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World Forum for Harmonization of Vehicle Regulations (WP.29)

Working Party on Lighting and Light-Signalling (GRE)

(Fifty-fourth session, 5–8 April 2005,  
agenda item 15.)

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 98  
(Headlamps with gas-discharge light sources)

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. 98 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/2003/34 (harmonized driving beam for Regulation No. 98) and TRANS/WP.29/GRE/2004/6 (harmonized passing beam for Regulation No. 112) and replaces TRANS/WP.29/GRE/2003/34. The amendments of Supplements 1, 2, 3 and 4 to Regulation No. 98 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.

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

**A. PROPOSAL**

Table of contents, annexes, amend to read:

".....

Annex 9 - Minimum requirements for sampling by an inspector

Annex 10 - **Definition and sharpness of the "cut-off" line for headlamps"**

Text of the Regulation,

Paragraph 1.6.5., amend to read:

"1.6.5. the kind of beam produced (passing beam or driving beam or both) **and the different "Classes" (D or E) of the headlamps as identified by particular photometric provisions;**"

Paragraphs 4.2.2.3. to 4.2.2.5., amend to read:

"4.2.2.3. on headlamps meeting the requirements of this Regulation in respect of the passing beam only, the letter "DC" **for Class D headlamp or "DCH" for Class E headlamp;**

4.2.2.4. on headlamps meeting the requirements of this Regulation in respect of the driving beam only, the letter "DR"; **for Class D headlamp or "DRH" for Class E 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 "DCR"; **for Class D headlamp or "DCRH" for Class E headlamp;**"

Paragraph 5.4.2., amend to read:

"5.4.2. In the case of failure, the illumination above the line H-H shall not exceed the values of a passing beam according to paragraph 6.2.6.; 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 D headlamps and 2.0 degrees D, V for Class E headlamps;**"

Paragraphs 6.2.1. and 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 10 to this Regulation, to permit a satisfactory adjustment with its aid.**

6.2.2. The headlamp shall be **visually aimed by means of the "cut-off" line which is specified in Annex 10 of this Regulation, so that:**"

Paragraph 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 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 10, which is:**

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

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

Insert new paragraphs 6.2.2.3. and 6.2.2.4., 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 10.**

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 10, 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 10, paragraphs 2 to 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 10, paragraphs 2-4)."**

Paragraph 6.2.6., insert before the photometric table an new subparagraph 6.2.6.1., to read:

**"6.2.6.1. For Class D headlamp"**

Insert new paragraphs 6.2.6.2. and 6.2.6.3., to read:

**"6.2.6.2 For Class E headlamp - right hand traffic:**

TEST POINT	Position (Degrees)		Luminous Intensity - Cd		
	Vertical	Horizontal	min	max	
1	0.60D	1.3R	14,000		
2	0.86D	0	6,250		
3	0.86D	3.5L	2,500	13,100	
4	0.50U	1.50L		450	
5	0.50D	4.0R	7,000		
6	2.00D	15L&15R	1,400		
7	4.00D	20L&20R	420		
8	0.50U	0		875	
9	0.50U	2R	850		
10	1.00U	2R		2,550	
Line11	4.00D	4Lto4R		12,250	See Note (ii)
Line12	2.00D	9Lto9R	1,750		
Line13	7.00U	10Lto10R		265	See Note (iii)
Line14	10.00U	10Lto10R		135	
Line15	10U to 60U	0		135	
16	4.00U	8.0L	90		See Note (iv)
17	4.00U	0	90		
18	4.00U	8.0R	90		
19	2.00U	4.0L	190		
20	2.00U	0	190		
21	2.00U	4.0R	190		
22	0	8.0L	90		
23	0	4.0L	190		
Line 24	1.5U/6R-1.5U/1.5R			875	
Line 25	0/1L-0/4L			620	
<b>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.</b>					
Zone1 (Right)	0.5U/V-4U/V-4U/8R-2U/8R-1.5U/6R-1.5U/1.5R-0.5U/V			875.00	
Zone1(Left)	1U/8L-4U/8L-4U/V-0.5U/V-0/1L-0/4L-1U/8L			620.00	
Zone2	>4Uto<10U	10Lto10R		265.00	See Note (iii)
Zone3	10Uto60U	10Lto10R		135.00	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 12,250 cd.

