# *ref.*: R.xxx Draft Reg.

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# Submitted by the Expert from GTB-AFS

The present proposals have been prepared by the Expert from GTB-AFS after further review of the <u>Draft Regulation No.xxx on AFS</u> in its form resulting from the fourth session of the Informal Group on AFS, 15-17 July 2003 (working paper **5-05**).

# A) Concerning the Safety Concept and its Verification / Demonstration

Amend paragraph 2.2.2.1. to read as follows:

- " 2.2.2.1. the safety concept as laid down in the documentation, **which**, to the satisfaction of the Technical Service responsible for type approval tests:
  - (i) **describes** the measures designed into the system to ensure compliance with the provisions of paragraphs 5.7.3., 5.9.1., 6.2.6.4. below, and

(ii) indicates the instructions for their verification according to 6.2.7. below; and/or (iii) gives access to the relevant FMEA documents, demonstrating the system's power and virtue concerning sufficient reliability and safe operation of the measures specified according to the paragraph 2.2.2.1. (i) above. "

# Rationale:

- The former sub-paragraph (ii) can be deleted due to the changed contents of par. 5.9.1.
- the new sub-paragraph (ii) contains the (unchanged) provisions concerning instructions for the verification test, if it applies
- a new sub-paragraph (iii) contains provisions concerning access to the relevant FMEA documentation; such FMEA documents may be accepted as an alternative to the verification tests, which in the case of system internal malfunction may provide adequate or even better means to demonstrate compliance with the provisions of the paragraphs 5.7.3., 5.9.1. and 6.2.6.4.

# <u>Literature</u>

<u>IEC 60812 Ed. 1.0 b, 1985</u>: Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA); 1985/07/30; 41 pages. Scope: Describes Failure Mode and Effects Analysis (FMEA) and Failure Mode, Effects and Criticality Analysis (FMECA). Gives guidance as to how they may be applied: -by providing the procedural steps necessary to perform an analysis; -by identifying appropriate terms, assumptions, criticality measures, failure modes; -by determining ground rules; -by providing examples of the necessary forms.

<u>SAE J 1739</u>: Potential Failure Mode and Effects Analysis in Design (Design FMEA) and Potential Failure Mode and Effects Analysis in Manufacturing and assembly Processes (Process FMEA) Reference Manual

<u>SS-IEC 812</u>: Dependability - Analysis techniques for system reliability - Procedure for failure mode and effectsanalysis (FMEA), 1988/12/07; (2 Pages:, Order: SIS Forlag AB (a subsidiary of Stardardiseringen i Sverige, SIS), Tel: +46 8 610 30 60, Fax: +46 8 32 11 60, Sankt Eriksgatan 115, PO-Box 6455, SE-113 82 Stockholm Sweden, <u>www.sisforlag.se</u>,

# **B)** Concerning the Annex 3

Table 1, element no. 13 (point 50L): to keep the photometric requirements unchanged as proposed by GTB (i.e. max 25 lx in classes C and V and 35 lx in class W).

#### Rationale.

1. Point 50L (left hand traffic point 50R) illuminates the road surface at a distance of around 50 metres ahead. When an opposing vehicle approaches this area is lit for a certain time by this opposing vehicle lighting. Theoretically, any pedestrians or other objects in this area would be visible in negative contrast for the driver. However due to the risk of being dazzled, the driver will normally keep his eyes directed to his side of the road and in this situation he cannot make use of the opposing lighting. When the approaching vehicle is closer than 50 metres the road surface in that area cannot of course be observed as it is masked by the presence of the oncoming vehicle. Despite this, when the vehicles are passing or even shortly before, the driver needs to check to determine whether any hazard is present in that area. In many cases in today's traffic conditions it is not possible to switch immediately to high beam and as a consequence it is important that the passing beam has sufficient capacity to adequately illuminate the said area. It is at this time that the driver's eye is starting to re-adapt after the opposing situation and this means that the passing beam must produce the best possible road illumination.

Literature contains proposals and recommendations to increase the illumination of the passing beam for a short time after, and even before, the meeting situation of the vehicles. This is described as "meeting light". In the EUREKA Project 1403, AFS members deemed some 50% of the Emax value in point 50L (50R) as being a fair value which would also lead to reasonable beam uniformity. This leads to the conclusion that a maximum value of 25 lx would be adequate.

2. The point 50L (50R) is sometimes deemed to have the character of a glare protection requirement but under normal conditions, this part of the illumination is below the opposing driver's eye at a vehicle separation distance of 50 metres where the vertical separation is about 1.5 degrees.

Misaim due to vehicle loading has been eliminated due to the decision to require automatic levelling for AFS equipped vehicles. The remaining situations where the vehicle can be tilted by the said 1.5 degrees are:

- a) Extreme acceleration
- b) Extreme road unevenness
- c) Hill top situations

In all these cases the duration is limited for vehicles in movement from fractions to a few seconds and studies have been carried out on the resulting disability glare. The results (see fig.1 below) show that the threshold increment and the respective recovery time for the opposer's eye after an exposure to glare illumination is only dependant upon the exposure time once a value of some 1 ...2 lx at the eye has been exceeded. The discussed limitation value of '15 lx at point 50L' (30 lx per vehicle) will produce 7.5 lx at the opposer's eye at 50 metres and similarly '25 lx at point 50L ' will yield 12.5 lx at the opposer's eye. But both of these cases will lead to the same recovery time for the opposer's eye. This means that (in one of the above said short-time situations) there is no benefit for the opposer's eye whether the vehicle is complying with the 15 lx limit or with the proposed limit of 25 lx at point 50L.

