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Working Party on Lighting and Light-Signalling (GRE)
(Fifty-fourth session, 5–8 April 2005,
agenda item 16.2.)

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 112
(Headlamps emitting an asymmetrical passing beam)

Transmitted by the expert from the Working Party "Brussels 1952" (GTB)

Note: The text reproduced below was prepared by the expert from GTB and identifies the amendments required to Regulation No. 112 to incorporate a package of proposals that includes the Worldwide Harmonized Passing and Driving Beam and a numeric definition and measurement of cut-off position and sharpness.

This text is based upon the proposals already considered by GRE in TRANS/WP.29/GRE/2002/41 (cut-off provisions), TRANS/WP.29/GRE/2004/6 (harmonized passing beam for Regulation No. 112) and TRANS/WP.29/GRE/2003/35 (harmonized driving beam for Regulation No. 112) and replaces TRANS/WP.29/GRE/2004/6. The amendments of Supplements 1, 2 and 3 to Regulation No. 112 have been taken into consideration during the compilation of this proposal. The modifications to the current text of the Regulation are marked in **bold** characters.

Note: This document is distributed to the Experts on Lighting and Light-Signalling only.

A. PROPOSAL

Table of contents, annexes, amend to read:

"…..
Annex 7 - Minimum requirements for sampling by an inspector
Annex 8 - Definition and sharpness of the "cut-off" line for headlamps"

Text of the Regulation,

Paragraph 1.4., amend to read:

"1.4. Headlamps of different "Classes" (A or B **or C**) mean headlamps identified by particular photometric provisions."

Paragraph 2.1.4., amend to read:

"2.1.4. whether it concerns a Class A or B **or C** headlamp;"

Paragraph 4.2.2.3., amend to read:

"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 **or "HWC" for Class C headlamp;**"

Paragraph 4.2.2.4., amend to read:

"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 **or "WR" for Class C headlamp;**"

Paragraph 4.2.2.5., amend to read:

"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 **or "HWCR" for Class C headlamp**;

Paragraph 5.9.2., amend to read:

"5.9.2. in the case of failure the illumination above the line H-H shall not exceed the values of a passing beam according to paragraph 6.2.5.; in addition, on headlamps designed to provide a passing and/or a driving beam to become a bend lighting, a minimum illumination of at least 5 lux shall be fulfilled in test point 25 V (VV line, D 75 cm) **for Class A and Class B headlamps and 2.0 degrees D, V for Class C headlamps;**"

Paragraphs 6.2.1 to 6.2.2., amend to read:

"**6.2.1. The passing beam shall produce on the aiming screen a sufficiently sharp "cut-off" as defined in Annex 9 of this Regulation, to permit a satisfactory adjustment with its aid.**

6.2.1.1. For Class A or Class B headlamp: On the other side, it must not extend beyond either the broken line HV-H_1-H_4 formed by a straight line HV-H_1 making a 45 degree angle with the horizontal and the straight line H_1-H_4, 25 cm above the straight line hh, or the straight line HV-H_3, inclined at an angle of 15 degrees above the horizontal (see Annex 3). A "cut-off" extending beyond both line HV-H_2 and line H_2-H_4 and resulting from a combination of the two above possibilities shall in no circumstances be permitted. These requirements apply to right-hand traffic; for left hand traffic the points to the left and to the right are transposed.

6.2.1.2. For Class C headlamp: On the other side, it must not extend above or to the left of the line connecting the points W_0, W_1, W_2, W_3 positioned as follows (see Annex 3):

W_0: 1.0 degree Left - H
W_1: 1.5 degree R-1.5 degree U
W_2: 6.0 degree R-1.5 degree U
W_3: 8.0 degree R-2.0 degree U

These requirements apply to right-hand traffic; for left hand traffic the points to the left and to the right are transposed.

6.2.2. The headlamp shall be visually aimed by means of the "cut-off" line which is specified in Annex 9 of this Regulation, so that:"

Paragraphs 6.2.2.1., amend to read (including the deletion of the reference to footnote 8/ and footnote 8/):

"6.2.2.1. in the case of headlamps designed to meet the requirements of right-hand traffic, the "cut-off" on the left-half of the screen is horizontal and, in the case of headlamps designed to meet the requirements of left-hand traffic, the "cut-off" on the right-half of the screen is horizontal.

The test screen for visual adjustment shall be positioned at either a distance of 10 m or at a distance of 25 m and be sufficiently wide to allow examination and adjustment of the "cut-off" over of at least 5° on either side of the v-v-line.

Paragraphs 6.2.2.2., amend to read:

"6.2.2.2. **for vertical adjustment: The horizontal part of the "cut-off" line is moved from below upwards and adjusted to its nominal position 1 per cent below the HH-line, as described in Annex 9, which is:**

- 10 cm below the headlamp axis on the screen at 10 m distance or
- 25 cm below the headlamp axis on the screen at 25 m distance.

The distance at which the adjustment was determined shall be recorded in item 9. of the communication form (see Annex 1 of this Regulation)."

Paragraph 6.2.2.3., amend to read:

"6.2.2.3. **for horizontal adjustment: The "elbow – shoulder" part of the "cut-off" line shall be positioned, as described in paragraph 3. of Annex 9**."

Insert a new paragraph 6.2.2.4., to read:

"**6.2.2.4. If, however, vertical or horizontal adjustment cannot be performed for a sufficient reproducible visual adjustment to the required position within the allowed tolerances in paragraph 6.2.4. below, the instrumental method of Annex 9, paragraphs 4. and 5. shall be applied to test compliance with the required minimum quality of the "cut-off" line and to perform the vertical and horizontal adjustment of the beam.**"

Paragraph 6.2.4., amend to read (deleting the reference to footnote 10/ and footnote 10/):

"6.2.4. Where a headlamp so aimed does not meet the requirements set out in paragraphs **6.2.6. to 6.2.9. and 6.3.**, its alignment may be changed, provided that the axis of the beam is not displaced:
Horizontally from line A (see Annex 9, paragraphs 2-4 laterally by more than:
- **0.25° to the left or 1.0° to the right, for right hand traffic, or**
- **0.25° to the right or 1.0° to the left, for left hand traffic and**

Vertically not more than 0. 2° up or down from line B (see Annex 9, paragraphs 2-4)."

