

E/ECE/324 }  
E/ECE/TRANS/505 } Rev.1/Add.97/Rev.1/Amend.4

7 August 2008

## **AGREEMENT**

### **CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS \*/**

(Revision 2, including the amendments that entered into force on 16 October 1995)

---

#### **Addendum 97: Regulation No. 98**

#### **Revision 1 - Amendment 4**

#### **Incorporating:**

Supplement 9 to the original version of the Regulation - Date of entry into force: 11 July 2008  
Corrigendum 1 to Supplement 9 to the original version, subject of Depository Notification  
C.N.254.2008.TREATIES-2 dated 9 April 2008

### **UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLE HEADLAMPS EQUIPPED WITH GAS-DISCHARGE LIGHT SOURCES**



**UNITED NATIONS**

---

\*/ Former title of the Agreement:

Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

GE.08-24844

Table of contents, list of annexes, amend to read:

" ....

Annex 9: Minimum requirements for sampling by an inspector

Annex 10: Instrumental verification of the "cut-off" for passing beam headlamps

Annex 11 Requirements for LED modules and headlamps including LED modules"

Text of the Regulation,

Insert a new paragraph 1.7., to read:

"1.7. References made in this Regulation to standard (étalon) filament lamp(s) and gas-discharge light source(s) shall refer to Regulations Nos. 37 and 99 respectively, and to their series of amendments in force at the time of application for type approval."

Paragraph 2.1.7., amend to read:

"2.1.7. the category of light source as listed in Regulations Nos. 37 or 99 and their series of amendments in force at the time of application for type approval.

For a distributed lighting system .... "

Paragraph 3., the reference to footnote 3/ and footnote 3/, should be deleted.

Paragraph 3.2., the reference to footnote 4/ and footnote 4/, renumber as footnote 3/.

Paragraph 2.2.1., amend to read:

"2.2.1. drawings in triplicate in sufficient detail to permit identification of the type (see paragraphs 3.2. and 4.2. below). The drawings must show the position intended for the approval number and the additional symbols in relation to the circle of the approval mark, in case of LED module(s) also the space reserved for the specific identification code(s) of the module(s), and must show the headlamp in vertical (axial) section and in front elevation, with main details of the optical design including the flutings, if applicable."

Paragraph 2.2.2., amend to read:

"2.2.2. A brief technical specification including, where it applies, the make and type of the ballast(s) and, in the case where the headlamp is 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.

In addition, for a distributed lighting system, a brief technical specification including the list of the light-guide(s) and related optical components and information describing the light-generator(s) sufficient to permit identification. This information shall include the part number assigned by the light-generator manufacturer, a drawing with dimensions and the basic electrical and photometric values and an official test report related to paragraph 5.8. of this Regulation."

Insert new paragraphs 3.6. to 3.7.2., to read:

- "3.6. In the case of lamps with LED module(s), the lamp shall bear the marking of the rated voltage and rated wattage and the light source module specific identification code.
- 3.7. LED module(s) submitted along with the approval of lamp:
- 3.7.1. shall bear the trade name or mark of the applicant. This marking shall be clearly legible and indelible;
- 3.7.2. shall bear the specific identification code of the module. This marking shall be clearly legible and indelible.

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

Paragraph 4.2.1.1., the reference to footnote 5/ and footnote 5/, renumber as footnote 4/.

The title of the Part B, the reference to footnote 6/ and footnote 6/, renumber as footnote 5/.

Insert a new paragraph 5.4., to read:

- "5.4.1. Illumination configuration for different traffic conditions
- 5.4.1. In the case of headlamps designed to meet the requirements of traffic moving on one side of the road (either right or left) only, appropriate measures shall be taken to prevent discomfort to users in a country where traffic moves on the side of the road opposite to that of the country for which the headlamp was designed. Such measures may be:
- (a) occulting a part of the outer headlamp lens area;

- (b) downward adjustment of the beam. In this case, the adjustment shall be at least 0.5 degree vertically. Horizontal adjustment is allowed;
- (c) any other measure to remove the asymmetrical part of the beam.

5.4.2. Following the application of this(these) measure(s) the following requirements regarding illumination shall be met:

- (a) points 50 L (for right-hand traffic) or 50 R (for left-hand traffic) at least five lux;
- (b) point B 50 R (for right-hand traffic) or B 50 L (for left-hand traffic) not more than one lux."

Paragraphs 5.4. (former), renumber as paragraph 5.5.

Paragraph 5.5. (new), the reference to footnote 7/ and footnote 7/, renumber as footnote 6/.