**Note (iii):** Narrow spots or stripes with not more than 620 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.

**6.2.6.3. For Class E headlamp - left hand traffic:**

TEST POINT	Position (Degrees)		Candelas at rated luminous flux		
	Vertical	Horizontal	min	max	
1	0.60D	1.3L	14,000		
2	0.86D	0	6,250		
3	0.86D	3.5R	2,500	13,100	
4	0.50U	1.50R		450	
5	0.50D	4.0L	7,000		
6	2.00D	15L&15R	1,400		
7	4.00D	20L&20R	420		
8	0.50U	0		875	
9	0.50U	2L	850		
10	1.00U	2L		2,550	
Line11	4.00D	4Lto4R		12,250	See Note (ii)
Line12	2.00D	9Lto9R	1,750		
Line13	7.00U	10Lto10R		265	See Note (iii)
Line14	10.00U	10Lto10R		135	
Line15	10U to 60U	0		135	
16	4.00U	8.0R	90		See Note (iv)
17	4.00U	0	90		
18	4.00U	8.0L	90		
19	2.00U	4.0R	190		
20	2.00U	0	190		
21	2.00U	4.0L	190		
22	0	8.0R	90		
23	0	4.0R	190		
Line 24	1.5U/6R-1.5U/1.5R			875	
Line 25	0/1L-0/4L			620	
<b>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.</b>					
Zone1 (Left)	0.5U/V-4U/V-4U/8L-2U/8L-1.5U/6L-1.5U/1.5L-0.5U/V			875.00	
Zone1(Right)	1U/8R-4U/8R-4U/V-0.5U/V-0/1R-0/4R-1U/8R			620.00	
Zone2	>4Uto<10U	10Lto10R		265.00	See Note (iii)
Zone3	10Uto60U	10Lto10R		135.00	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 12,250 cd.

**Note (iii):** Narrow spots or stripes with not more than 620 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."

Paragraph 6.3.2.3., amend to read:

"6.3.2.3. Starting from point HV, horizontally to the right and left, the illuminance shall be not less than 40 lux up to a distance of 1.125 m and not less than 10 lux up to a distance of 2.25 m.

**In the case of a headlamp designed to produce a Class E driving beam, 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 a primary driving beam headlamp."**

Paragraph 6.5.2., amend to read:

"6.5.2. Additional tests are made after the reflector has been tilted vertically upwards by the angle quoted in paragraph 2.1.4. or 2 degrees, whichever is smaller, by means of the headlamp aiming devices. The headlamp is then re-aimed downwards (by means of the goniometer), and the photometric specifications must be met at the following points:

Passing beam: HV and 75 R (75 L respectively) **for Class D headlamps and at the test point No. 1 for Class E headlamps.**

Driving beam: E max, HV as percent of Emax.

If the aiming devices do not allow a continuous movement, the position nearest to 2 degrees is chosen."

Annex 1,

Insert a new item 9.2.1., to read:

**"9.2.1. Position lamp contributing to Class E passing beam: yes/no 2/"**

Insert a new item 9.6., to read:

"9.6.       **The adjustment of the "cut-off" has been determined at: 10m / 25m 2/.  
The determination of the minimum sharpness of the "cut-off" has been carried out at: 10 m / 25 m 2/."**

Item 9.6. (former), renumber as item 9.7.

Footnote 3/, add the markings "**DCH, DCH PL,**" and "**DRH, DRH PL**" to the existing list.

Annex 3,

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

"Annex 3

**Table A - Primary driving beam headlamp**

**Refer to Figure F for details of test point positions**

TEST POINT NUMBER	TEST POINT LOCATION	Required illumination in lux	
		Min.	Max.
<b>1</b>	<b>H-V <u>1/</u></b>	<b><u>1/</u></b>	---
<b>2</b>	<b>H-3R &amp; 3L</b>	<b>40.0</b>	---
<b>3</b>	<b>H-6R &amp; 6L</b>	<b>10.0</b>	---
<b>4</b>	<b>H-9R &amp; 9L</b>	<b>4</b>	---
<b>5</b>	<b>H-12R &amp; 12L</b>	<b>1.2</b>	---
<b>6</b>	<b>2U-V</b>	<b>2</b>	---
<b>7</b>	<b>4D-V</b>	---	<b><u>2/</u></b>
	<b>Peak illuminance anywhere in the beam pattern</b>	<b>70.0</b>	<b>180.0</b>