Paragraph 6.2.5., insert before the table a new subparagraph 6.2.5.1., to read:

"6.2.5.1. **For Class A or Class B headlamp:**"

Insert new paragraphs 6.2.5.2. and 6.2.5.3., to read:

"**6.2.5.2. For Class C headlamp - right hand traffic:**

TEST POINT	Position (Degrees)		Candelas at rated luminous flux		
	Vertical	Horizontal	min	max	
1	0.60D	1.3R	10,000		
2	0.86D	0	4,500		
3	0.86D	3.5L	1,800	9,350	
4	0.50U	1.50L		320	
5	0.50D	4.0R	5,000		
6	2.00D	15L&15R	1,000		
7	4.00D	20L&20R	300		
8	0.50U	0		625	
9	0.50U	2R	600		
10	1.00U	2R		1,800	
Line11	4.00D	4Lto4R		8,750	See Note (ii)
Line12	2.00D	9Lto9R	1,250		
Line13	7.00U	10Lto10R		190	
Line14	10.00U	10Lto10R		95	See Note (iii)
Line15	10U to 60U	0		95	
16	4.00U	8.0L	64		
17	4.00U	0	64		
18	4.00U	8.0R	64		
19	2.00U	4.0L	135		
20	2.00U	0	135		See Note (iv)
21	2.00U	4.0R	135		
22	0	8.0L	64		
23	0	4.0L	135		
Line 24	1.5U/6R-1.5U/1.5R			625	
Line 25	0/1L-0/4L			440	
If streaks or spots are observed in zones 1 or 2 or 3 then that area shall be scanned in accordance with the table below.					
Zone1 (Right)	0.5U/V-4U/V-4U/8R-2U/8R-1.5U/6R-1.5U/1.5R-0.5U/V			625.00	
Zone1(Left)	1U/8L-4U/8L-4U/V-0.5U/V-0/1L-0/4L-1U/8L			440.00	
Zone2	>4Uto<10U	10Lto10R		190.00	See Note (iii)
Zone3	10Uto60U	10Lto10R		95.00	See Note (iii)

Note (i): "D" means under the HH line.
"U" means above the HH line.
"R" means right of the VV line.
"L" means left of the VV line.

Note (ii): Not greater than 35 per cent of the maximum intensity and in any case not greater than 8,750 cd.

Note (iii): Narrow spots or stripes with not more than 440 cd are allowed, if not extending beyond either a conical angle of 2° aperture or a width of 1°. If multiple spots or stripes are present they shall be separated by an angle of 10°.

Note (iv). During measurement of these points, the front position lamp approved to Regulation No. 7 - if combined, grouped, or reciprocally incorporated - with the dipped beam function - shall be switched on

6.2.5.3. For Class C headlamp - left hand traffic:

TEST POINT	Position (Degrees)		Candelas at Rated luminous flux		
	Vertical	Horizontal	min	max	
1	0.60D	1.3L	10,000		
2	0.86D	0	4,500		
3	0.86D	3.5R	1,800	9,350	
4	0.50U	1.50R		320	
5	0.50D	4.0L	5,000		
6	2.00D	15L&15R	1,000		
7	4.00D	20L&20R	300		
8	0.50U	0		625	
9	0.50U	2L	600		
10	1.00U	2L		1,800	
Line11	4.00D	4Lto4R		8,750	See Note (ii)
Line12	2.00D	9Lto9R	1,250		
Line13	7.00U	10Lto10R		190	
Line14	10.00U	10Lto10R		95	See Note (iii)
Line15	10U to 60U	0		95	
16	4.00U	8.0R	64		
17	4.00U	0	64		
18	4.00U	8.0L	64		
19	2.00U	4.0R	135		See Note (iv)
20	2.00U	0	135		
21	2.00U	4.0L	135		
22	0	8.0R	64		
23	0	4.0R	135		
Line 24	1.5U/6R-1.5U/1.5R			625	
Line 25	0/1L-0/4L			440	
If streaks or spots are observed in zones 1 or 2 or 3 then that area shall be scanned in accordance with the table below.					
Zone1 (Left)	0.5U/V-4U/V-4U/8L-2U/8L-1.5U/6L-1.5U/1.5L-0.5U/V			625.00	
Zone1(Right)	1U/8R-4U/8R-4U/V-0.5U/V-0/1R-0/4R-1U/8R			440.00	
Zone2	>4Uto<10U	10Lto10R		190.00	See Note (iii)
Zone3	10Uto60U	10Lto10R		95.00	See Note (iii)

Note (i): "D" means under the HH line.
"U" means above the HH line.
"R" means right of the VV line
"L" means left of the VV line.

Note (ii): Not greater than 35 per cent of the maximum intensity and in any case not greater than 8,750 cd.

Note (iii): Narrow spots or stripes with not more than 440 cd are allowed, if not extending beyond either a conical angle of 2° aperture or a width of 1°. If multiple spots or stripes are present they shall be separated by an angle of 10°.

Note (iv): During measurement of these points, the front position lamp approved to Regulation No. 7 - if combined, grouped, or reciprocally incorporated - with the dipped beam function - shall be switched on."

Paragraphs 6.2.6. and 2.6.7., amend to read:

"6.2.6. There shall be no lateral variations detrimental to good visibility in any of the zones I, II, III and IV **for Class A or Class B headlamp and in any of the zones 1, 2, and 3 for Class C headlamp.**

6.2.7. **For Class A or Class B headlamps the** illumination values in zones "A" and "B" as shown in figure C in annex 3 shall be checked by the measurement of the photometric values of points 1 to 8 on this figure; these values shall lie within the following limits:

1 + 2 + 3 > 0.3 lux, and
4 + 5 + 6 > 0.6 lux, and
0.7 lux > 7 > 0.1 lux and
0.7 lux > 8 > 0.2 lux"

Paragraph 6.3.2.1., amend to read:

"6.3.2.1. The point of intersection (HV) of lines hh and vv shall be situated within the isolux 80 per cent of maximum illumination. This maximum value (E_M) shall not be less than 32 lux for Class A headlamps, 48 lux for Class B headlamps **and 50 lux for Class C headlamps.** The maximum value shall in no circumstances exceed 240 lux; in addition, in the case of a combined passing and driving headlamp, this maximum value shall not be more than 16 times the illumination measured for the passing beam at point 75 R (or 75 L) **for Class A or Class B headlamps and at the test point 1 for Class C headlamps.**"

Paragraph 6.3.2.2., amend to read:

"6.3.2.2. Starting from point HV, horizontally to the right and left, the illumination shall be not less than 16 lux for Class A headlamp and 24 lux for Class B headlamp up to a distance of 1.125 m and not less than 4 lux for Class A headlamp and 6 lux for Class B headlamp up to a distance of 2.25 m.

In the case of a Class C headlamp, the intensities shall conform to the tables "A" and "B" in Annex 3. Table "A" applies in the case where a primary driving beam is being produced with a single light source. Table "B" applies in the case where the driving beam is being produced by a secondary driving beam headlamp operated with a passing beam headlamp or with a primary driving beam headlamp."

Paragraph 6.4.3., amend to read:

"6.4.3. additional tests are made after the reflector has been moved vertically ± 2° 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) **for Class A or Class B headlamps and at the test point 1 for Class C headlamps**;
- driving beam: I_M and point HV (percentage of I_M)."