Paragraphs 5.4.1. and 5.4.2. (former), renumber as paragraph 5.5.1 and 5.5.2. and amend to read:

"5.5.1. the device is robust enough to withstand 50,000 operations under normal conditions of use. In order to verify compliance with this requirement, the Technical Service responsible for approval tests may:

- (a) require the applicant to supply the equipment necessary to perform the test;
- (b) forego the test if the headlamp presented by the applicant is accompanied by a test report, issued by a Technical Service responsible for approval tests for headlamps of the same construction (assembly), confirming compliance with this requirement.

5.5.2. 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).

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

Paragraphs 5.4.3. to 5.6. (former), renumber as paragraphs 5.5.3. to 5.7.

Paragraph 5.7. (former), renumber as paragraph 5.8. and amend to read:

"5.8. Replaceability of light sources

5.8.1. The gas-discharge light source(s) used in gas-discharge headlamps or in distributed lighting systems shall be approved according to Regulation No. 99 and its series of amendments in force at the time of application for type approval. Gas-discharge light source(s) not approved according to Regulation No. 99 can be used only in the

case where they are a non-replaceable part of a light-generator. However, in the case of distributed lighting systems the light-generator can be replaceable without using special tools also in the case where the light-source used in it is not approved.

- 5.8.2. In the case that one or more (additional) filament light sources are used in the gas-discharge headlamp, these filament light sources shall be approved according to Regulation No. 37 and its series of amendments in force at the time of application for type approval, provided that no restriction on the use is made in Regulation No. 37 and its series of amendments in force at the time of application for type approval.
- 5.8.3. The design of the device shall be such that the filament lamp, if any, can be fixed in no other position but the correct one.
- 5.8.4. In the case of replaceable gas-discharge light sources and in the case of additional filament light sources the lamp holder shall conform to the dimensional characteristics as given on the data sheet of IEC Publication 60061, relevant to the category of light source(s) used. The light source(s) shall fit easily into the headlamp."

Paragraphs 5.8. and 5.9. (former), renumber as paragraphs 5.9. and 5.10.

Paragraph 5.10. (new), the reference to footnote 8/ and footnote 8/, renumber as footnote 7/.

Paragraphs 5.10. and 5.11. (former), renumber as paragraphs 5.11. and 5.12.

Insert a new paragraph 5.13., to read:

- "5.13. The headlamp (if equipped with LED modules) and the LED module(s) themselves shall comply with the relevant requirements specified in Annex 11 of this Regulation. The compliance with the requirements shall be tested."

Paragraph 6.1.2., amend to read:

- "6.1.2. The illumination produced by the headlamp shall be determined by means of a flat vertical screen set up 25 m forward of the headlamp, at right angles to its axes as shown in Annex 3 to this Regulation; the test screen shall be sufficiently wide to allow examination and adjustment of the "cut-off" of the passing beam over at least 5° on either side of the V-V line."

Paragraph 6.1.7., amend to read:

- "6.1.7. Four seconds after ignition of a headlamp that has not been operated for 30 minutes or more:"

Insert new paragraphs 6.1.7.1. to 6.1.7.3., to read:

- "6.1.7.1. At least 60 lux shall be attained at point HV, for a headlamp producing driving beam only.
- 6.1.7.2. At least 10 lux shall be attained at point 50V for headlamps producing passing beam only or alternately passing and driving beam functions as described in paragraph 5.4. of this Regulation.
- 6.1.7.3. In either case the power supply shall be sufficient to secure the required rise of the high current pulse."

Paragraphs 6.2.1. to 6.2.2.2., amend to read:

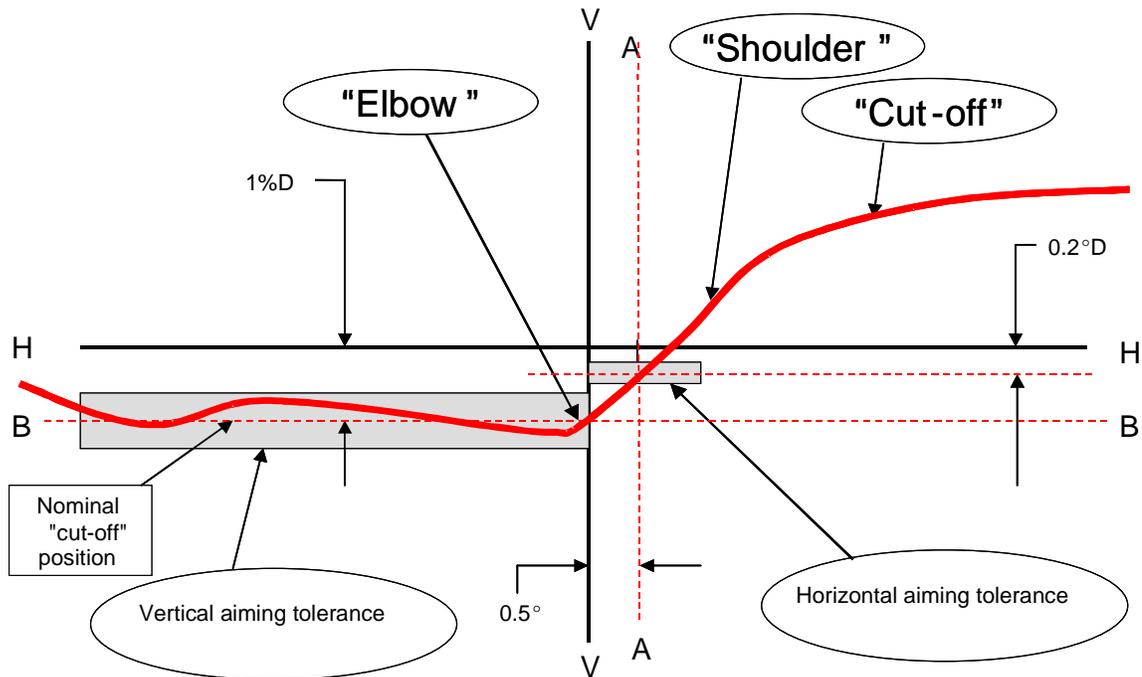
- "6.2.1. The luminous intensity distribution of the passing beam headlamp shall incorporate a "cut-off" (see figure 1 below), which enables the headlamp to be adjusted correctly for the photometric measurements and for the aiming on the vehicle.

The "cut-off" 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.

In each case the "elbow – shoulder" part shall have a sharp edge.

- 6.2.2. The headlamp shall be visually aimed by means of the "cut-off" (see figure 1 below) as follows:
- 6.2.2.1. for vertical adjustment: the horizontal part of the "cut-off" is moved upward from below line B and adjusted to its nominal position one per cent (25 cm) below the H-H line;



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

Figure 1

- 6.2.2.2. for horizontal adjustment: the "elbow-shoulder" part of the "cut-off" shall be moved:
- for right hand traffic from right to left and shall be horizontally positioned after its movement so that:
  - above the line  $0.2^\circ D$  its "shoulder" shall not exceed the line A to the left and
  - on the the line  $0.2^\circ D$  or below its "shoulder" should cross the line A and
  - the kink of "elbow" should be primarily on the V-V line;

or

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

- above the line  $0.2^\circ D$  its "shoulder" shall not exceed the line A to the right and
- on the the line  $0.2^\circ D$  or below its "shoulder" should cross the line A and
- the kink of "elbow" should be primarily on the V-V line."

Paragraph 6.2.2.1. (former), the reference to footnote 9/ and footnote 9/, should be deleted.

Insert new paragraphs 6.2.2.3. and 6.2.2.4., to read:

"6.2.2.3. Where a headlamp so aimed does not meet the requirements set out in paragraphs 6.2.5., 6.2.6. and 6.3., its alignment may be changed, provided that the axis of the beam is not displaced:

Horizontally from line A by more than:

- (a) 0.5° to the left or 0.75° to the right, for right hand traffic or
- (b) 0.5° to the right or 0.75° to the left, for left hand traffic and

Vertically not more than 0.25° up or down from line B.

6.2.2.4. If, however, vertical adjustment cannot be performed repeatedly to the required position within the tolerances described in paragraph 6.2.2.3. above, the instrumental method of Annex 10, paragraphs 2. and 3. shall be applied to test compliance with the required minimum quality of the "cut-off" and to perform the vertical and horizontal adjustment of the beam."

Paragraph 6.2.3., amend to read:

"6.2.3. When so aimed, the headlamp needs, if its approval is sought solely for a passing beam, to comply only with the requirements referred to in paragraphs 6.2.4. and 6.2.5. 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 6.2.4. to 6.2.6. The values specified for Segment II in paragraph 6.2.5. do not apply to Annex 3, Screen 2."

Paragraph 6.2.4., should be deleted (including the reference to footnote 10/ and footnote 10/).

Paragraphs 6.2.5. (former), renumber as paragraph 6.2.4.