- 1/ Illuminance at H-V shall be equal to or greater than 80 per cent of the peak illuminance in the beam pattern.**
- 2/ Illuminance at 4D-V shall be equal to or less than 30 per cent of the peak illuminance in the beam pattern.**



**Table B - Secondary driving beam headlamp operated with a passing beam headlamp or a primary driving beam headlamp**

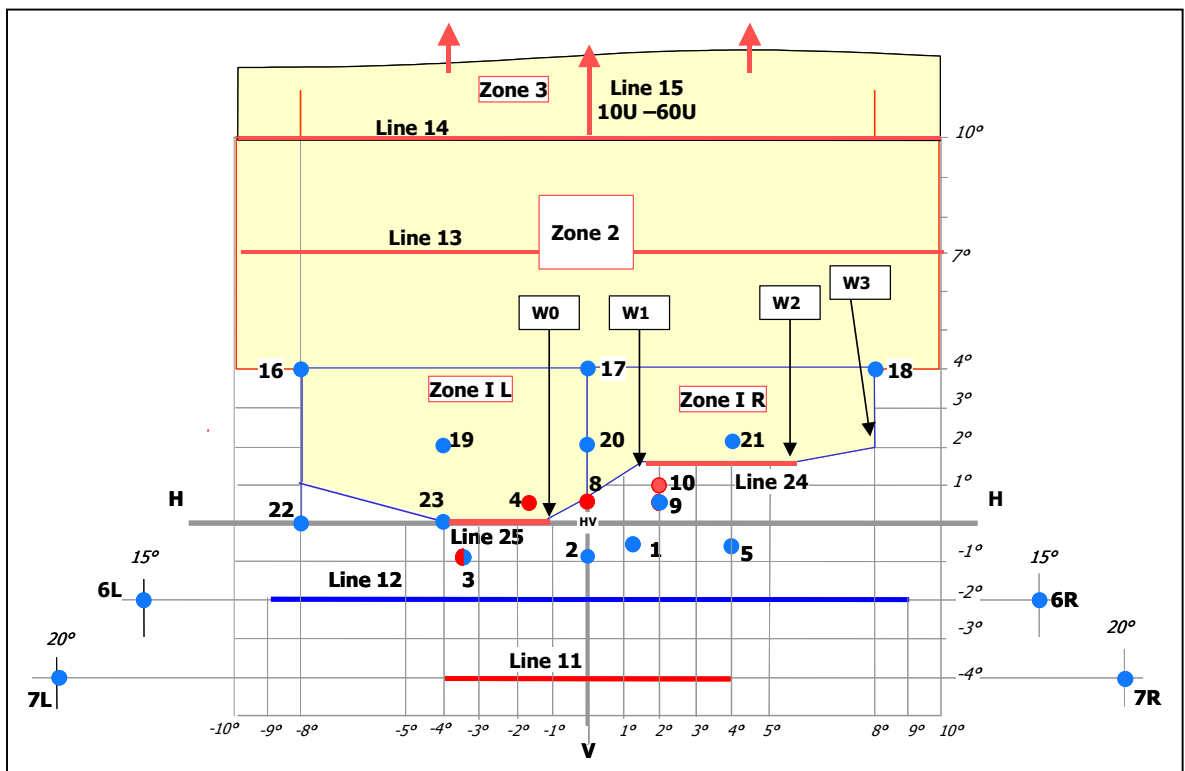
Refer to Figure G for details of test point positions

TEST POINT NUMBER	TEST POINT LOCATION	Required illumination in lux	
		Min.	Max.
1	H-V 1/	1/	---
2	H-3R & 3L	40.0	---
3	H-6R & 6L	10.0	---
6	2U-V	2	---
7	4D-V	---	2/
	Peak illuminance anywhere in the beam pattern	70	180