Annex 1,

Item 9., amend to read:

"9. Brief description:

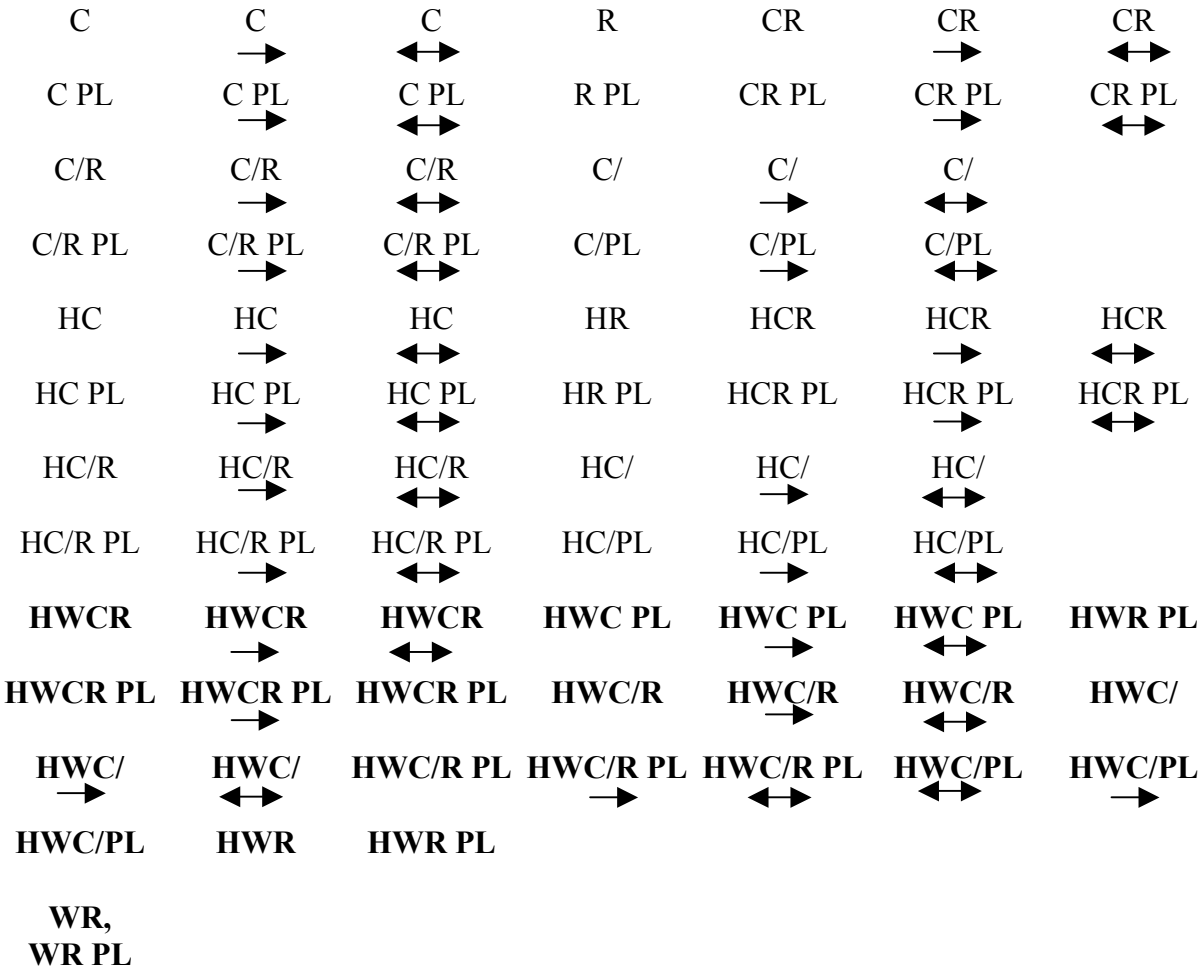
Category as described by the relevant marking: 3/ .....
.....

Number and category(ies) of filament lamp(s): .....
.....

Position lamp contributing to Class C passing beam: yes/no 2/
The adjustment of the cut-off has been determined at: 10 m / 25 m 2/.
The determination of the minimum sharpness of the "cut-off" has been carried out at: 10 m / 25 m 2/."

Footnote 3/, amend to read:

"3/ Indicate the appropriate marking selected from the list below:



"

Annex 3,

Insert, after the title, tables A and B, to read:

"Annex 3

Table A - Class C Headlamp -Primary high beam

Refer to Figure F for details of test point positions

TEST POINT NUMBER	TEST POINT LOCATION	Required illuminance in lux	
		Min.	Max.
1	H-V 1/	1/	---
2	H-3R & 3L	20	---
3	H-6R & 6L	7	---
4	H-9R & 9L	4	---
5	H-12R & 12L	1.2	---
6	2U-V	2	---
7	4D-V	---	2/
	Peak illuminance anywhere in the beam pattern	50	180.0

1/ Intensity at H-V shall be equal to or greater than 80 per cent of the peak illuminance in the beam pattern.

2/ Intensity at 4D-V shall be equal to or less than 30 per cent of the peak illuminance in the beam pattern.

Table B - Class C Headlamp - Secondary high beam operated with a passing beam headlamp or a primary driving beam headlamp

Refer to Figure G for details of test point positions

TEST POINT NUMBER	TEST POINT LOCATION	Required illuminance in lux	
		Min.	Max.
1	H-V (1/)	1/	---
2	H-3R & 3L	20	---
3	H-6R & 6L	7	---
6	2U-V	2	---
7	4D-V	---	2/
	Peak illuminance anywhere in the beam pattern	50	180

1/ Intensity at H-V shall be equal to or greater than 80 per cent of the peak illuminance in the beam pattern.

2/ Intensity at 4D-V shall be equal to or less than 30 per cent of the peak illuminance in the beam pattern."

Figure A, amend the title to read:

"**Figure A**: **Class A and Class B headlamps** for right-hand traffic
(dimension in mm with screen at 25 m distance)"

Figure B, amend the title to read:

"**Figure B**: **Class A and Class B headlamps** for left-hand traffic
(dimension in mm with screen at 25 m distance)"

Figure C, insert the title to read:

"Figure C: **Class A and Class B headlamps**"

Insert new figures D and E, to read:

"**Figure D: Class C headlamp for right-hand traffic**

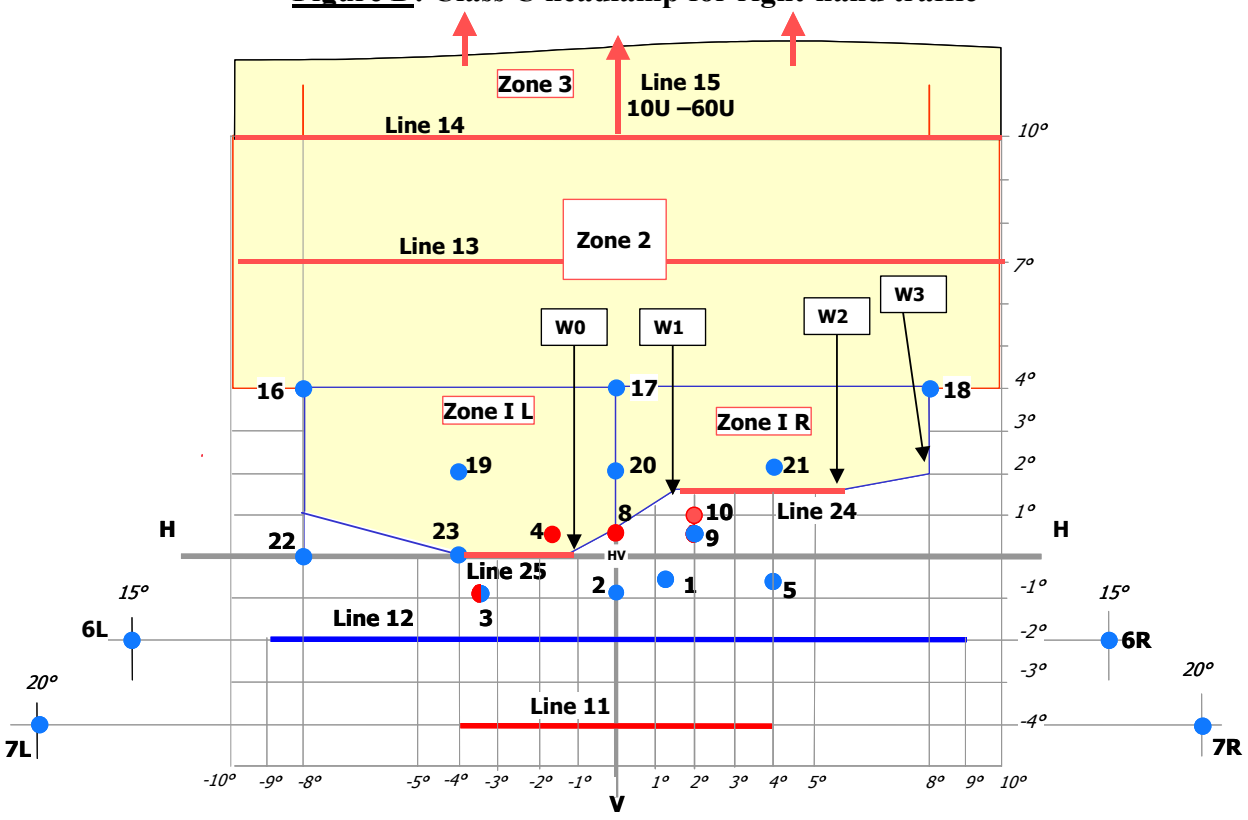
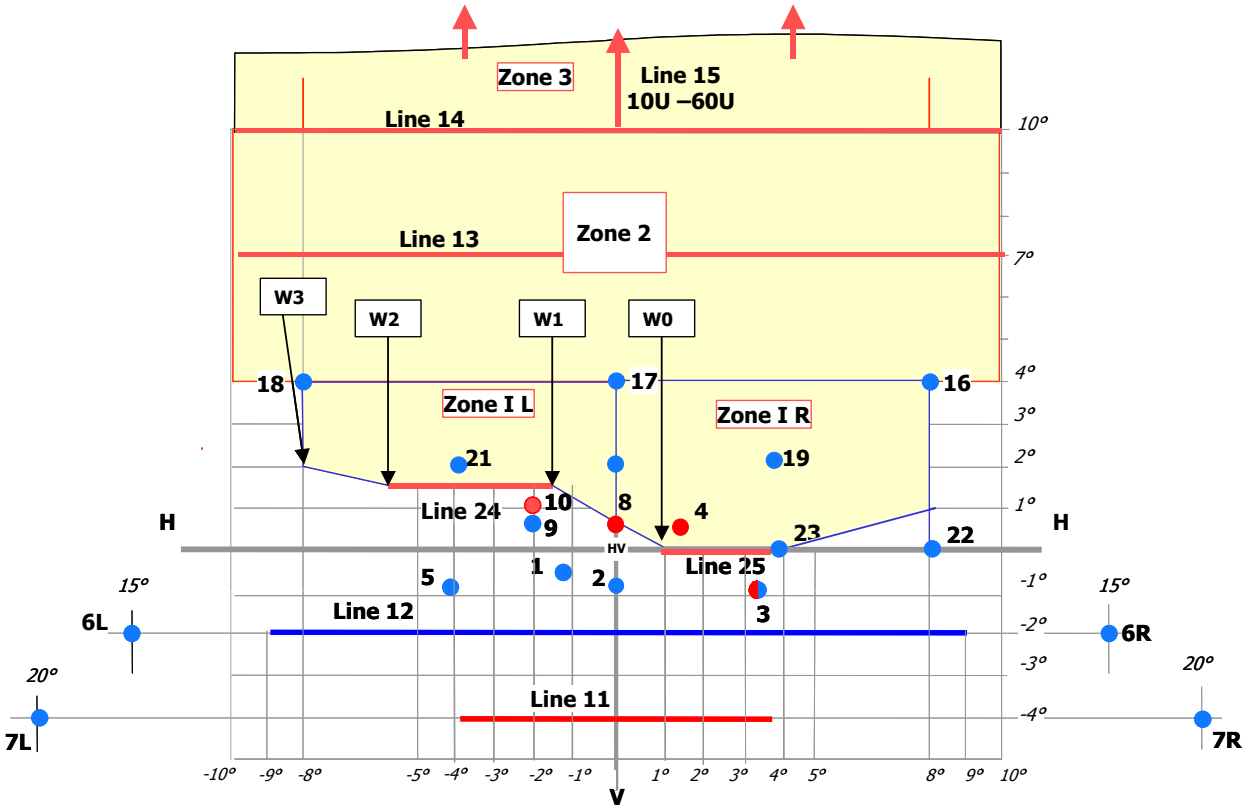


Figure E: Class C headlamp for left-hand traffic


Zone 3
Line 15
10U –60U
Line 14
Line 13
Zone 2
W3
W2
W1
W0
18
17
16
Zone I L
Zone I R
21
19
Line 24
10
9
8
4
23
22
H
HV
H
1
2
5
Line 25
3
15°
6L
Line 12
15°
6R
20°
20°
Line 11
7L
7R
10°
7°
4°
3°
2°
1°
-1°
-2°
-3°
-4°
-10° -9° -8° -5° -4° -3° -2° -1° 1° 2° 3° 4° 5° 8° 9° 10°
V

"

Add at the end of Annex 3 figures F and G, to read:

"**Figure F: Primary driving beam**

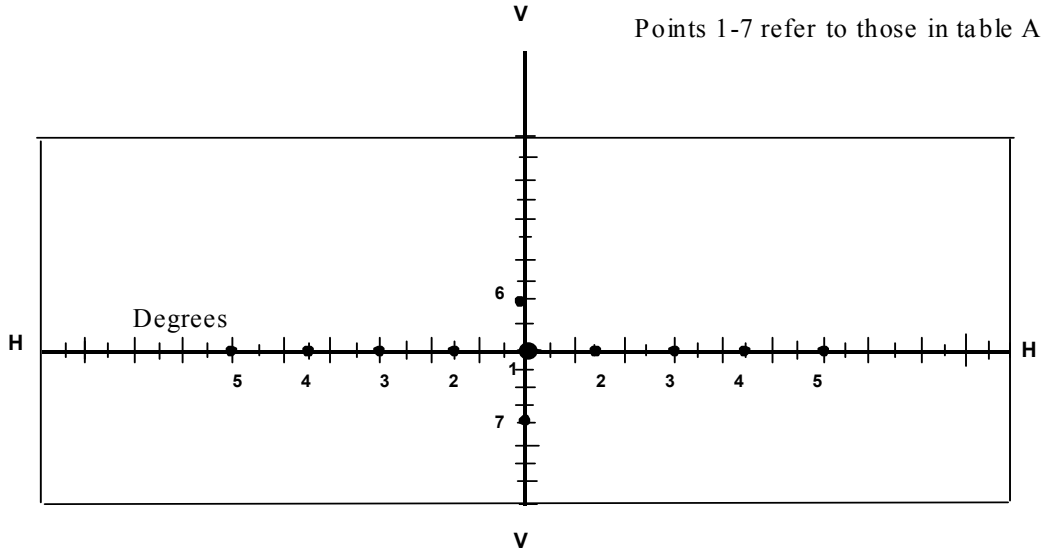
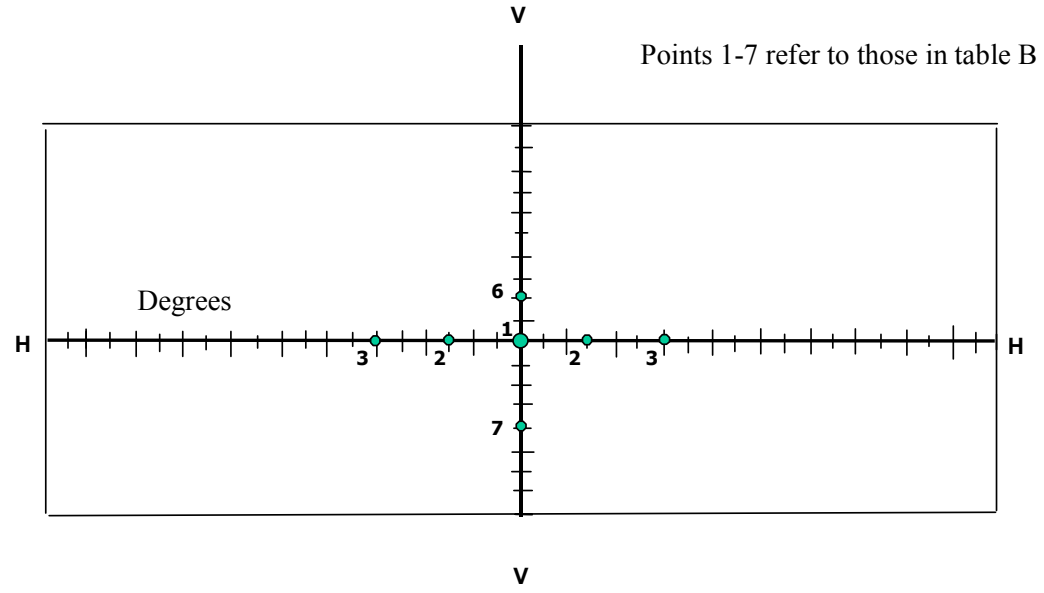


Figure G: Secondary Driving Beam



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Annex 4,

The opening paragraph, amend to read:

"TESTS ON COMPLETE HEADLAMPS

Once the photometric values have been measured according to the prescriptions of this Regulation, in the point for E_{max} for driving beam and **for passing beam:**

in points HV, 50 R, B 50 L **for Class A and B headlamps** (or HV, 50 L, B 50 R for headlamps designed for left-hand traffic) **and in points 8, 2 and 4 for Class C headlamps,** a complete headlamp sample shall be tested for stability of photometric performance in operation. "Complete headlamp" shall be understood to mean the complete lamp itself including those surrounding body parts and lamps which could influence its thermal dissipation.

Paragraph 1.1.2.2., amend to read:

"1.1.2.2. Photometric test

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

Passing beam:
50 R - B 50 L - HV for **Class A and B** headlamps designed for right-hand traffic,
50 L - B 50 R - HV for **Class A and B** headlamps designed for left-hand traffic,
points 8, 2 and 4 for Class C headlamps.

Driving beam: Point of E_{max} ."

Paragraph 1.2.1.2., amend to read (footnote 5/ unchanged):

"1.2.1.2. Application of the test mixture to the headlamp

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

Point of E_{max} in passing beam/driving beam and in driving beam only,
50 R and 50 V 5/ for a **Class A and B** passing lamp only, designed for right-hand traffic,
50 L and 50 V 5/ for a **Class A and B** passing lamp only, designed for left-hand traffic,
Point 2 for Class C passing beam only."

Paragraph 2.1., amend to read:

"2.1. Test

The test shall be carried out in a dry and still atmosphere at an ambient temperature of 23°C ± 5°C.

Using a mass production filament lamp, which has been aged for at least one hour the headlamp shall be operated on passing beam without being dismounted from or readjusted in relation to its test fixture. (For the purpose of this test, the voltage shall be adjusted as specified in paragraph 1.1.1.2.). The position of the cut-off line in its horizontal part (**for Class A and B headlamps** between vv and the vertical line passing through point B 50 L for right-hand traffic or B 50 R for left-hand traffic **and for Class C headlamps between HV and the vertical line passing through point 4**) shall be verified 3 minutes (r_3) and 60 minutes (r_{60}) respectively after operation."

Annex 5,

Paragraph 1.2.1., amend to read:

"1.2.1. no measured value deviates unfavourably by more than 20 per cent from the value prescribed in this Regulation. **In the case of Class A and B headlamps, for** values B 50 L (or R) and zone III, the maximum unfavourable deviation may be respectively:

B 50 L (or R):	0.2 lx equivalent 20 per cent
	0.3 lx equivalent 30 per cent
Zone III	0.3 lx equivalent 20 per cent
	0.45 lx equivalent 30 per cent

In the case of Class C headlamps, for values at test points 4 and zones 1L and 1R, the maximum unfavourable deviation may be respectively:

Test Point 4	**125 cd equivalent 20 per cent**
	185 cd equivalent 30 per cent
Zones 1L and 1R	**185 cd equivalent 20 per cent**
	280 cd equivalent 30 per cent"

Paragraph 1.2.2.1., amend to read:

"1.2.2.1. for the **Class A and B** passing beam, the values prescribed in this Regulation are met at HV (with a tolerance of + 0.2 lx) and related to that aiming at least one point of each area delimited on the measuring screen (at 25 m) by a circle 15 cm in radius around points B 50 L (or R) 1/ (with a tolerance of + 0.1 lx), 75 R (or L), 50 V, 25 R, 25 L, and in the entire area of zone IV which is not more than 22.5 cm above line 25 R and 25 L; **and for Class C passing beam, the values prescribed in this Regulation are met at point 8 (with a tolerance of + 125 cd.) and related to that aiming at least one point of each area delimited by a circle 0.35 degrees in radius around point 4 (with a tolerance of + 65 cd), points 1, 4, 6 and 7 and along line 11.**"

Insert a new paragraph 1.4., to read:

"**1.4. If, however, vertical adjustment cannot be performed repeatedly to the required position within the tolerances described in paragraph 6.2.4., one sample shall be tested according to the procedure in Annex 9, paragraphs 2.and 3**."

Paragraph 2.4., footnote 4/, amend to read:

"4/ HL and HR: points "hh" located at 1.125 m to the left and to the right of point HV respectively **in the case of a Class A or B headlamp and at 3 degrees to the right and left of HV in the case of a Class C headlamp. beam, and to points B 50 L (or R), HV, 50 V, 75 R (or L) and 25 L (or R) in the case of a Class A or B passing beam (see figure in Annex 3) and to points 4, 8, 2, 1, 6L and 6R.**"

Annex 6, paragraph 2.1.2.1., amend to read:

"2.1.2.1. Method

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

These measurements shall be made using a standard (étalon) lamp, at the following points:

B 50 L and 50 R for the passing beam of a **Class A or B** passing lamp or a passing/driving lamp (B 50 R and 50 L in the case of headlamps intended for left-hand traffic) **and for a Class C passing beam points 4 and 1;**

E_{max} route for the driving beam of a driving lamp or a passing/driving lamp."

