

ref.: Annex 9 of the  
Draft Regulation on AFS

Working Paper  
(non-approved)  
of  
the "ad-hoc Group on Rxxx-Annex 9"

by  
10 July 2003

REF.: DRAFT REGULATION NR.XXX , (WD 4-1)

Rationale

The cut-off's main purpose is to allow for

- a clear separation between the (strong) illuminating part and the stray light or glare controlled part of the passing beam, and
- sufficiently re-producible aiming of the passing beam.

The unanimous visual aiming for easy lamp adjustment or testing throughout the vehicle's practical use (during maintenance, after repair or bulb re-placement or periodical inspection) shall ensure safe traffic conditions with respect to the individual's car illumination as well as with respect to glare prevention.

The 'ECONOMIC COMMISSION FOR EUROPE' Regulations for passing beam headlamps require therefore a sufficiently sharp cut-off with a clear kink.

These conditions apply without any question fully to AFS systems.

However, some specific provisions are needed in order to cover the possible technical configurations being allowed for the purpose of adaptive frontlighting according to the AFS Draft Regulation.

Such cases are e.g. additional lighting units providing:

- a horizontal cut-off, only
- a cut-off shoulder and a horizontal cut-off however of reduced length only
- a cut-off shoulder, but effectively no horizontal cut-off,
- a (weak) lighting without a cut-off

The task of the ad-hoc group was understood to draft adequate solutions for these cases.

In principle, several possibilities may apply if the cut-off of a partial beam is not a "complete" one: .....

- \* the lighting unit is designed to be adjusted (automatically) together with another lighting unit which provides a cut-off, or,
- \*\* the partial beam produced from a lighting unit is a "weak" one, or situated far outside of the central region of the passing beam; such a lighting unit may be sufficiently pre-set by design, or,

\*\*\* the partial beam provides features which allow for a sufficient visual aiming anyhow, to be specified by the manufacturer; (in this case the type approval test may refer also to these specifications,) or,

\*\*\*\* the partial beam is so designed (e.g. uniformly) that no horizontal adjustment is necessary at all (pre-set).

The draft provisions of paragraph 2.3. are drafted to cover the above-mentioned cases; they include the application of respective instructions indicated by the manufacturer.

But on the other hand a general restriction concerning the glare protection applies through the provisions of paragraph 2.3.4. (notwithstanding the photometric provisions of the Regulation, in total).

In all cases, however, where a partial beam provides a "complete cut-off", as defined basically in paragraph 1., the aiming procedure is in principle the same, as defined in R.112 (TRANS-WP29-GRE-2002-42e). This is represented by the provisions of paragraph 2.2.

The cut-off quality may (after a subjective appraisal), or must (after having experienced e.g. missing re-reproducibility or other respective difficulties during aiming), be measured and evaluated (paragraph 1.2.). The respective procedure is laid down in paragraph 3., which in principle are the same as being introduced for conventional headlamps (TRANS-WP29-GRE-2002-42e). However again some specific provisions for adaptive lighting according to the AFS Draft Regulation are needed for clarification (see paragraph 3.2.1.).

The graphs in the Figures A.9-1 through A.9-3 have been amended accordingly.

At the end of this working paper a schematical graph shows some examples of partial beam patterns for adaptive frontlighting and their cut-off characteristic and related aiming provisions.

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PROPOSAL

Annex 5, paragraph 1.4., and annex 7, paragraph 1.3., each amend to read:

"... ***If, however, vertical adjustment, according to the provisions of paragraph 2. or 4. of annex 9 to this Regulation, cannot be performed repeatedly to the required position, one of the sampled systems shall be tested with respect to the quality of cut-off (shape and measurement of the quality of cut-off) according to the procedure described in paragraphs 1.1. and 3. of annex 9 to this Regulation. "***

Annex 9 amend to read:

Annex 9

PASSING BEAM "CUT-OFF" AND AIMING PROVISIONS

1. **Cut-off basic definition ("complete cut-off")**

The "cut-off" of a passing beam, when projected on the aiming screen as defined in annex 10 to this Regulation, shall be a clearly visible border line limiting the illuminating part of the beam versus the stray light part(s); it shall comply with the following requirements.