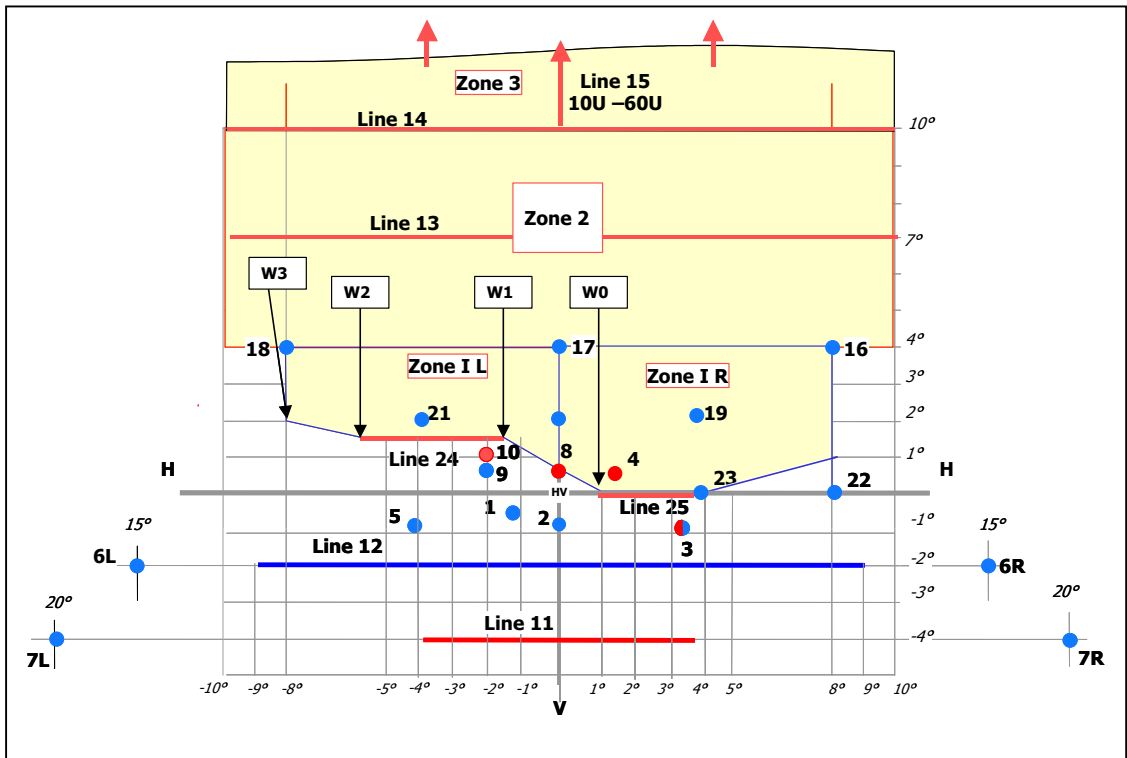
- 1/ Illuminance at H-V shall be equal to or greater than 80 per cent of the peak illuminance in the beam pattern.
- 2/ Illuminance at 4D-V shall be equal to or less than 30 per cent of the peak illuminance in the beam pattern."

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

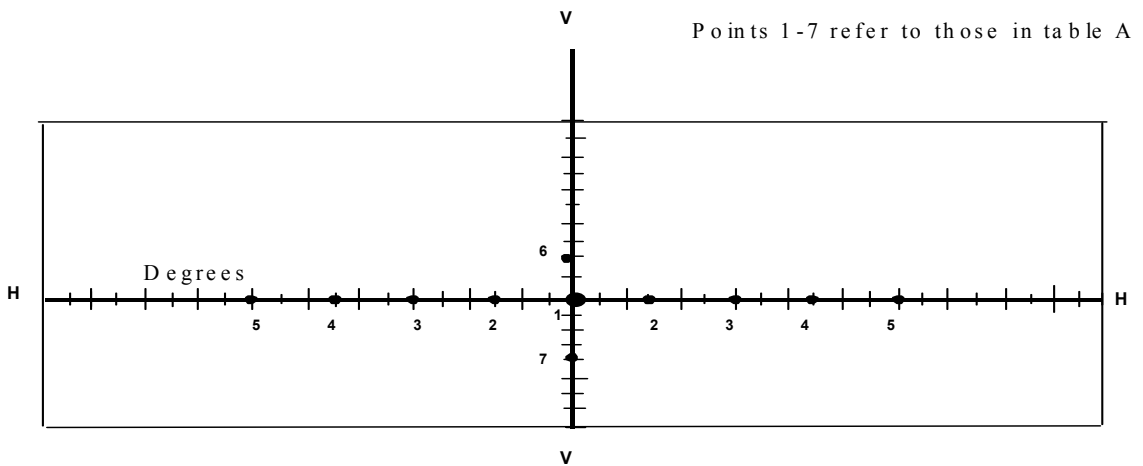
**"Figure D (Class E headlamp for right hand traffic)**