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Table 1, element no. 17 (Segment D, 10m) to keep the photometric requirements unchanged as proposed by GTB (i.e. max 14 lx in class C, V and E and 8 or 4 lx in class W).

Discussion and Rationale.

• Which part of the illumination is addressed?

The beam parts allocated to the angular element Segment D are, when observed under real installation conditions, illuminating an area some 10m ahead and right middle on the own lane of the road. This area is of high interest for the driver when driving slowly or when just starting the ride.

So, good lighting there is no disadvantage. (In an early stage of the AFS Group's investigations special provisions were considered even for these cases.)

• What is there the situation today?

Headlamps approved according R112 or 98 provide in this area typically some 16 ...18 lx. In R 98 a respective zone is located at 4,29 deg below H-H with a max value of 20 lx, which is corresponding to 14 lx in terms of AFS (due to the factor of 0.7 to be applied). Vehicles with this characteristics of illumination there are standard today.

• What is intended by the AFS Draft?

The Draft Regulation on AFS is providing reduced illumination there in case of a class W passing beam for reduced indirect glare on a reflecting road surface, however combined with the balance of increased illumination in other, non-reflecting areas being farther distant. For the other passing beam classes a slight reduction compared with conventional lamps is foreseen: 14 lx at 4.0 deg below H-H

• What would be the consequence of max 10 lx in segment D?

This requirement looks like trying to transfer said wet road situation related illumination restriction to the other classes of passing beam, doing it however partially only (10 instead 8 lx) and doing it without granting the respective benefit in other zones.

This reduces the range of allowed illumination conditions which is the heart of the AFS idea. And, which is necessary for the main advantage of AFS: its capability for situation dependent optimization concerning the main and principle compromise between driver's and opposing traffic's needs. AFS shall allow different and better fitting solutions and thus safety improvements compared with a single passing beam type for all situations.

Moreover the later AFS lamps could not make use of today technical solutions. This results in increased cost and less propagation of AFS and its safety benefits.

Conclusion

Today passing beam conditions and technical solutions should be accepted as standard (basic) passing beam in an AFS system, too.

Annex 3 figure 1 and table 1, designation of elements to contain a figure indicating the target's distance. At 4 deg up: "S50LL", "S50", "S50RR"; at 2 deg up: "S100LL", "S100", "S100RR"; at 2 deg down: "Segment 20", at 4 deg down: "Segment 10".

# C) Concerning the main text

Amend paragraph 1.2. to read:

1.2. "Adaptive front lighting system" (or "system") means a lighting device, providing beams with differing characteristics for automatic adaptation to varying conditions of use of the dipped-beam (passing beam) and, if it applies, the main-beam (driving-beam) with a minimum functional content as indicated in paragraph 6.1.1.;

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such systems consist of the 'system control', one or more 'supply and operating device(s)', if any, and the 'installation units' of the right and of the left side of the vehicle;

and, amend paragraph 6.1.1. to read:

6.1.1. Each system shall provide a class C (basic) passing beam according to paragraph 6.2.5. below and one or more passing beam(s) of additional class(es); it may incorporate one or more additional modes within each class of passing beam and the front-lighting functions according to paragraph 6.3. and/or 2.1.1.1. of this Regulation.

<u>Rationale</u>: by the reference in 1.2. concerning the specification of the minimum functional content of an AFS in 6.1.1. any discrepancy can editorially be avoided.

# Amend paragraph 1.4. to read:

1.4. "Mode" of a front-lighting function provided by a system means a **beam within the** relevant provisions either for one of the passing beam classes or for the main beam, designed and specified by the manufacturer for adaptation to dedicated vehicle and ambient conditions;

Rationale: The definition should apply also to adaptive main beams.

Amend the footnote 1/ to read:

 $\underline{1}$ / For explanation only.

The provisions of the **passing beam** classes are dedicated to conditions as follows: C for the basic **passing** beam, <del>class</del> V for use in lit areas such as towns, <del>class</del> E for use on roads such as motorways, <del>class</del> W for use in adverse conditions such as wet road. <u>Rationale</u>: editorial only

Paragraphs 2.1.5.1. and 2.1.6.1.: delete the words "and its objective luminous flux" Rationale: the indication of the objective luminous flux is no longer needed.

Amend paragraph 5.1. at the end as follows:

5.1. ... and vice versa. Correspondingly, the designation of the angular positions and elements is adjusted by exchanging "R" for "L" and vice versa.

# D) Concerning Annex 1

Amend paragraphs 9.5. and 9.6. to read:

9.5. the type(s) of vehicles for which the system is intended

9.6. whether approval is sought for a system which is not intended to be included as part of the approval of a vehicle type according to Regulation No.48.......yes/no

<u>Rationale</u>: The former paragraphs 9.5 and 9.6 are not longer needed; the new provisions are induced by the amended provisions of paragraphs 4.1.6. and 4.1.7.

# E) Concerning Annex 2

Figure 11, the example should be amended to comply with the changed contents of paragraph 6.1.1. of the Draft Regulation

# F) Concerning Annex 10

Paragraph 1.8.1. amend to read: ...paragraphs 6.2.9.1., 6.3.2.1.2. and ...

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<u>Figure 1:</u> Time  $t_R$  needed for re-adaptation of the test person (visual task can be performed again without enhanced need for active lighting) after the exposure to a "glare puls" producing 1, 2, 5 or 10 lx for 0.5, 2, 8 or 15 seconds.

The task and conditions corresponded to a typical opposing traffic situation at 50 m distance.

After some 2 s short direct views into the glare source occur, which lead to increased re-adaptation time