1.1. Cut-off shape

The "cut-off" of the passing beam shall provide a horizontal "flat part" towards the left, a monotonously upwards and rightwards going "shoulder" part to the right and a "kink", in between, formed by said horizontal "flat" and "shoulder" parts;

in addition:

1.1.1. the "flat part" shall not deviate by more than 0.2 deg up or down from its horizontal "mean line" within 0.5 and 4.5 deg left from the "kink";

1.1.2. the "shoulder" shall extend only between the lines "A" and "B", as being defined in the graph of Fig. A.9-1 below;

1.1.3. The "kink" is the point where the horizontal "flat part" meets the "shoulder" part (see graph (a) of Fig. A.9-2 below);

1.2. Cut-off horizontal "flat part" quality

If the horizontal "flat part" of the "cut-off", if any, does not provide sufficient sharpness and/or flatness and/or horizontal orientation for a **sufficiently reproducible** visual adjustment according to paragraph 2. below, the "cut-off" shall be tested according to the provisions of paragraph 3. below.

1.3. "Kink" specification

if the "flat part", if any, where it meets the "shoulder", is not representing the horizontal "mean line", the "kink" shall be

considered to be the point of intersection of the extended horizontal "mean line" with a 60 deg tangential line to the **left side of the "shoulder"** as shown in graph (b) of Fig. A.9-2 below.

2. Visual Aiming procedure

The instructions below apply to the **output** of each lighting unit ("partial beam"), contributing to the passing beam.

2.1. The system shall, prior to the subsequent test procedures, be set to the neutral state, emitting the class C (basic) passing beam.

2.2. Partial beams providing a "complete cut-off"

2.2.1. The beam shall be **vertically** positioned such, that the "flat part" of its "cut-off" is situated at the nominal vertical position according to the respective requirements indicated in Table 2 of annex 3 to this Regulation;

2.2.2. The beam shall be **horizontally** positioned such, that the "kink" of its "cut-off", is situated at the V-V-line;

2.3. Partial beams not providing a "complete cut-off"

2.3.1. **if a partial beam does provide a horizontally "cut-off" only: vertical adjustment shall be performed according to the provisions of paragraph 2.2.1. above; no special requirements for horizontal adjustment apply if not specified by the applicant;**

2.3.2. **if a partial beam does provide no "flat part" of its "cut-off" line, or a reduced "flat part" only, or no "cut-off" line: no special requirements for adjustment apply if not specified by the applicant;**

2.3.2.1. however, the beam shall be adjusted so, that its illuminating part does not extend beyond the line "B-C" as defined in the graph of Fig. A.9-1 below, and at the nominal vertical position (see Fig. A.9-3 below) according to the respective requirements indicated in Table 2 of annex 3. to this Regulation.

2.4. For each further mode of passing beam:

2.4.1. the shape and position of the "cut-off", if any, shall comply automatically with the respective requirements of Table 2 of annex 3. to this Regulation.

2.4.2. A separate initial aiming and/or adjustment process according to the applicant's specification may apply to lighting units intended to be installed separately.

3. "Cut-off" measurements <sup>1/</sup>

3.1. Measurements of the illuminance on the aiming screen **shall be performed by vertical scanning through the horizontal "flat part" of the "cut-off" continuously or in steps being equidistant and not exceeding 0.05 deg of the vertical angle  $\beta$ , using a receiver cell with a diameter of approximately:**

**10 mm aperture at 10 m distance, or  
30 mm aperture at 25 m distance, or  
1/1000 of the measuring distance at any distance exceeding 10 m**

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<sup>1/</sup> For background information see CIE CONGRESS REPORT 1979, KYOTO.