Annex 7,

Paragraph 1.2.1., amend to read (including the insertion of a new footnote 1/):

"1.2.1. no measured value deviates unfavourably by more than 20 per cent from the value prescribed in this Regulation. **In the case of Class A and B headlamps, for** values

B 50 L (or R) **1/** and zone III, the maximum unfavourable deviation may be respectively:

B 50 L (or R):	0.2 lx equivalent 20 per cent
	0.3 lx equivalent 30 per cent
Zone III	0.3 lx equivalent 20 per cent
	0.45 lx equivalent 30 per cent

In the case of Class C headlamps, for values at test points 4 and zones 1L and 1R, the maximum unfavourable deviation may be respectively:

Test Point 4	**125 cd equivalent 20 per cent**
	185 cd equivalent 30 per cent
Zones 1L and 1R	**185 cd equivalent 20 per cent**
	280 cd equivalent 30 per cent

Insert a new footnote 1/, to read:

"**1/ Letters in brackets refer to headlamps intended for left-hand traffic**."

Paragraph 1.2.2.1., amend to read:

"1.2.2.1. **for the Class A and B passing beam,** the values prescribed in this Regulation are met at HV (with a tolerance of + 0.2 lx) and related to that aiming at least one point of each area delimited on the measuring screen (at 25 m) by a circle 15 cm in radius around points B 50 L (or R) **1/** (with a tolerance of + 0.1 lx), 75 R (or L), 50 V, 25 R, 25 L, and in the entire area of zone IV which is not more than 22.5 cm above line 25 R and 25 L; **and for Class C passing beam, the values prescribed in this Regulation are met at point 8 (with a tolerance of + 125 cd) and related to that aiming at least one point of each area delimited by a circle 0.35 degrees in radius around point 4 (with a tolerance of + 65 cd), points 1, 4, 6 and 7 and along line 11**."

Paragraph 1.2.3., the reference to footnote 1/ and footnote 1/ (former), renumber as footnote 2/.

Insert a new Annex 9, to read:

"**Annex 9**

DEFINITION AND SHARPNESS OF THE "CUT-OFF" LINE FOR HEADLAMPS

1. GENERAL

The luminous intensity distribution of the headlamp shall incorporate a "cut-off" line, which enables the headlamp to be adjusted correctly for the photometric measurements and for the aiming on the vehicle.

The "cut-off" line shall provide

A) for right hand traffic beams:
- **i) a straight "horizontal part" towards the left**
- **ii) a raised "elbow - shoulder" part towards the right**

B) for left hand traffic beams:
- **i) a straight "horizontal part" towards the right**
- **ii) a raised "elbow - shoulder" part towards the left**
- **iii) in each case the "elbow - shoulder" part shall have a sharp edge.**

The characteristics of the "cut-off" line shall comply with the requirements set out in paragraph 2. to 4. below:

2. SHAPE OF THE "CUT-OFF" LINE

The cut-off line shall provide a straight horizontal line between 1.5° and 3.5° to the left of the v-v-line (see Figure 1)(to the right ….)

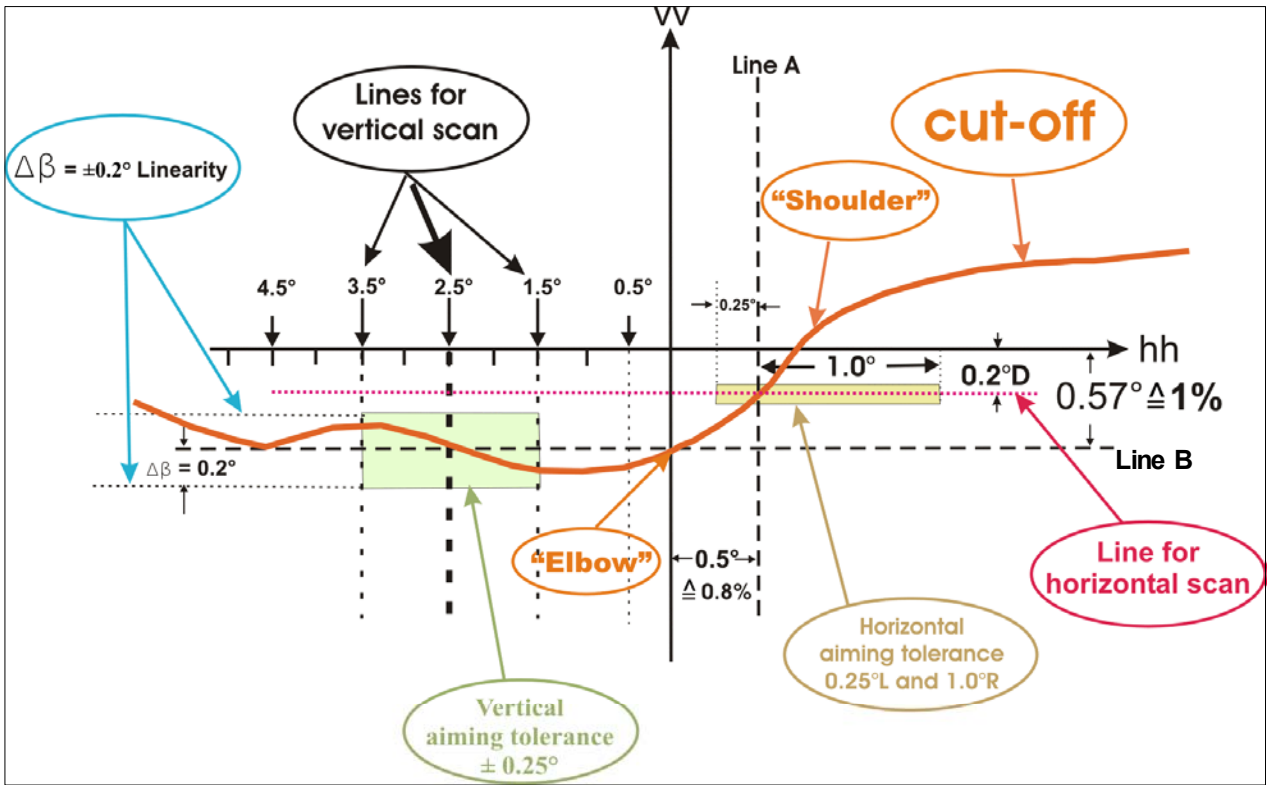

Figure 1

3. VISUAL ADJUSTMENT OF THE PASSING BEAM

3.1 Horizontal pre-adjustment

The straight "horizontal part" shall be on the left side of the vv-line (left hand traffic: on the right side of the vv-line)

3.2. Vertical adjustment

3.2.1. **Following horizontal pre-adjustment of the passing beam according to paragraph 3.1 above, the vertical adjustment of the passing beam shall be performed in such a way that the beam with its cut-off line is moved from below upwards until the horizontal part of the cut-off line is situated at its nominal vertical position 1 per cent below the HH-line.**

The vertical deviation of the cut-off line shall be not more than 0.2degrees up or down from its horizontal median line and within 2/3 from its median line of said length not more than 0.1 degrees up or down.

3.2.2. **If, however, vertical adjustment cannot be performed repeatedly to the required position within the allowed tolerances, the instrumental method of paragraphs 4. and 5. shall be applied to test for compliance with the required minimum**

quality of the "cut-off" line. This measurement shall be performed in the line 2.5 ° left (for beams for left hand side traffic: 2.5 ° right).