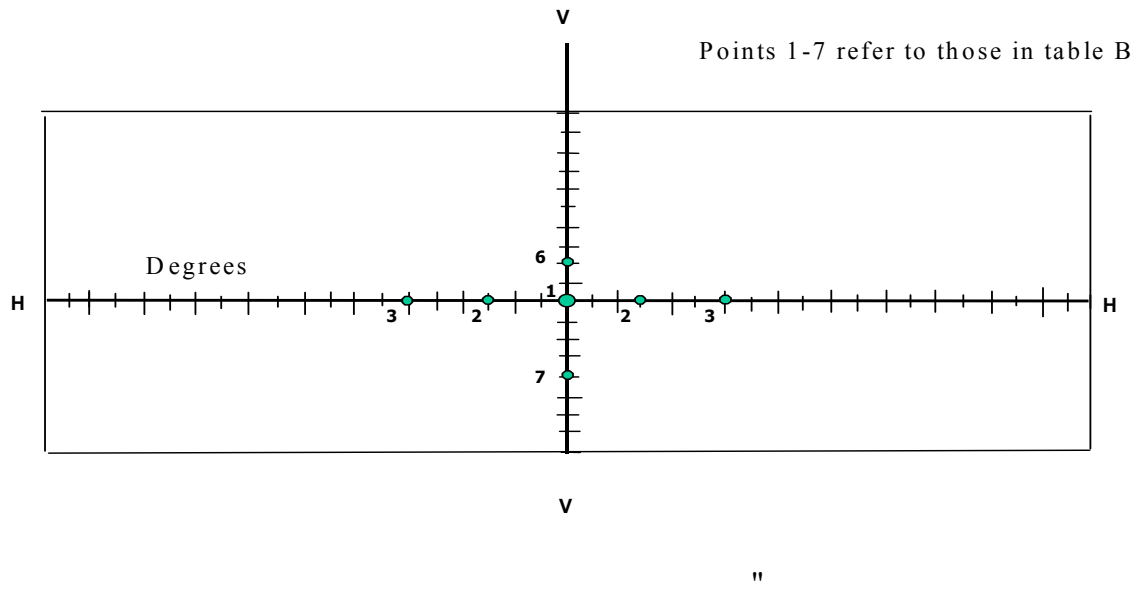
**Figure E (Class E headlamp for left hand traffic)**



**Figure F - Primary driving beam**



**Figure G - Secondary driving beam**



Annex 4,

The opening paragraph, amend to read:

"TEST ON COMPLETE HEADLAMPS

Once the photometric values have been measured according to the prescriptions of this Regulation, in the point for Emax for driving beam and in points HV, 50 R, B 50 L for **Class D passing beam (or HV, 50 L, B 50 R for headlamps designed for left-hand traffic) and in points 8, 2 and 4 for Class E passing beam,** 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 D** headlamps designed for right-hand traffic,  
50 L - B 50 R - HV for **Class D** headlamps designed for left-hand traffic,

**Points 8, 2 and 4 for Class E headlamps.**

Driving beam: Point of Emax

Another aiming ....."

Paragraph 1.2.1.2., amend to read:

"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 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 Emax in passing beam/driving beam and in driving beam only,

50 R and 50 V 4/ for a **Class D** passing lamp only, designed for right-hand traffic,

50 L and 50 V 4/ for a **Class D** passing lamp only, designed for left-hand traffic,

**Point 2 for Class E passing beam only."**

Paragraph 2.1., amend to read:

"2.1. Test for passing beam headlamps

The test shall be carried out in a dry and still atmosphere at an ambient temperature of  $23\text{ }^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

Using a mass production gas-discharge light source which has been aged for at least 15 hours, the headlamp shall be operated on passing beam function without being dismantled from or readjusted in relation to its test fixture. (For the purpose of this test, the voltage shall be adjusted as specified in paragraph 1.1.1.2.).

