 1) indicate that it concerns a Class A passing and driving-beam and the letters HCR (Figure 2) indicate that it concerns a Class B passing and driving-beam.

The figure 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 and either above or below the letter "E", or to the right or left of that letter. The digits of the approval number shall be on the same side of the letter "E" and face in the same direction.

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

Figure 3

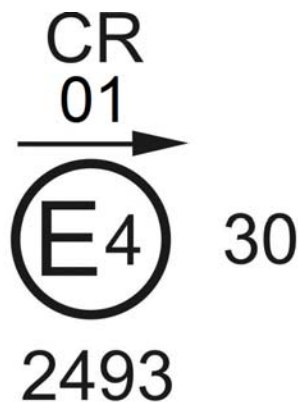


Figure 4a

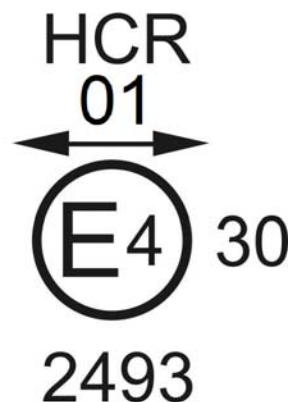


Figure 4b



The headlamp 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 A for left hand traffic only.

Figures 4a and 4b: Class B for both traffic systems by means of an appropriate adjustment of the setting of the optical unit or the filament lamp on the vehicle.

Figure 5



Figure 6



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

Figure 5: Class A for both traffic systems.

Figure 6: Class B for right-hand traffic only.

Further examples are stated in Annex 1 of the HRD.

Figure 7

LED modules

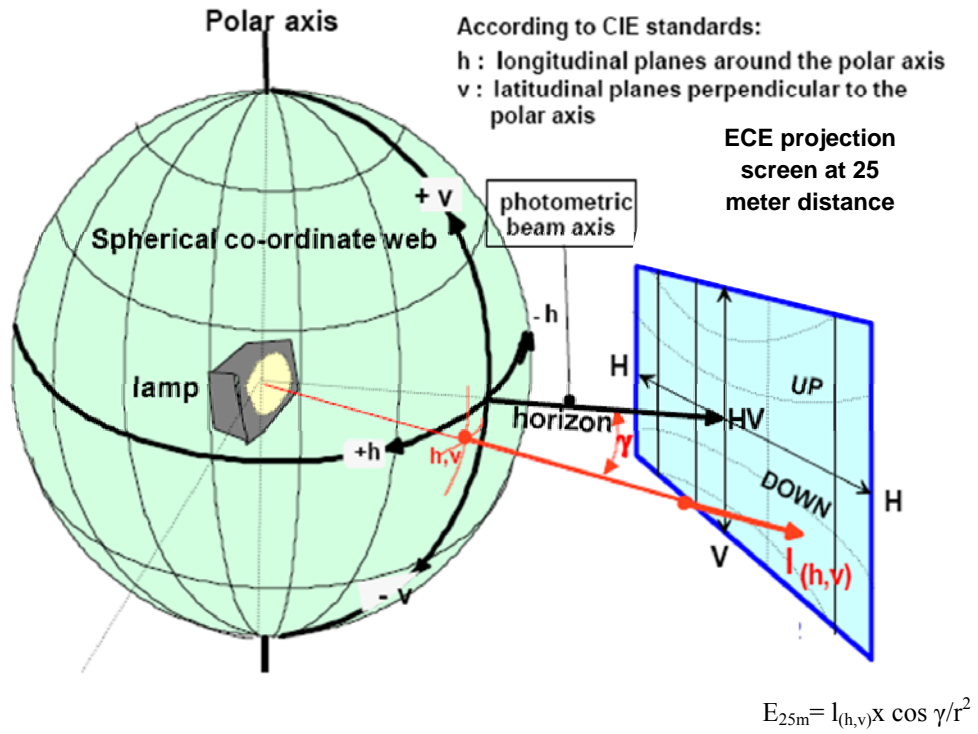
MD E3 17325

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

Annex 3

Spherical coordinate measuring system and test point locations

Figure A
 Spherical coordinate measuring system



Annex 4

Tests for stability of photometric performance of headlamps in operation

Part B of Annex 10 of the HRD shall apply.

Annex 4 - Appendix 1

Overview of operational periods concerning test for stability of photometric performance

Appendix 1 of Annex 10 of the HRD shall apply.

Annex 5

Minimum requirements for conformity of production control procedures

Annex 2 of the HRD shall apply.

Annex 6

Requirements for lamps incorporating lenses of plastic material – Testing of lens or material samples and of complete lamps

A Annex 11 with additional Appendices of the HRD shall apply.