Paragraphs 6.2.5.1. to 6.2.5.3.(former), renumber as paragraphs 6.2.4.1. to 6.2.4.3. and amend to read:

"6.2.4.1. 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.

6.2.4.2. 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 gas-discharge light source. In the event that the gas-discharge light source fails, this additional light source and/or LED module(s) shall be automatically switched off.

The test voltage for the measurement with this additional light source and/or LED module(s) shall be the same as in paragraph 6.2.4.4.

6.2.4.3. In the event of failure of an additional light source or LED module, the headlamp shall continue to fulfil the requirements of the passing beam."

Paragraphs 6.2.5.4 and 6.2.6. (former), renumber as paragraphs 6.2.4.4. and 6.2.5.

Paragraph 6.2.7. (former), renumber as paragraph 6.2.6. and amend to read:

"6.2.6. The requirements in paragraph 6.2.5. 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 6.2.4.2. 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°."

Paragraphs 6.2.7.1. to 6.2.7.1.2. (former), renumber as paragraphs 6.2.6.1. to 6.2.6.1.2.

Paragraph 6.2.7.1.3. (former), renumber as paragraph 6.2.6.1.3. and amend to read:

"6.2.6.1.3. means of one additional 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."

Paragraph 6.3.1., amend to read:

"6.3.1. In the case of a headlamp designed to provide a driving beam and a passing beam, measurements of the illumination produced on the screen by the driving beam shall be taken with the same headlamp alignment as for measurements under paragraph 6.2.5. above; in the case of a headlamp providing a driving beam only, it shall be so adjusted that the area of maximum illumination is centred on the point of intersection of lines H-H and V-V; such a headlamp needs meet only the requirements referred to in paragraph 6.3. Test voltages are the same as in paragraph 6.2.4.4."

Paragraph 6.4., amend to read:

"6.4. The screen illuminance values mentioned in paragraphs 6.2.5. to 6.3.2.3. above shall be measured by means of a photo-receptor, the effective area of which shall be contained within a square of 65 mm side."

Paragraph 7., the reference to footnote 11/ and footnote 11/, renumber as footnote 8/.

Insert a new paragraph 13., to read:

"13. TRANSITIONAL PROVISIONS

- 13.1. As from the official date of entry into force of Supplement 9, no Contracting Party applying this Regulation shall refuse to grant approvals under this Regulation as amended by Supplement 9 to the original version of the Regulation.
- 13.2. As from 24 months from the entry into force of Supplement 9, Contracting Parties applying this Regulation shall grant approvals only if the headlamp type to be approved meets the requirements of this Regulation as amended by Supplement 9 to the original version of the Regulation.
- 13.3. Approvals granted under the preceding supplements to this Regulation shall remain valid.
- 13.4. Contracting Parties applying this Regulation shall continue to grant approvals on the basis of the preceding supplements to this Regulation, provided that the headlamps are intended as replacements for fitting to vehicles in use.
- 13.5. Contracting Parties applying this Regulation shall not refuse to grant extensions of approvals to the preceding supplements to this Regulation."

Annex 1,

Insert new items 9.6. and 9.7., to read:

- "9.6. 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/.  
  
9.7. Number and specific identification code(s) of LED module(s): ....."

Items 9.6. and 9.7. (former), renumber as items 9.8. and 9.9. accordingly.

Insert a new item 9.10., to read:

- "9.10. Measures according to paragraph 5.4. of this Regulation: ....."

Annex 2, insert a new figure 13., to read:

"Figure 13

LED modules

**MD E3 17325**

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

Annex 4,

Paragraph 1.1.1.2., amend to read:

"1.1.1.2. Test voltage

The test voltage for the ballast and for LED module(s), if applicable, is  $13.5 \pm 0.1$  volts for 12 V network system, or otherwise specified in the application for approval. If there are reciprocally incorporated filament lamps, the voltage producing the reference flux shall be used."