The position of the cut-off line in its horizontal part (**for Class D 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 E headlamps between HV and the vertical line passing through point 4**) shall be verified 3 minutes ( $t_3$ ) and 60 minutes ( $t_{60}$ ) 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."

Annex 5,

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 lamp, at the following points:

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

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

Annex 8,

Paragraph 1.2.1., amend to read:

"1.2.1. no illuminance value, if measured and corrected according to paragraph 1.2. above, deviates unfavourably by more than 20 per cent from the values prescribed in this Regulation. **In the case of Class D headlamps, for values B 50 L (or R) and on line H/H2 (or H/H3/H4) and above, the maximum unfavourable deviation may be respectively:**

B 50 L (or R): <u>1/</u>	0.20 lx equivalent 20 per cent
	0.30 lx equivalent 30 per cent

On line H/H2 (or line H/H3/H4) and above:

	0.30 lx equivalent 20 per cent
	0.45 lx equivalent 30 per cent

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

<b>Test Point 4</b>	<b>125 cd equivalent 20 per cent</b>
	<b>185 cd equivalent 30 per cent</b>

<b>Zones 1L and 1R</b>	<b>185 cd equivalent 20 per cent</b>
	<b>280 cd equivalent 30 per cent"</b>

Paragraph 1.2.2.1., amend to read:

"1.2.2.1. for the **Class D** 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 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 R1, 25 L2, and on segment I;

**and for Class E 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 1.5., to read:

**"1.5. 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 10, paragraphs 2. and 3."**

Paragraph 2.4., amend to read:

"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  $E_{max}$ , HV 2/, HL, HR 3/ in the case of the driving beam, and to points B 50 L (or R) 1/, HV, 50 V, 75 R (or L) and 25 L2 (or R2) in the case of the **Class D** passing beam **and to points 4, 8, 2, 1, 6L and 6R in the case of a Class E passing beam (see figures in Annex 3)."**

Footnote 3/, amend to read:

"3/ HL and HR: points on "hh" located at 1.125 m to the left and to the right of point HV respectively **in the case of a Class D headlamp and at 3 degrees to the right and left of HV in the case of a Class E driving beam."**

Annex 9,

Paragraph 1.2.1., to read:

"1.2.1. no measured value deviates unfavourably by more than 20 per cent from the values prescribed in this Regulation.

**In the case of Class D headlamps**, in the glare zone the maximum deviation may be respectively:

B 50 L (or R): <u>1/</u>	0.20 lx equivalent 20 per cent
	0.30 lx equivalent 30 per cent

On line H/H2 (or line H/H3/H4)  
and above: 0.30 lx equivalent 20 per cent  
0.45 lx equivalent 30 per cent

**In the case of Class E 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 D** 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 one point of each area delimited on the measuring screen (at 25 m) by a circle of 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 R1, 25 L2, and on segment I;

**and for Class E 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 1.5., to read:

"1.5. **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 10, paragraphs 2. and 3."**

Insert a new Annex 10, to read:

**"Annex 10**

**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

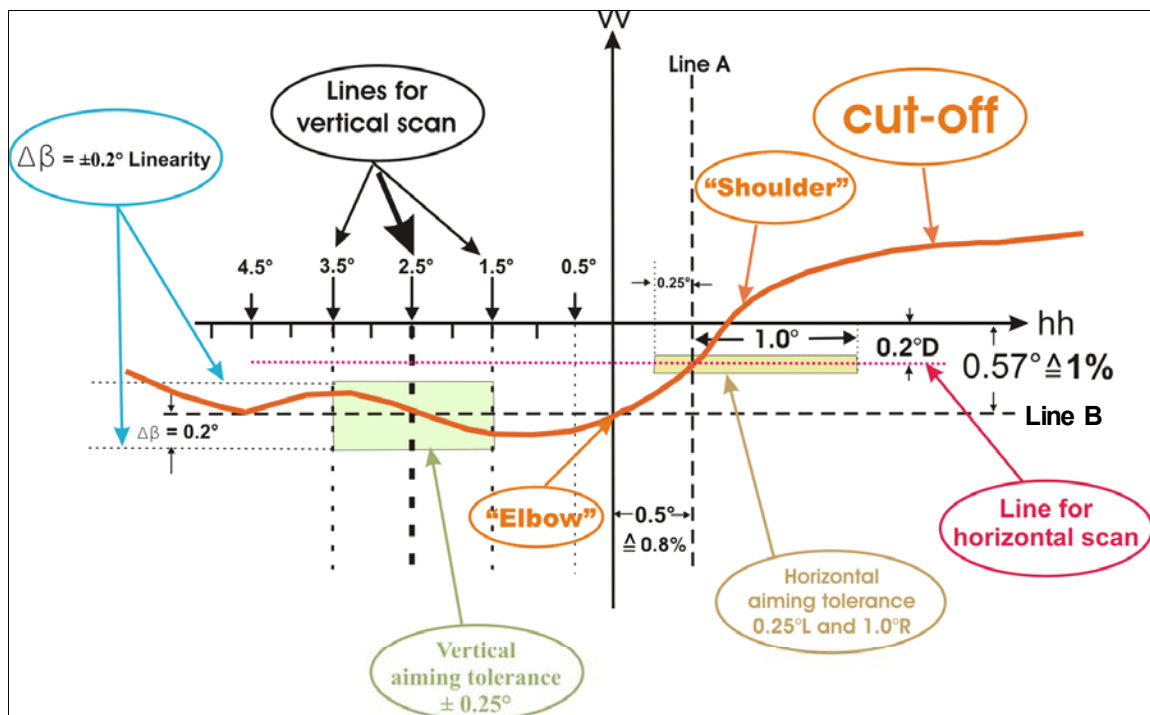
B) for left hand traffic beams:

- 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 paragraphs 2. to 4. below:

## 2. SHAPE OF THE "CUT-OFF" LINE

The "cut-off" line shall provide a straight horizontal line between  $1.5^\circ$  and  $3.5^\circ$  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. After 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 0.2 degrees 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 point 2.5 ° left (for beams for left hand side traffic: 2.5 ° right).

#### **3.3. Horizontal adjustment**

After 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 2 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 a detector with 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 <sup>1/</sup>

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

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

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 larger than 0.35 (maximum sharpness).

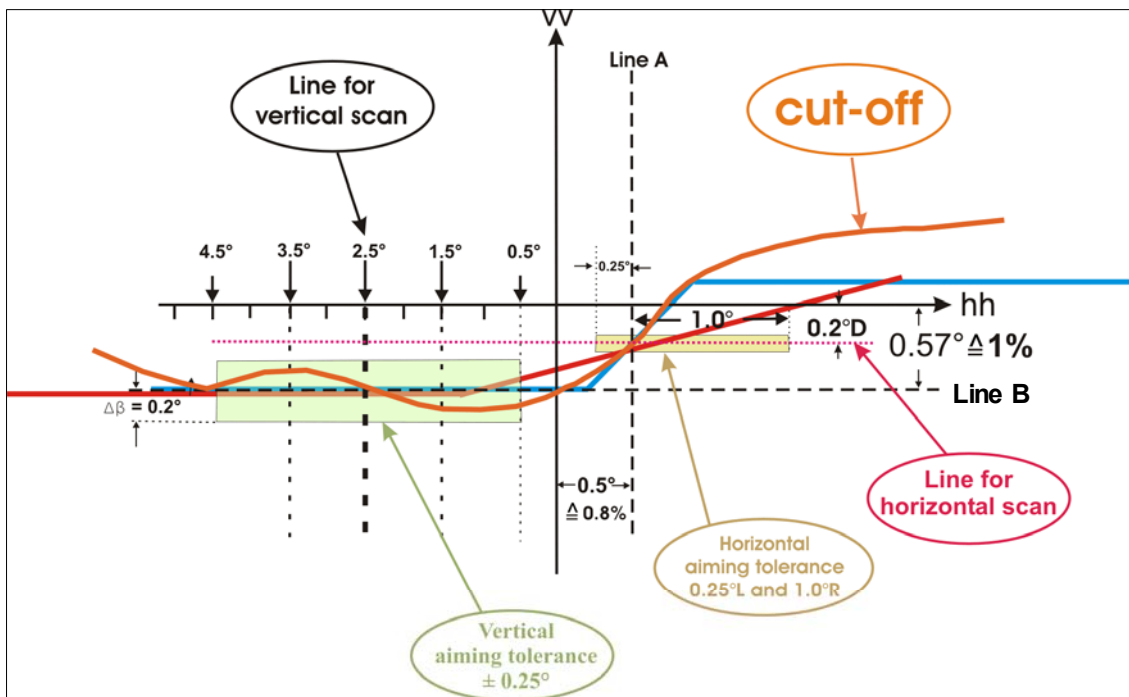
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<sup>1/</sup> This paragraph will be amended, when an objective test method will be available.