The distance to the receiver cell **and its aperture** shall be noted in paragraph 9. of a form conforming to the model of annex 1 to this Regulation.

**After horizontal adjustment according to paragraph 2.3. or 2.4.2. above, the cut-off line shall be scanned bottom-up along the vertical lines at 1.5°, 2.5° and 3.5° to the left of V-V.**

3.2. When so measured, the following conditions shall be met:

3.2.1. One "cut-off" line only per a partial beam

In case a "cut-off" serves, according to the Applicants specification, for beam adjustment purposes, no secondary "cut-off line" (double line) shall be produced from the same lighting unit.

~~A double line shall be deemed not being detrimental if its sharpness factor G, as defined in the paragraph 3.2.2. below, is less than [0.10].~~

3.2.2. Sufficient sharpness

the maximum value of  $(\log E_{\beta} - \log E_{(\beta + 0.1^{\circ})})$  evaluated at 2.5 deg left of the V-V, is called the "sharpness factor" G of the "cut-off". G shall not be less than 0.13.

3.2.3. Sufficient flatness and orientation

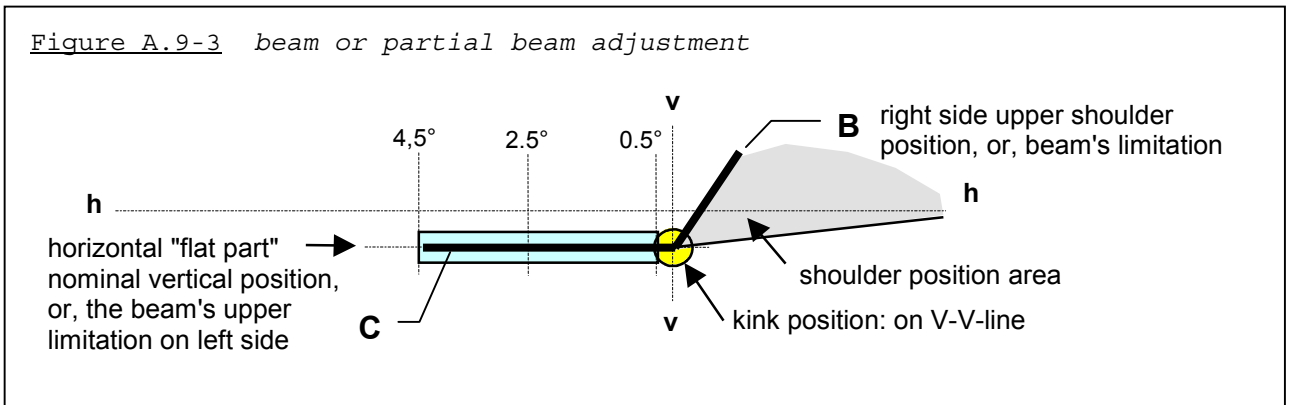
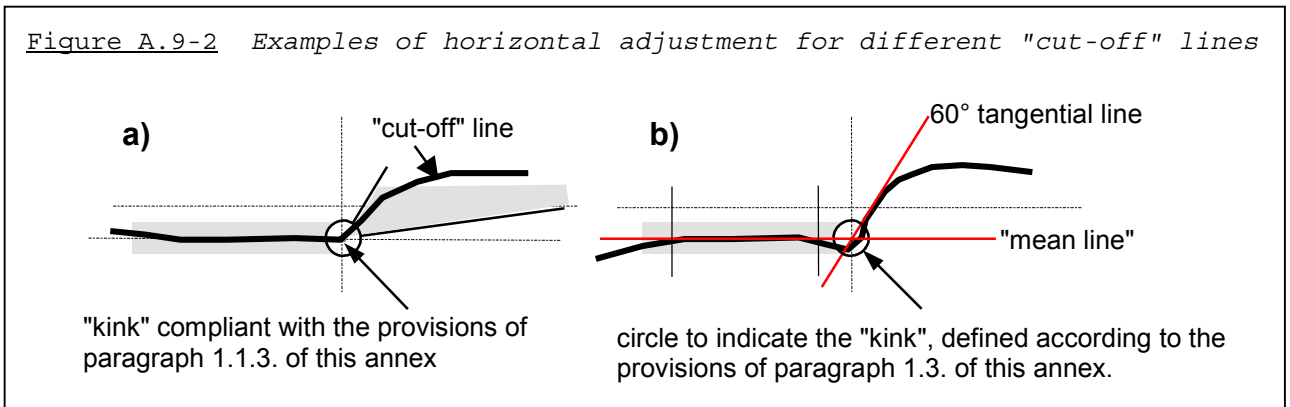
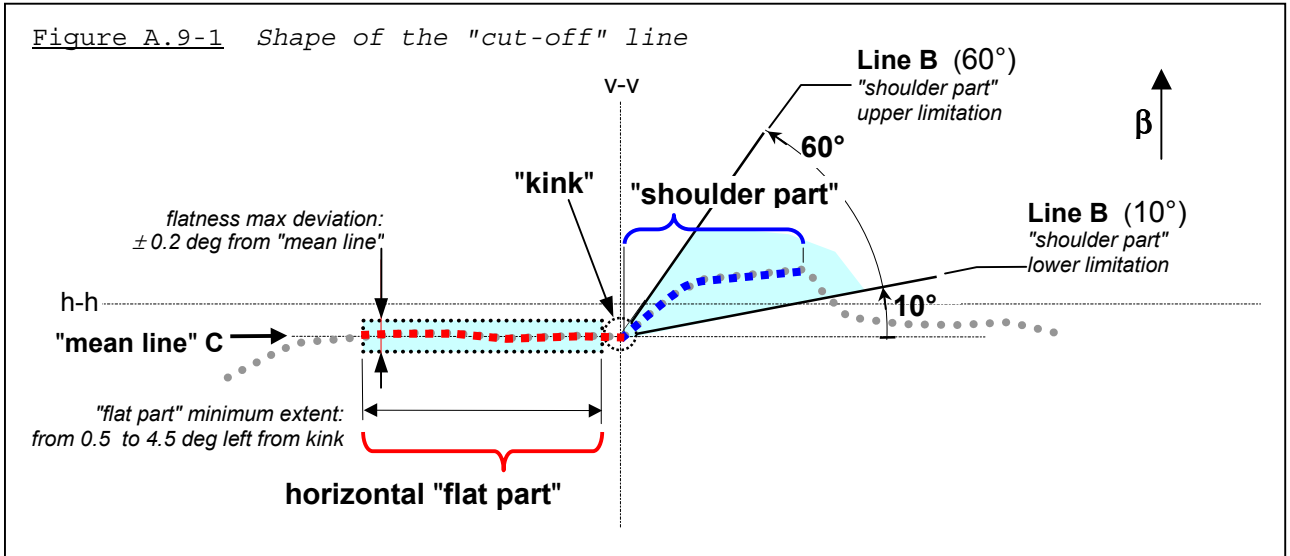
the horizontal "flat part" of the "cut-off" line is deemed sufficiently flat and horizontally orientated, if the vertical positions where  $d^2(\log E_{\beta}) / d\beta^2 = 0$  of each vertical scanning line according paragraph 3.1. above, are located within a bandwidth of  $\pm 0.2$  deg from the mean of all values.

4. Instrumental vertical [and horizontal] adjustment

If the "cut-off" line complies with the requirements set out in paragraph 3. above, the adjustment may be performed with other means instead visually.

