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## Economic Commission for Europe

### Inland Transport Committee

### World Forum for Harmonization of Vehicle Regulations

#### Working Party on Lighting and Light-Signalling

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Geneva, 16–18 October 2012

Item 16 of the provisional agenda

#### Regulation No. 127 (Light Emitting Diode (LED) light sources)

### **Proposal for Supplement 1 to the original version of Regulation 127 (Light Emitting Diode (LED) light sources)**

#### **Submitted by the expert from the Working Party "Brussels 1952"\***

The text reproduced below was prepared by the expert from the Working Party "Brussels 1952" (GTB) introducing a new category LW2 into the new draft Regulation for LED light sources [127] and introducing some editorial amendments to the existing text. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2010–2014 (ECE/TRANS/208, para. 106, ECE/TRANS/2010/8, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

## I. Proposal

*Insert a new paragraph 3.1.12 and note 1, to read:*

“**3.1.12 Cumulative luminous flux: luminous flux emitted by the light source under operating conditions, within a cone enclosing the specified solid angle and centred on the reference axis.** <sup>1</sup>

<sup>1</sup> **Based on CIE / IEC vocabulary IEV 845-09-31.”**

*Insert a new paragraph 3.1.13, to read:*

“**3.1.13 Light emitting diode (LED) light source: a light source where the element for visible radiation is one or more solid state junctions producing injection-luminescence and/or fluorescence.**”

*Insert a new paragraph 3.2.7, to read:*

“**3.2.7. When energized, the solid state junction(s) shall be the only primary source(s) of injection-luminescence and/or fluorescence of the LED Light source.**”

*Paragraph 3.6 and its subparagraph 3.6.1, amend to read:*

“3.6. Normalized luminous intensity distribution/ **cumulative luminous flux distribution**

3.6.1. When measured according to the test conditions specified in Annex 4, the normalized luminous intensity distribution **and/or cumulative luminous flux distribution** shall be within the limits given on the relevant data sheet of annex 1.”

*Annex 1*

*The note <sup>\*/</sup>, amend to read:*

“Tables, Electrical and Photometric characteristics:  
 Voltage is expressed in V;  
 Wattage is expressed in W;  
 Luminous flux is expressed in lm;  
 Normalized luminous intensity is expressed in cd/1000 lm;  
**Normalized cumulative luminous flux is expressed in %”**

*The list of categories of LED light sources and their sheet numbers, amend to read:*

“

Category	Sheet number(s)
LR1	LR1/1 to 5
LW2	LW2/1 to 5

Category

Sheet  
number(s)

“

The list of sheets for LED light sources and their sequence, amend to read:

“

Sheet number(s)

LR1/1 to 5

**LW2/1 to 5**

“

Sheet LR1/2, the table, amend to read:

(Replace “Reference luminous flux” by “objective luminous flux” and re-format the table)

“Table 1

**Essential electrical and photometric characteristics**

		Tolerance			
		LED light sources of normal production		Standard LED light source	
<i>Dimensions in mm</i>					
e <sup>3/</sup>	24.0	0.2		0.1	
Cap PGJ21t-1 in accordance with IEC Publication 60061 (sheet 7004-165-1)					
Electrical and photometric characteristics <sup>5/</sup>					
Rated values		<i>Minor function</i>	<i>Major function</i>	<i>Minor function</i>	<i>Major function</i>
	Volts	12		12	
Objective Values <sup>6/</sup>	<b>Watts (at 13.5 V DC)</b>	0.75 max.	3.5 max. 1.4 min.	0.75 max.	3.5 max. 1.4 min.
	<b>Luminous flux (in lm at 13.5V DC)</b>			<b>3.5 ± 10%</b>	<b>47 ± 10%</b>
	<b>Luminous flux (in lm at 10-16 V DC)</b>	<b>3.5 ± 20%</b>	<b>47 ± 20%</b>		

”

Insert new sheets LW2/1 to 5, to read:

“

The drawings are intended only to illustrate the essential dimensions (in mm) of the LED light source