B. Tests on complete headlamps (supplied pursuant to paragraph 2.2.3. of this Regulation).

<i>Tests</i>	<i>Complete headlamp</i>	
	<i>Sample No.</i>	
	<i>1</i>	<i>2</i>
2.1. Deterioration (para. 2.6.1.1.)	x	
2.2. Photometry (para. 2.6.1.2.)	x	
2.3. Adherence (para. 2.6.2.)		x

Annex 7

Minimum requirements for sampling by an inspector

Annex 3 of the HRD shall apply.

1. In addition to the paragraph “deviations” the following requirements shall apply:
 - 1.1. No measured value deviates unfavourably by more than 20 per cent from the value prescribed in this Regulation. For values B 50 L (or R)¹ and zone III, the maximum unfavourable deviation may be respectively:

B 50 L (or R):	170 cd equivalent 20 per cent
	255 cd equivalent 30 per cent
Zone III	255 cd equivalent 20 per cent
	380 cd equivalent 30 per cent
 - 1.2. Or if
 - 1.2.1. For the passing-beam, the values prescribed in this Regulation are met at HV (with a tolerance of +170 cd) and related to that aiming at least one point within a circle of 0.35 degrees around points B 50 L (or R) (with a tolerance of 85 cd), 75 R (or L), 50 V, 25 R, 25 L, and in the entire area of zone IV which is not more than 0.52 degrees above line 25 R and 25 L;
 - 1.2.2. And if, 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.
 - 1.3. If the results of the test described above do not meet the requirements, the alignment of the headlamp may be changed, provided that the axis of the beam is not displaced laterally by more than 1° to the right or left.