3.3 Horizontal adjustment

Following vertical adjustment of the straight "horizontal part" according to paragraph 3.2. above, the horizontal adjustment of the passing beam shall be performed in such a way that:

3.3.1. The beam with its "cut-off" line shall be moved for right hand traffic from right to left and shall be horizontally positioned after its movement so that:

- **above the line 0.2°D its "shoulder" shall not exceed the line A to the left and**
- **on the the line 0.2°D or below its "shoulder" should cross the line A and**
- **the kink of "elbow" should be primarily on the vv-line;**

or

for left hand traffic from left to right and shall be horizontally positioned after its movement so that:

- **above the line 0.2°D its "shoulder" shall not exceed the line A to the right and**
- **on the the line 0.2°D or below its "shoulder" should cross the line A and**
- **the kink of "elbow" should be primarily on the vv-line;**

3.3.2. If a visual horizontal adjustment is not possible inside the above specified tolerances the instrumental method shall be applied.
The manufacturer may specify one of two horizontal aim methods.
If the "3 line" method (Figure 3) is used, 3 vertical lines shall be scanned at 1R, 2R, and 3R after the lamp is aimed vertically.
If the "0.2D line" method (Figure 2) is used, a single horizontal line shall be scanned. The minimum gradient found on the 0.2D line shall be not less than 0.08.

4. MEASUREMENT OF THE QUALITY OF CUT-OFF

For minimum sharpness the measurements shall be performed by vertically scanning through the horizontal part of the cut-off line in angular steps of 0.05° at either a measurement distance of:

- **10 m and a detector with a diameter of approximately 10 mm or at a measurement distance of**
- **25 m and a detector with a diameter of approximately 30 mm.**

The measurement of the cut-off quality shall be considered acceptable if the requirements of paragraph 4.1. to 4.3. below, comply with at least one set of measurements at 10 m or 25 m.

The measuring distance at which the test was determined shall be noted down in paragraph 9. of the communication form (see Annex 1 of this Regulation).

For maximum sharpness the measurements shall be performed by vertically scanning through the horizontal part of the cut-off line 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.

After visual horizontal pre-adjustment according to paragraph 3.1. above, the quality of the cut-off shall meet the following requirements:

4.1. Not more than one "cut-off" line shall be visible 1/.

4.2. Sharpness of "cut-off"

If scanned vertically through the horizontal part of the cut-off line at 2.5° distant from the V-V-line, the maximum value measured for

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

is called the sharpness factor G of the cut-off line. The value of G shall not be less than 0.13 (minimum sharpness) and not greater than 0.35 (maximum sharpness).

4.3. Linearity

The part of the cut-off line that serves for vertical adjustment shall be horizontal between 1.5° and 3.5° to the left from the V-V-line for right-hand traffic.

- **The inflection points of the cut-off gradient at the vertical lines at 1.5, 2.5 and 3.5 degrees shall be determined by the equation ($d^2 (\log E) / d\beta^2 = 0$).**

- **The inflection points determined shall be within the limits of ± 0.2 degrees**

1/ This paragraph will be amended, when an objective test method will be available.

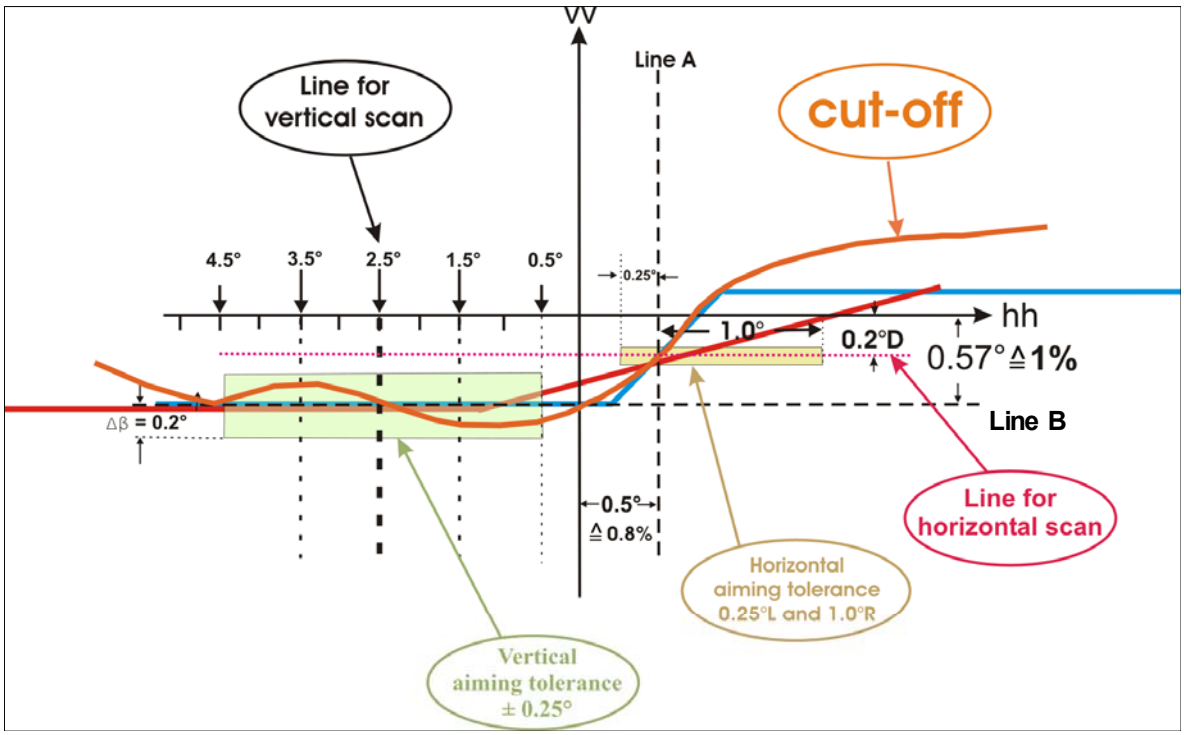

Figure 2: Instrumental vertical and horizontally adjustment - horizontal line scan method