Figure 1 – Main Drawing – front and side view

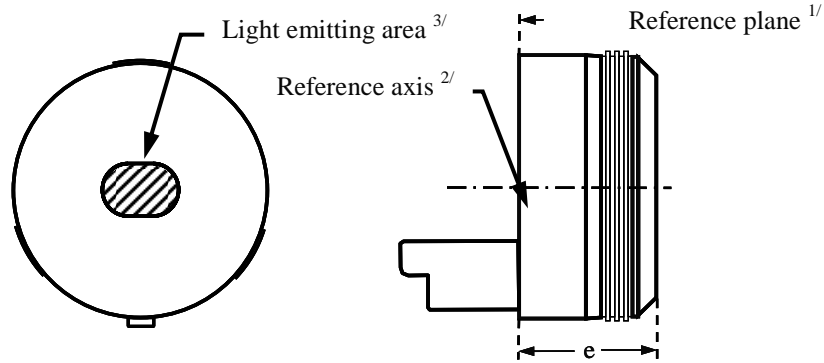


Figure 2 – Connector Detail

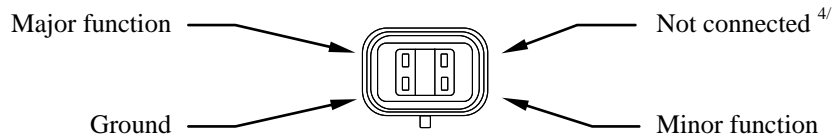


Table 1

**Essential electrical and photometric characteristics**

Dimensions in mm		Tolerances			
		LED light sources of normal production		Standard LED light sources	
e	26.4	0.2		0.1	
[Cap PGJY50] in accordance with IEC Publication 60061 (sheet 7004-[...] -1)					
Electrical and photometric characteristics <sup>5/</sup>					
Rated values		Minor function	Major function	Minor function	Major function
	Volts	12		12	
Objective Values <sup>6/ 7/</sup>	Watts (at 13.5 V DC)	1 max.	12 max. 4 min.	1 max.	12 max. 4 min.
	Luminous flux (in lm at 13.5V DC)			50 ± 10%	725 ± 10%
	Luminous flux (in lm at 10-16 V DC)	50 ± 15%	725 ± 15%		
Corresponding base temperature T <sub>b</sub> in °C		30 ± 2	55 ± 2	30 ± 0.5	55 ± 0.5

<sup>1/</sup> The reference plane is given by the thermal transfer area on the backside of the light source.

<sup>2/</sup> The reference axis is perpendicular to the reference plane and passing through the centre of the light source as defined by three notches on the outer perimeter.

<sup>3/</sup> Light emitting area: to be checked by means of the box system in Figure 3.

<sup>4/</sup> Optional pin.

<sup>5/</sup> The emitted light shall be white.

<sup>6/</sup> Continuous operation for 30 minutes with base temperature T<sub>b</sub> stabilized as specified above.

<sup>7/</sup> Luminous flux from the light emitting area shall be determined within a solid angle of  $-40^\circ < \alpha < +40^\circ$  and  $-40^\circ < \beta < +40^\circ$  using either integral methods or the procedure described on sheets LW2/3 and LW2/4.

Category LW2

Sheet LW2/2

Screen projection requirements

This test is intended to determine whether the light emitting area of the LED light source is correctly positioned relative to the reference axis and reference plane.

Compliance of position and dimension as defined in Table 2 is checked by the box system shown in Figure 3. The left drawing displays the projection when viewing along the reference axis with an aperture acceptance angle of  $\pm 40^\circ$  while the right drawing defines the position of the reference plane and axis.

Size determination shall be done with suitable means.

Figure 3 – Box definition of light emitting area

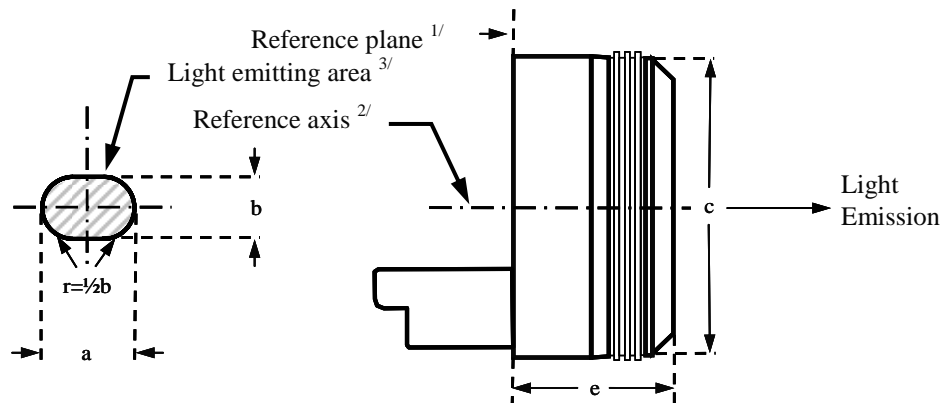


Table 2

Dimensions of the light emitting area in Figure 3

Dimensions in mm	e	a	b	c
LED light sources of normal production	$26.4 \pm 0.2$	$14.5 +0/-2.5$	$10.1 +0/-1.5$	$\text{Ø } 50.00 + 0.10/-0$
Standard (Etalon) LED light sources	$26.4 \pm 0.1$	$14.5 +0/-2.5$	$10.1 +0/-1.5$	$\text{Ø } 50.05 + 0.05/-0$