Annex 4 - Appendix, amend to read:

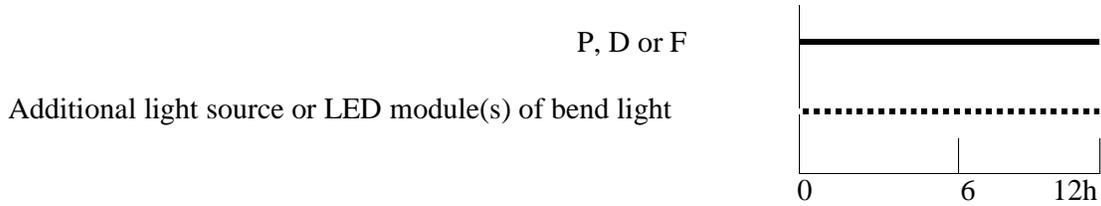
"Annex 4 - Appendix

OVERVIEW OF OPERATIONAL PERIODS  
CONCERNING TEST FOR STABILITY OF PHOTOMETRIC PERFORMANCE

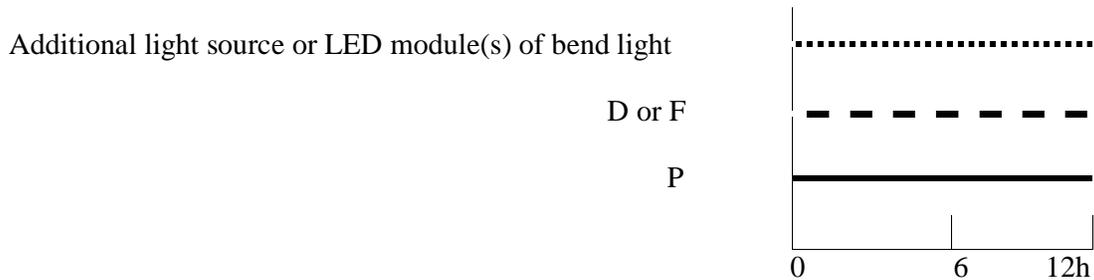
Abbreviations: P: passing beam lamp  
D: driving beam lamp (D<sub>1</sub> + D<sub>2</sub> means two driving beams)  
F: front fog lamp  
- - - - means a cycle of 15 minutes off and 5 minute lit  
..... means a cycle of 9 minutes off and 1 minute lit

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

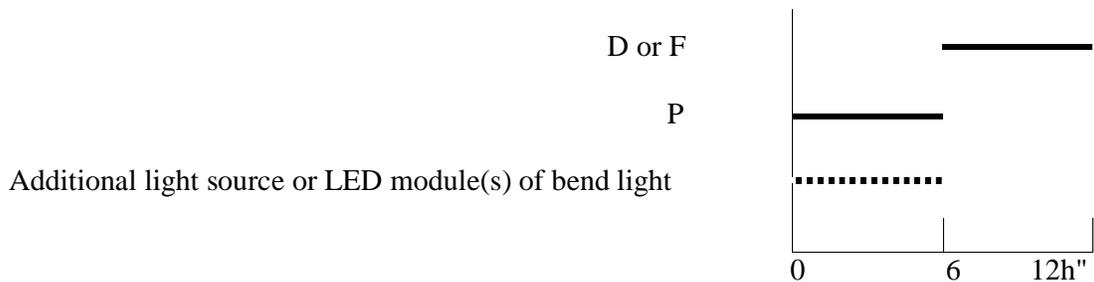
1. P or D or F (HC or HR or B)



2. P+F (HC B) or P+D (HCR)



3. P+F (HC B/) or HC/B or P+D (HC/R)



Annex 7, the last sentence, amend to read:

"None of the filament lamps and/or LED module(s) which the headlamp contains is designed for a 24 Volts network system."

Annex 8,

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 6.2.2.3. of this Regulation, one sample shall be tested according to the procedure described in paragraphs 2. and 3. of Annex 10."

Annex 9,

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 6.2.2.3. of this Regulation, one sample shall be tested according to the procedure described in paragraphs 2. and 3. of Annex 10."

Insert a new Annex 10, to read:

"Annex 10

**INSTRUMENTAL VERIFICATION OF THE "CUT-OFF" FOR PASSING BEAM  
HEADLAMPS**

1. GENERAL

In the case where paragraph 6.2.2.4. of this Regulation applies, the quality of the "cut-off" shall be tested according to the requirements set out in paragraph 2. below and the instrumental vertical and horizontal adjustment of the beam shall be performed according to the requirements set out in paragraph 3. below.

Before carrying out the measurement of the quality of "cut-off" and the instrumental aiming procedure, a visual pre-aim in accordance with paragraphs 6.2.2.1. and 6.2.2.2. of this Regulation is required.

2. MEASUREMENT OF THE QUALITY OF THE "CUT-OFF"

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

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

The measuring distance at which the test was carried out shall be recorded in item 9. of the communication form (see Annex 1 of this Regulation).

To determine the maximum sharpness, measurements shall be performed by vertically scanning through the horizontal part of the "cut-off" in angular steps of 0.05° exclusively at a measurement distance of 25 m and with a detector having a diameter of approximately 30 mm.