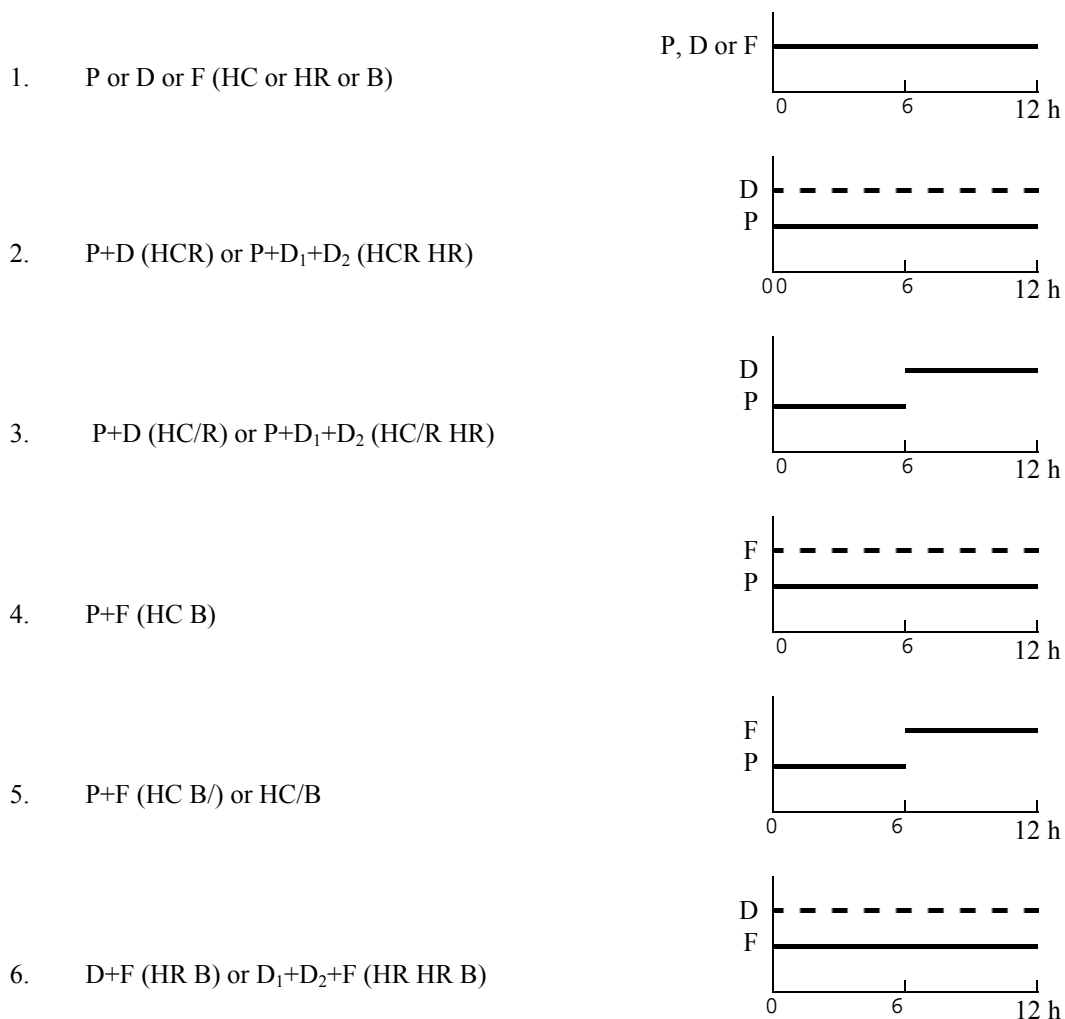
Annex 8

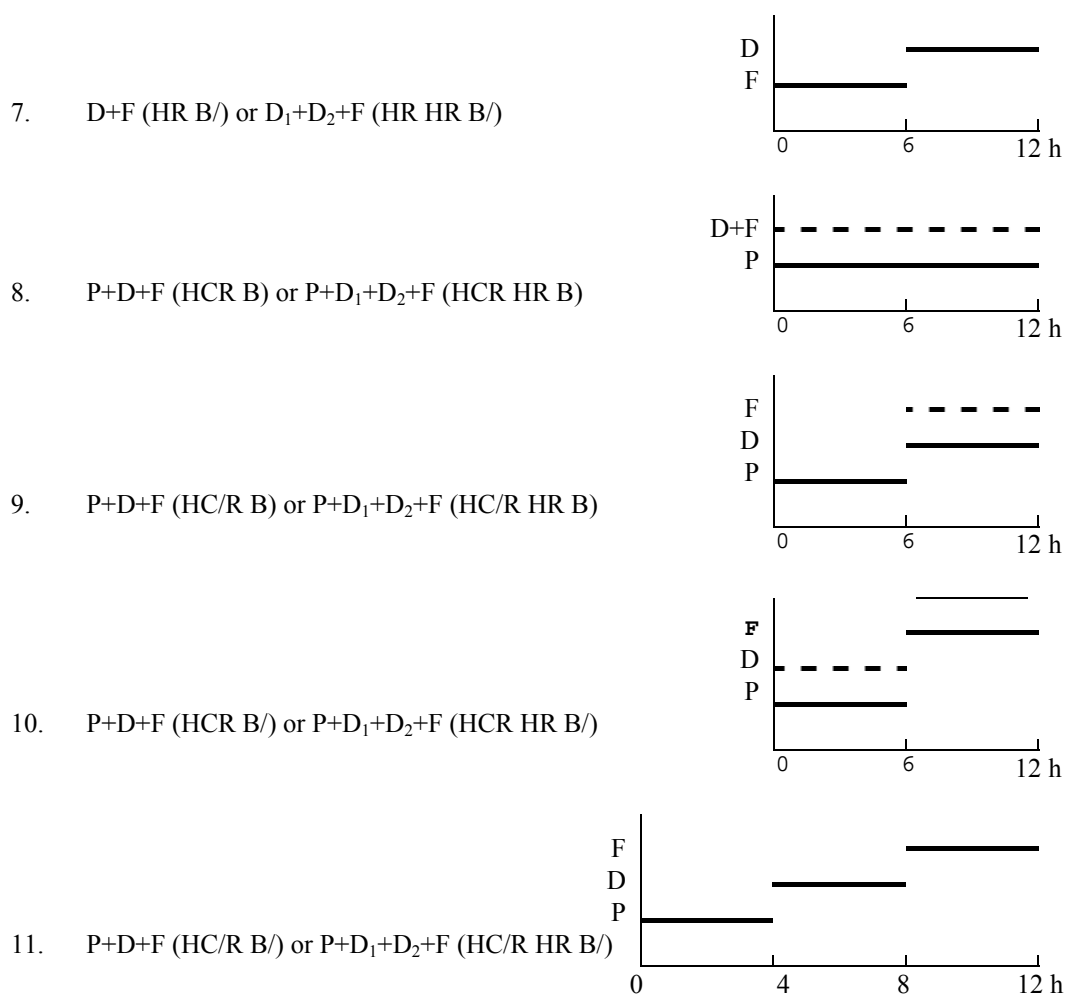
Overview of operational periods concerning tests for stability of photometric performance

- Abbreviations: P: passing-beam lamp
D: driving-beam lamp (D₁ + D₂ means two driving-beams)
F: front fog lamp
- - - - -: means a cycle of 15 minutes off and 5 minutes lit.

¹ Letters in brackets refer to headlamps intended for right-hand traffic.

All following grouped headlamps and front fog lamps together with the added class B marking symbols are given as examples and are not exhaustive.





Annex 9

Instrumental verification of the "cut-off" for passing-beam headlamps

Annex 9 A of the HRD shall apply.

Annex 10

Requirements for LED modules and headlamps including LED modules

Annex 14 with of the HRD shall apply.

Annex 11

A general illustration for principal passing-beam and beam contributors and correlated light source options