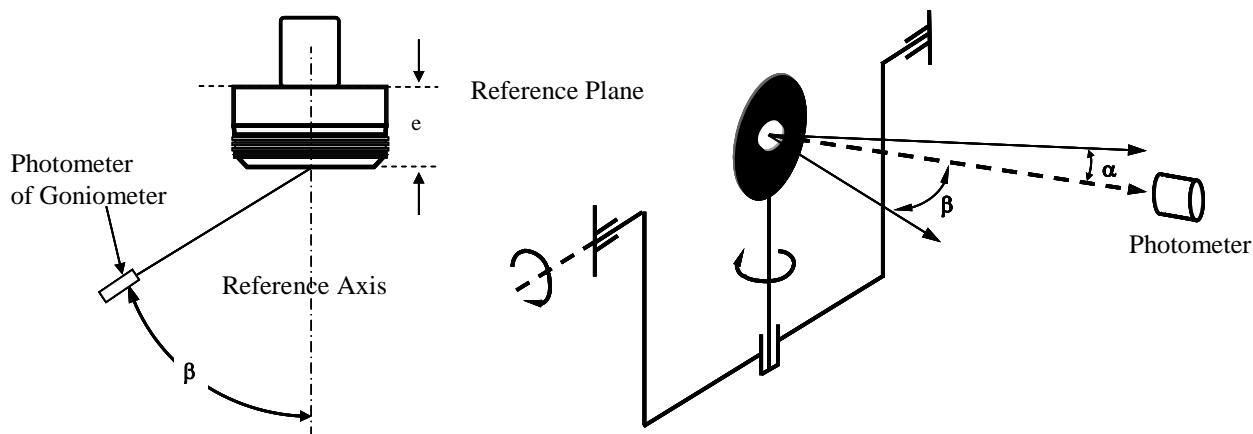
Cumulative luminous flux distribution

Measurement set-up

This test is intended to determine the cumulative luminous flux within defined solid angles of the luminous intensity distribution.

Goniophotometers of type I or II according to CIE publication No. 70 -1987 with the capability of turning the light source around two axes perpendicular to the axis of light emission can be used. The intersection of the reference axis and the parallel plane to the reference plane in distance  $e$  is used as the coordinate system origin.

Figure 4 – Set-up to measure the luminous intensity distribution using a type I photogoniometer



The light source is mounted on a flat plate with the corresponding mounting lug features. The plate is mounted to the goniometer table by a bracket in such way, that the reference axis of the light source lines up with the measurement axis of the goniometer. The corresponding measurement set-up is described in Figure 4.

## Category LW2

## Sheet LW2/4

## Cumulative luminous flux distribution

## Measurement and calculation procedure

Data shall be recorded for the specified base temperature  $T_b$  from Table 1 at the location shown in Fig. 5.

Luminous intensity distribution data shall be recorded within a solid angle of  $-40^\circ < \alpha < +40^\circ$  and  $-40^\circ < \beta < +40^\circ$ .

The measurement distance shall be chosen in such manner that the detector is located in the far field of the light distribution. An angular step size of  $1^\circ$  or less is required.

After the measurement, the cumulative luminous flux distribution shall be calculated from the recorded data for various solid angles as specified in Table 3 according to CIE publication 84-1989, section 4.3. Subsequently, the distribution shall be normalized to the total luminous flux determined for  $-40^\circ < \alpha < +40^\circ$  and  $-40^\circ < \beta < +40^\circ$ . The data shall comply with the tolerance band defined in Table 3.

In order to secure a symmetrical distribution within each solid angle in Table 3 the luminous flux determination shall be done independently for all 4 quadrants and flux values shall not differ by more than 15%.