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

2.1. Not more than one "cut-off" shall be visible. <sup>1/</sup>

2.2. Sharpness of "cut-off"

The sharpness factor G is determined by scanning vertically through the horizontal part of the "cut-off" at 2.5° from the V-V where:

$G = (\log E_{\beta} - \log E_{(\beta + 0.1^{\circ})})$  where  $\beta$  = the vertical position in degrees.

The value of G shall not be less than 0.13 (minimum sharpness) and not greater than 0.40 (maximum sharpness).

2.3. Linearity

The part of the horizontal "cut-off" that serves for vertical adjustment shall be horizontal between 1.5° and 3.5° from the V-V line (see figure 1 below).

(a) The inflection points of the "cut-off" gradient at the vertical lines at 1.5°, 2.5° and 3.5° shall be determined by the equation:

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

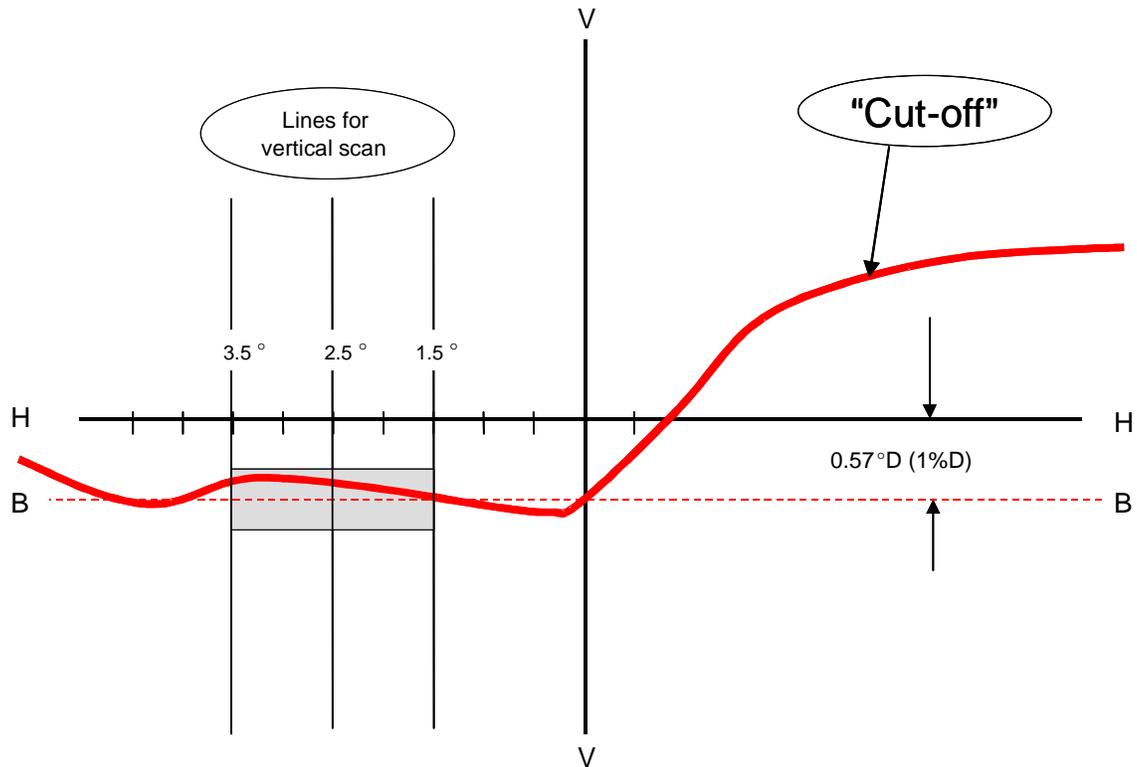
(b) The maximum vertical distance between the inflection points determined shall not exceed 0.2 °.

---

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

3. VERTICAL AND HORIZONTAL ADJUSTMENT

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



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

Figure 1: Measurement of "cut-off" quality

3.1. Vertical adjustment

Moving upward from below the line B (see figure 2 below), a vertical scan is carried out through the horizontal part of the "cut-off" at 2.5° from V-V. The inflection point (where  $d^2(\log E) / dv^2 = 0$ ) is determined and positioned on the line B situated one per cent below H-H.

