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Item 9 of the provisional agenda

REGULATION No. 123
(Adaptative front-lighting systems (AFS) for motor vehicles)

Proposal for Supplement 3 to Regulation No. 123

Submitted by the expert from the Working Party "Brussels 1952" (GTB) */

The text reproduced below was prepared by the expert from the Working Party "Brussels 1952" (GTB) in order to introduce into the Regulation provisions for LED modules. The proposal is based on similar amendments to Regulation No. 112 which are part of Supplement 8 to that Regulation (ECE/TRANS/WP.29/2007/77). The modifications to the current text of the Regulation (up to Supplement 2 to the original version) are marked in **bold** or ~~strikethrough~~ characters.

*/ In accordance with the programme of work of the Inland Transport Committee for 2006-2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance performance of vehicles. The present document is submitted in conformity with that mandate.

A. PROPOSAL

The list of contents, the annexes, amend to read:

"

Annex 11 - Requirements for LED modules and AFS including LED modules"

Text of the Regulation,

Paragraph 2.1.4., amend to read:

"2.1.4. the category, as listed in Regulation No. 37 or 99 and their series of amendments in force at the time of the application for type approval, of replaceable and/or non-replaceable **filament or gas discharge** light source(s) used **and/or the light source module specific identification code(s) for LED modules, if available;**"

Paragraph 2.2.1., amend to read:

"2.2.1.
if applicable **and in case of LED module(s) also the space(s) reserved for the specific identification code(s) of the module(s).** "

Paragraph 2.2.2., amend to read:

"2.2.2.
(k) In the case of LED module(s) this shall include:
(i) a brief technical specification of the LED module(s);
(ii) a drawing with dimensions and the basic electrical and photometric values and the objective luminous flux;
(iii) in case of electronic light source control gear, information on the electrical interface necessary for approval testing;"

Paragraph 2.2.5., amend to read:

"2.2.5. for testing the resistance of the light transmitting components made of plastic material against UV radiation of those light source(s) inside the system, which can emit UV radiation as e.g. gas discharge light sources, **LED modules**, according to paragraph 2.2.4. of Annex 6 to this Regulation:"

Insert new paragraphs 3.5. to 3.7., to read:

"3.5. In the case of an AFS with LED module(s), the corresponding installation unit(s) shall bear the marking of the rated voltage and rated wattage and the light source module specific identification code.

3.6. LED module(s) submitted along with the approval of the AFS:

3.6.1. shall bear the trade name or mark of the applicant. This marking shall be clearly legible and indelible;

3.6.2. 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.

3.7. If an electronic light source control gear which is not part of a LED module is used to operate a LED module(s), it shall be marked with its specific identification code(s), the rated input voltage and wattage."

Paragraph 5.3., amend to read:

"5.3. **With the exception of LED modules** the system shall not be equipped with light sources that are not approved according to Regulation No. 37 or 99"

Paragraph 5.9., amend to read:

"5.9. The system shall be so made that, if a light source **and/or a LED module** has failed, a failure signal in order to comply with the relevant provisions of Regulation No. 48 shall be provided."

Insert new paragraphs 5.12. to 5.14., to read:

"5.12. **The AFS, 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.**

5.13. **In case of an AFS incorporating light sources and/or LED module(s) producing the basic passing beam and having a total objective luminous flux of the lighting units as indicated under item 9.3 of the communication form conforming to the model in Annex 1 which exceeds 2,000 lumen per side a reference shall be made in item 9.2.4. of the communication form in Annex 1. The objective luminous flux of LED module(s) shall be measured as described in paragraph 5 of Annex 11.**

5.14. **In the case of the basic passing beam in the neutral state being produced exclusively by LED modules, the total objective luminous flux of these LED**

modules shall be equal or greater than 1,000 lumen per side, when measured as described in paragraph 5 of Annex 11. "

Annex 1

Item 9.2., amend to read:

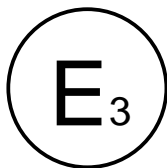
- "9.2. Number and category(ies) of replaceable light sources
- 9.2.1. Number and specific identification code(s) of LED module, if applicable**
- 9.2.2. Number and specific identification code(s) of electronic light source control gear(s), if applicable**
- 9.2.3. Total objective luminous flux as described in paragraph 5.13 exceeds 2,000 lumen: yes/no 2"**

Annex 2

Insert a new Figure 14, to read:

"Figure 14

LED modules



MD E3 17325

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

Annex 4, amend to read:

".....

For the purpose of this annex:

- (a) "complete system" shall be understood to mean.... Each installation unit of the system and lamp(s) **and/or LED module**, if any, of the complete system may be tested separately;

.....

- (c) **the expression "light source" shall be understood to comprise also any single filament of a filament lamp, LED modules or light emitting parts of a LED module.**

The tests shall be carried out:

.....

- (b) in case of replaceable light sources: using a mass production which has been aged for at least 15 hours **or a mass production LED module which has been aged for at least 48 hours**

The measuring equipment shall be equivalent to that used during system approval tests. The system or part(s) thereof shall, prior to the subsequent tests, be set to the neutral state.

....."

Paragraph 1.1.1.2., amend to read:

".....