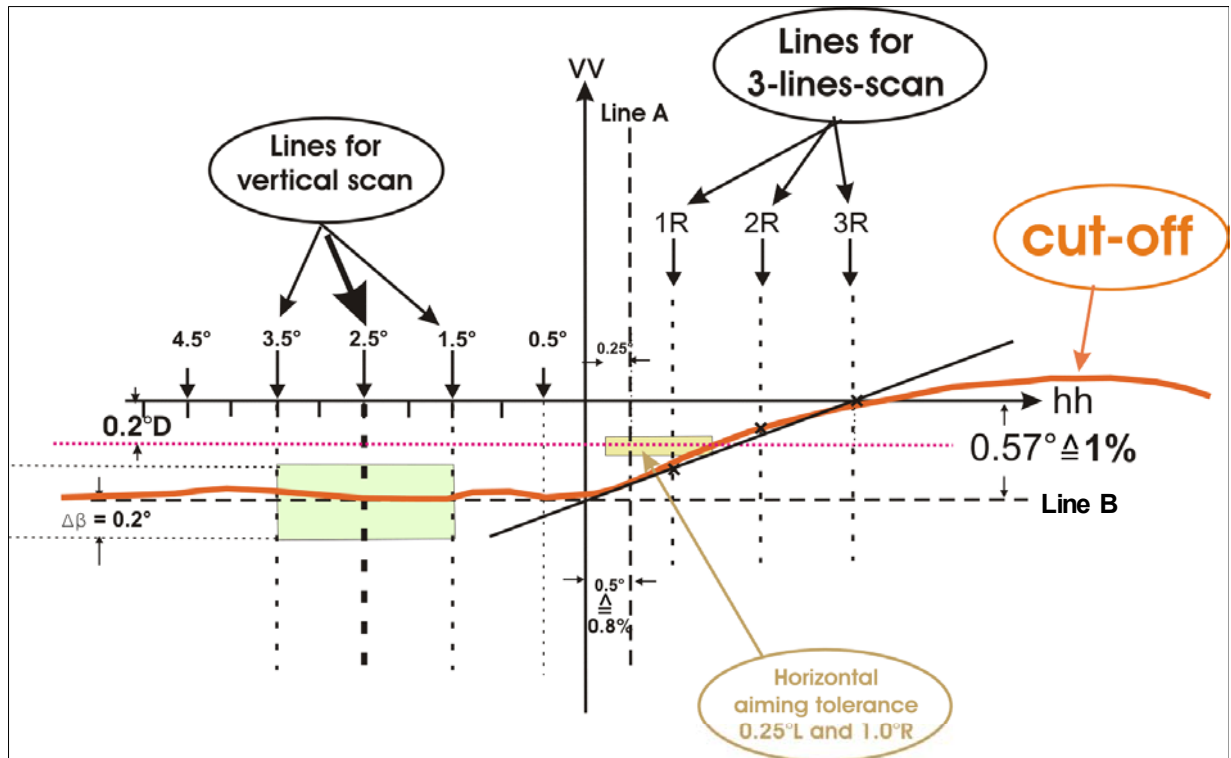
4.3. Linearity

The part of the "cut-off" line which 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  $\pm 0.2$  degrees.



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



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

## 5. 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.

### 5.1. 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.

### 5.2. 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. Determine the maximum

**gradient as defined in paragraph 4.2. above, shall not be less than 0.08 and "A" is 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. Determine the maximum gradient 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**

Proposals for a worldwide harmonized passing and driving beam have already been considered by GRE based upon documents TRANS/WP.29/GRE/2003/34 (harmonized driving beam for Regulation No. 98) and TRANS/WP.29/GRE/2004/06 (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 session. The same principles for the harmonized passing beam have been applied in the context of Regulation No. 98 provisions with particular regard to the photometric tables adjusted to the measuring voltage.

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. 98.

### 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<sup>e</sup>, Geneva 7 – 11 April 2003
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