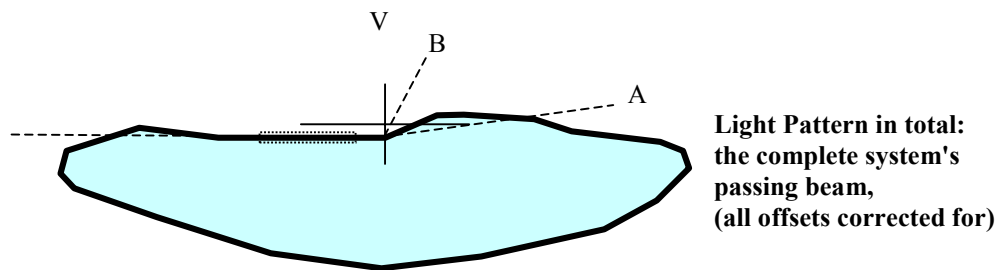
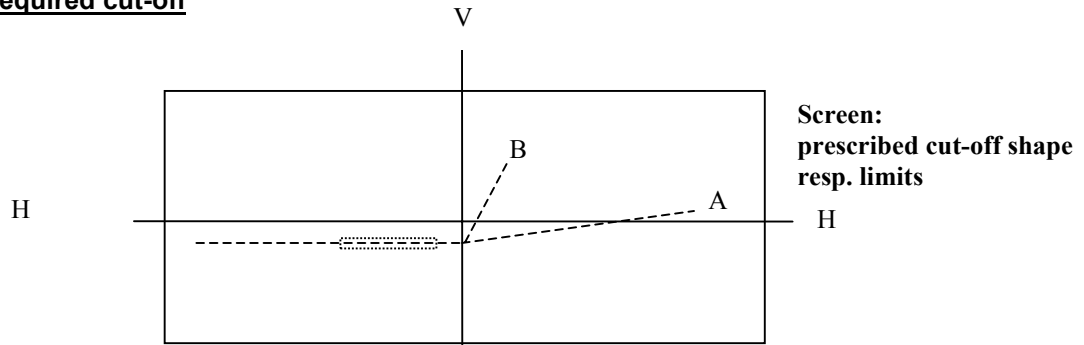
Figures A.9-1 through A.9-3

Note: In the figures the "cut-off" is shown schematically, projected on the aiming screen.



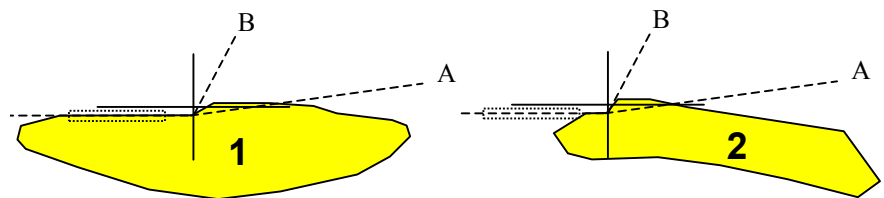
**Explanatory Notes**

**Scheme of required cut-off**

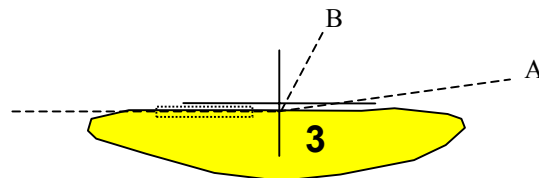


Partial beams from the  
system's lighting units

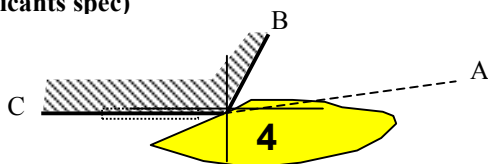
vert. adjustment: para. 2.2.1.  
horiz. adjustment: para. 2.2.2.



vert. adjustment: para. 2.3.1.  
horiz. adjustment: para. 2.3.1.  
(applicants spec)



vert. adjustment: para. 2.3.2.  
horiz. adjustment: para. 2.3.2.  
(applicants spec)



pre-set by design