- (d) In the case of light sources, replaceable or non-replaceable, being operated independently from vehicle supply voltage and fully controlled by the system, or, in the case of light sources supplied by a supply and operating device, the test voltages as specified above shall be applied to the input terminals of that device. The test laboratory may require from the manufacturer the supply and operating device or a special power supply needed to supply the light source(s).
- (e) **LED module(s) shall be measured at 6.75 V, 13.5 V or 28.0 V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an electronic light source control gear, shall be measured as specified by the applicant."**

Annex 6, paragraph 2.2.4., amend to read:

"2.2.4. The UV-resistance testing of internal materials to light source radiation is not necessary if light sources according to Regulation No. 37 and/or low-UV-type gas discharge light sources **and/or low-UV-type LED modules are being applied** or if provisions are taken, to shield the relevant system components from UV radiation, e.g. by glass filters."

Annex 9

Insert a new paragraph 2.5., to read:

"2.5. **LED module(s) shall be measured at 6.75 V, 13.5 V or 28.0 V respectively, if not otherwise specified within this Regulation. LED module(s) operated by an**

electronic light source control gear, shall be measured as specified by the applicant.

The measured photometric values shall be multiplied by a factor of 0.7 prior to the check for compliance."

Insert a new Annex 11, to read:

"Annex 11

**REQUIREMENTS FOR LED MODULES AND AFS 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. A LED module shall be considered to have failed if any one of its LEDs has failed.

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 by another module provided by the applicant and bearing the same light source module identification code, the photometric specifications of the AFS shall be met;

1.4.2. LED modules with different light source module identification codes within the same lamp housing, shall not be interchangeable.

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 6.1.4. and 6.1.5. of this Regulation. If not specified differently in this annex LED modules shall be tested inside the AFS as submitted by the manufacturer.

3.2.2. Ambient temperature

For the measurement of electrical and photometric characteristics, the AFS shall be operated in dry and still atmosphere at an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

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 SPECIFICATIONS AND TESTS

4.1. Colour rendering

4.1.1. Red content

In addition to measurements as described in paragraph 7. of this Regulation:

The minimum red content of the light of a LED module or AFS incorporating LED module(s) tested at 50 V shall be such that:

$$k_{\text{red}} = \frac{\int_{\lambda=610\text{ nm}}^{780\text{ nm}} E_e(\lambda) V(\lambda) d\lambda}{\int_{\lambda=380\text{ nm}}^{780\text{ nm}} E_e(\lambda) V(\lambda) d\lambda} \geq 0.05$$

where:

$E_e(\lambda)$ (unit: W) is the spectral distribution of the irradiance;
 $V(\lambda)$ (unit: 1) is the spectral luminous efficiency;
 λ (unit: nm) is the wavelength.

This value shall be calculated using intervals of one nanometre.

4.2. UV-radiation

The UV-radiation of a low-UV-type 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. above).

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

λ	$S(\lambda)$	λ	$S(\lambda)$	λ	$S(\lambda)$
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 nanometre) chosen are representative; other values should be interpolated.

4.3. Temperature stability

4.3.1. Illuminance

4.3.1.1. A photometric measurement of the AFS shall be made after 1 minute of operation for the specific function at the test point specified below. For these measurements, the aim can be approximate but must be maintained for before and after ratio measurements.

Test points to be measured:

Passing beam 50 V

Driving beam H – V

4.3.1.2. The lamp shall continue operation until photometric stability has occurred. The moment at which the photometry is stable is defined as the point in time at which the variation of the photometric value is less than 3 per cent within any 15 minute period. After stability has occurred, aim for complete photometry shall be performed in accordance with requirements of specific device. Photometer the lamp at all test points required for the specific device.

4.3.1.3. Calculate the ratio between the photometric test point value determined in paragraph 4.3.1.1. and the point value determined in paragraph 4.3.1.2.

4.3.1.4. Once stability of photometry has been achieved, apply the ratio calculated above to each of the remainder of the test points to create a new photometric table that describes the complete photometry based on one minute of operation.

4.3.1.5. The illuminance values, measured after one minute and after photometric stability has occurred, shall comply with the minimum and maximum requirements.

4.3.2. Colour

The colour of the light emitted measured after one minute and measured after photometric stability has been obtained, as described in paragraph 4.3.1.2. of this annex, shall both be within the required colour boundaries.

5. The measurement of the objective luminous flux of LED module(s) producing the principal passing beam shall be carried out as follows:

5.1. The LED module(s) shall be in the configuration as described in the technical specification as defined in paragraph 2.2.2. of this Regulation. Optical elements (secondary optics) shall be removed by the Technical Service at the request of the applicant by the use of tools. This procedure and the conditions during the measurements as described below shall be described in the test report.

5.2. Three LED modules of each type shall be submitted by the applicant with the light source control gear, if applicable, and sufficient instructions.

Suitable thermal management (e.g. heat sink) may be provided, to simulate similar thermal conditions as in the corresponding AFS application.

Before the test each LED module shall be aged at least for seventy-two hours under the same conditions as in the corresponding AFS application.

In the case of use of an integrating sphere, the sphere shall have a minimum diameter of one meter, and at least ten times the maximum dimension of the LED module, whichever is the largest. The flux measurements can also be performed by integration using a goniophotometer. The prescriptions in the CIE – Publication 84 – 1989, regarding the room temperature, positioning, etc., shall be taken into consideration.

The LED module shall be burned in for approximately one hour in the closed sphere or goniophotometer.

The flux shall be measured after stability has occurred, as explained in paragraph 4.3.1.2. of this Annex.

The average of the measurements of the three samples of each type of LED module shall be deemed to be its objective luminous flux."

B. JUSTIFICATION

Provisions concerning LED modules are already part of Regulations Nos. 19, 98 and 112. It is now proposed to follow the same procedure for Regulation No. 123 (AFS). The introduction of "LED modules" does not require changes to the well-established photometric requirements of Regulation No. 123.