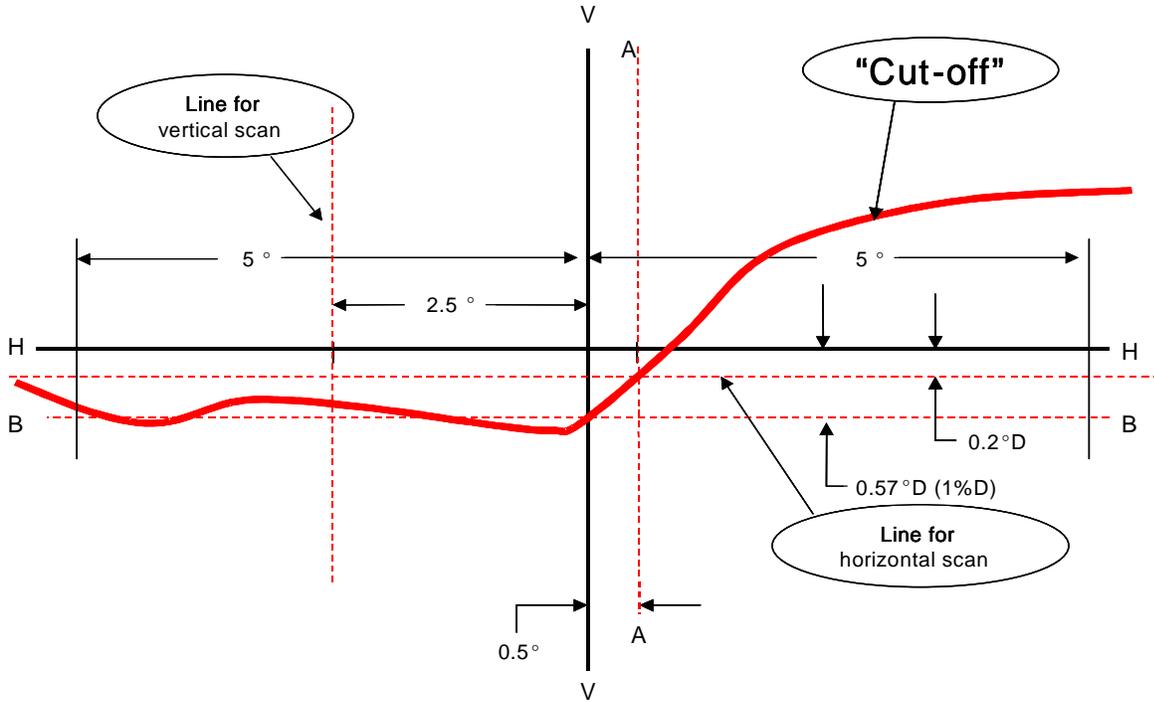
3.2. Horizontal adjustment

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

- (a) The "0.2 D line" method (see figure 2 below).

A single horizontal line at 0.2° D shall be scanned from 5° left to 5° right after the lamp has been aimed vertically. The maximum gradient "G" determined using the formula  $G = (\log E_{\beta} - \log E_{(\beta + 0.1^{\circ})})$  where  $\beta$  is the horizontal position in degrees, shall not be less than 0.08.

The inflection point found on the 0.2 D line shall be positioned on the line A.