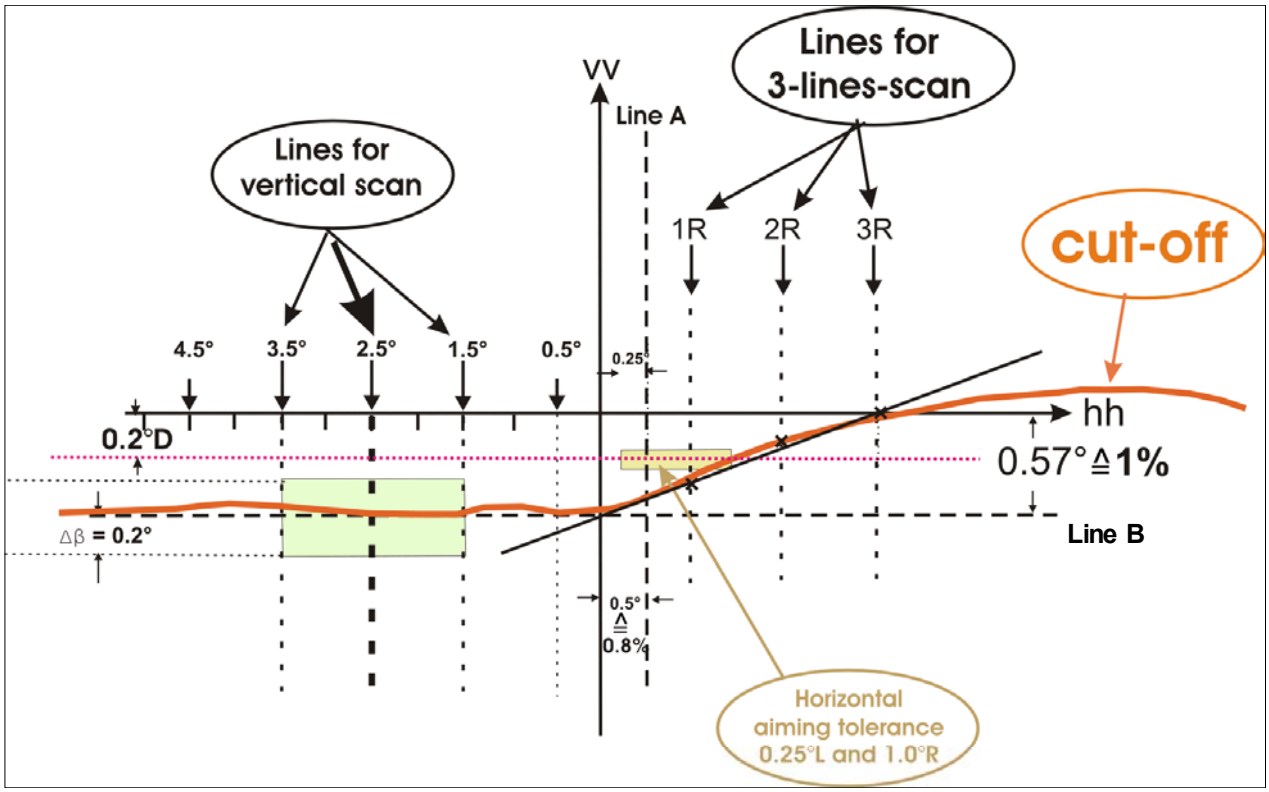

Figure 3: Instrumental vertical and horizontally adjustment - three line scan method

4. INSTRUMENTAL VERTICAL AND HORIZONTALLY ADJUSTMENT

If the cut-off line complies with the above quality requirements, the vertical beam adjustment can be performed instrumentally.

Before carrying out the instrumental aiming procedure a pre-aim in accordance with paragraph 3. above is required, than starting with vertical aim followed by the horizontal aim.

4.1. Vertically

The movement of the headlamp for measuring and adjusting the "cut-off" line shall be upwards from below the nominal position. For this purpose the inflection point at 2.5° distant of the gradient (where d^2 (log E) / dv^2 = 0) from the v-v-line is positioned at its nominal position below the h-h-line as described in paragraph 3.2.1. above.

4.2. Horizontally

For the horizontal adjustment, a horizontal scan from 2°L to 2°R (left hand traffic: from 2°R to 2°L) at the line 0.2°D shall be made to determine the position of the maximum of the gradient (where d^2 (log E)/dv^2 = 0). This maximum shall be positioned on the line A.

If the "3 line" method (Figure 3) is used, 3 vertical lines shall be scanned at 2° D to 2° U at 1R, 2R, and 3R after the lamp is aimed vertically. The maximum gradient determined as defined in paragraph 4.2. above, shall not be less than 0.08 and "A" is the vertical angular position. The maximum gradient positions found on the 3 lines shall be used to construct an angled straight line. The intersection of this line and the 0.57D position found while performing vertical aim shall be placed on the V line.

If the "0.2D line" method (Figure 2) is used, a single horizontal line at 0.2° D shall be scanned from 5L to 5R after the lamp is aimed vertically. The maximum gradient determined as defined in paragraph 4.2. above, shall not be less than 0.08. The maximum gradient positions found on the 0.2D line shall be placed on the V line."

* * *

B. JUSTIFICATION

(a) Harmonized passing and driving beam

Proposals for a worldwide harmonized passing and driving beam have already been considered by GRE based upon documents TRANS/WP.29/GRE/2003/35 (harmonized driving beam for Regulation No. 112) and TRANS/WP.29/GRE/2004/6 (harmonized passing beam for Regulation No. 112). The harmonized driving beam has already been agreed and the proposals for the harmonized passing beam relative to Regulation No. 112 were broadly accepted at the fifty-second GRE session.

(b) Numeric definition and measurement of cut-off position and sharpness

A method for the numeric definition and measurement of cut-off position and sharpness has been developed, which can be used for instrumental aiming and for the decision as to whether the cut-off line of a passing beam headlamp yields sufficient sharpness such that proper vertical aim is possible, be it visually or instrumentally. This proposal supersedes that contained in TRANS/WP.29/GRE/2002/41.

The GTB proposes that the new provisions for the harmonized passing and driving beams and the numeric definition and measurement of cut-off position and sharpness are combined into a single consolidated amendment to Regulation No. 112.

Literature relating to the cut-off definition:

The main background and references are given in the following publications:

- H.J.Schmidt-Clausen, Methods for an objective determination of the position of a "cutoff", CIE Congress 19th sess. TC 4.7 indiv. com. Kyoto 1979
- R. Rendu, UTAC report nr. 86 14.60.622/337, 1986
- Harrison, A.L. (1984). Defining the illuminance cut-off for the E.C.E. low beam headlamp as a means of analysing the effects of bulb replacement on headlamp output (Report No. ST-336). Ottawa, Canada: National Aeronautical Establishment, Structures and Materials Laboratory
- Poynter, W. D., Plummer, R.D., and Donohue, R.J. (1989) Vertical alignment of headlamps by visual aim (Report No. GMR-6693). Warren, MI: General Motors Technical Laboratories
- M. Sivak, M. Flannagan, D. Chandra, A. W. Gellaty, Visual Aiming of European and U.S. Low-Beam Headlamps, Report N0. UMTRI-91-34, University of Michigan, September 1991
- CIE-Draft Publication: "Definition of cut-off", Vienna 1993
- H.J.Schmidt-Clausen, Evaluation of the Cut-Off Referring to Quality, Proceedings of Progress In Automobile Lighting, Vol. 1 , PAL 1995, p. 171
- W. Pollack, Journ. ATZ-worldwide, 100 (1998) 1
- FMVSS 108 after implementation of cut-off and visual aim, 1998
- NHTSA, Final Summary Minutes, Headlamp Regulatory Negotiation, Session 3, October 18 and 19
- K. Manz, ARE MEASUREMENTS FOR THE CUT-OFF GRADIENT OF HEAD LAMPS IN DIFFERENT MEASUREMENT DISTANCES POSSIBLE?, paper presented at the SAE Lighting Conference 2000 in Detroit, Conference Paper # 2000-01-0803

- K. Manz, Tolerances of Cut-Off-Measurements, Proceedings of Progress In Automobile Lighting, Vol. 8, PAL 2001, p. 635
- T. Targosinski, "Cut-Off" Line in AFS Draft Regulation, Informal Document 50th GRE, TRANS-WP.29-GRE-50-08, Geneva 7 – 11 April 2003

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