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

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

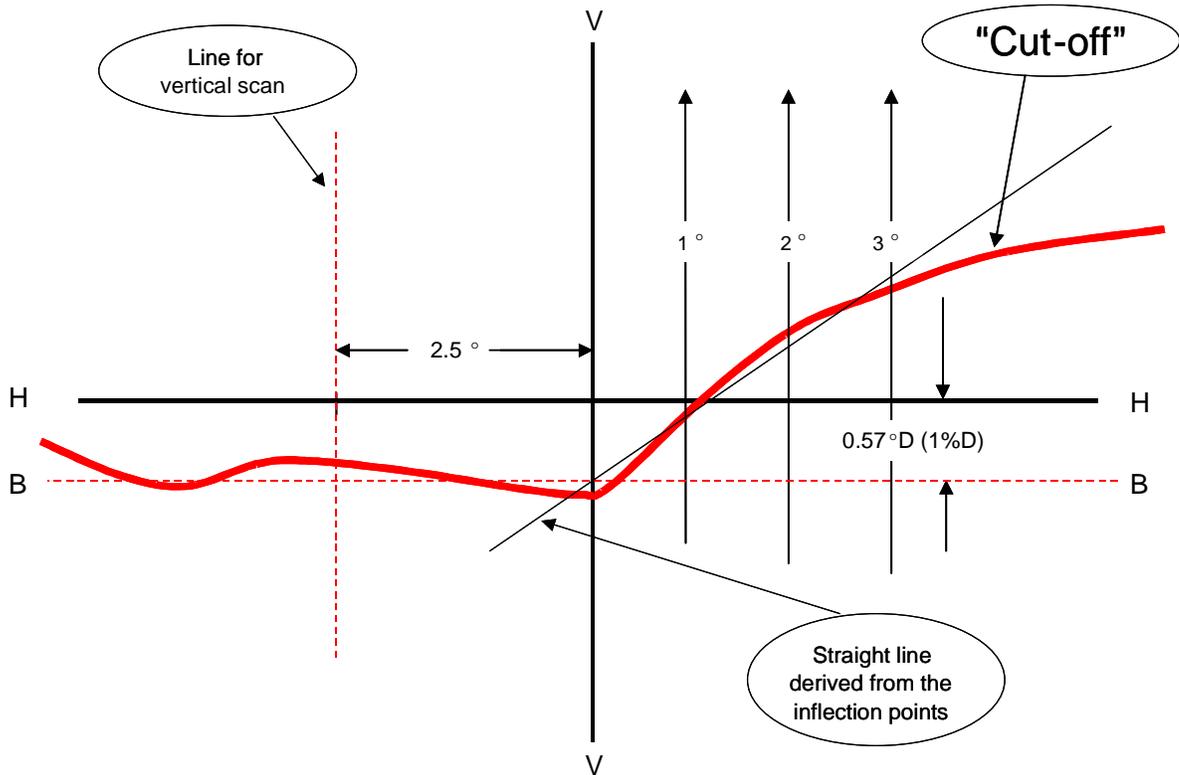
(b) The "3 line" method (see figure 3 below)

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

$$G = (\log E_{\beta} - \log E_{(\beta + 0.1^{\circ})})$$

where  $\beta$  is the vertical position in degrees, shall not be less than 0.08. The inflection points found on the three lines shall be used to derive a straight line.

The intersection of this line and the line B found while performing vertical aim shall be placed on the V line.



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

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

Insert a new Annex 11, to read:

"Annex 11

REQUIREMENTS FOR LED MODULES AND HEADLAMPS INCLUDING  
 LED MODULES

1. GENERAL SPECIFICATIONS
  - 1.1. Each LED module sample submitted shall conform to the relevant specifications of this Regulation when tested with the supplied electronic light source control-gear(s), if any.

- 1.2. LED module(s) shall be so designed as to be and to remain in good working order when in normal use. They shall moreover exhibit no fault in design or manufacture.
- 1.3. LED module(s) shall be tamperproof.
- 1.4. The design of removable LED module(s) shall be such that:
  - 1.4.1. when the LED module is removed and replaced with another module provided by the applicant and bearing the same light source module identification code, the photometric specifications of the headlamp shall be met;
  - 1.4.2. LED modules with different light source module identification codes within the same lamp housing, shall not be interchangeable.
- 1.5. Electronic light source control gear(s) may be part of the LED module(s)."

## 2. MANUFACTURE

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

## 3. TEST CONDITIONS

### 3.1. Application

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

### 3.2. Operating conditions

#### 3.2.1. LED module operating conditions

All samples shall be tested under the conditions as specified in paragraphs 6.2.4.4. of this Regulation. If not specified differently in this annex LED modules shall be tested inside the headlamp as submitted by the manufacturer.

3.2.2. Ambient temperature

For the measurement of electrical and photometric characteristics, the headlamp shall be operated in dry and still atmosphere at an ambient temperature of 23 °C ± 5 °C.

3.3. Ageing

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

4. SPECIFIC REQUIREMENTS AND TESTS

4.1. UV-radiation

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

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

where:

$S(\lambda)$ (unit: 1) is the spectral weighting function;  
 $k_m = 683 \text{ lm/W}$  is the maximum value of the luminous efficacy of radiation.

(For definitions of the other symbols see paragraph 4.1.1. of Annex 9 to Regulation No. 112).

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

$\lambda$	$S(\lambda)$	$\lambda$	$S(\lambda)$	$\lambda$	$S(\lambda)$
250	0.430	305	0.060	355	0.000 16
255	0.520	310	0.015	360	0.000 13
260	0.650	315	0.003	365	0.000 11
265	0.810	320	0.001	370	0.000 09
270	1.000	325	0.000 50	375	0.000 077
275	0.960	330	0.000 41	380	0.000 064
280	0.880	335	0.000 34	385	0.000 530

285	0.770	340	0.000 28	390	0.000 044
290	0.640	345	0.000 24	395	0.000 036
295	0.540	350	0.000 20	400	0.000 030
300	0.300				

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

-----