Table 3

**Test point values of normalized cumulative luminous flux for both normal production and standard lamps**

<i>Angle <math>\alpha, \beta</math></i>	<i>Min. normalized flux in %</i>	<i>Max. normalized flux in %</i>
$-5^\circ < \alpha, \beta < +5^\circ$	8	14
$-10^\circ < \alpha, \beta < +10^\circ$	31	37
$-15^\circ < \alpha, \beta < +15^\circ$	54	59
$-20^\circ < \alpha, \beta < +20^\circ$	75	81
$-25^\circ < \alpha, \beta < +25^\circ$	91	95
$-30^\circ < \alpha, \beta < +30^\circ$	97	100
$-35^\circ < \alpha, \beta < +35^\circ$	98	100
$-40^\circ < \alpha, \beta < +40^\circ$	100 (by definition)	

The cumulative luminous flux distribution of the minor function may be verified by measuring the ratio of major and minor function under a fixed angle and multiplication of this factor with the luminous flux of the major function.

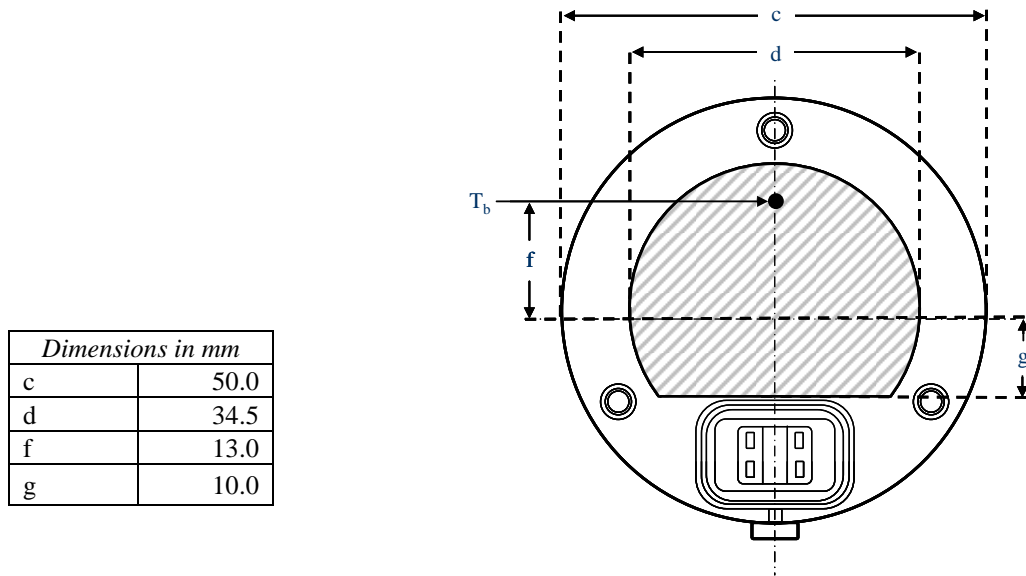
In case of doubt that cumulative luminous flux distributions of major and minor function differ, the procedure as described above for the major function shall be repeated for the minor function.

## Thermal interface geometry

The LW2 thermal interface is located within the reference plane (shaded area in Figure 5) and described in detail in IEC Publication 60061 as indicated in Table 1 on sheet LW2/1. It shall be attached to an appropriate heat sink or thermal management system.

The luminous flux given in Table 1 shall be achieved once the base temperature  $T_b$  measured at the location shown in Figure 5 is stabilized.

Figure 5 – rear-view: thermal contact area and location of  $T_b$ -point on the vertical symmetry axis, at a distance  $f$  from the center



Failure condition behaviour

In case of LED light source failure (no light emitted) the maximum current draw – when operated within the input voltage range in major function mode – shall be less than 20 mA (open circuit condition).  
 ”



*Annex 4**Paragraph 2, the title, amend to read:*“2. Normalized luminous intensity/ **cumulative luminous flux**”*Insert a new paragraph 2.4, to read:*“**2.4. Cumulative luminous flux of a test sample is calculated according to CIE publication 84-1989, section 4.3 by integrating the luminous intensity within a cone enclosing a solid angle.**”*Annex 6**Table 1, the bottom row, amend to read:*

“ ...

Normalised luminous intensity <b>or cumulative luminous flux</b> distribution	All lamps of one type	20	6.5
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...“

**II. Justification**

1. The current increase in penetration and diversification of LEDs usage in automotive lighting is triggering a growing market demand from industry for a standardization of LED light sources. This proposal is to introduce a new category LW2 suitable for light guide applications emitting white light. For this category, an alternative method for the characterisation of the directional emission is introduced that is also well known in general lighting, i.e. the cumulative luminous flux distribution.

2. Additionally, some editorial amendments are proposed: a definition for LED light sources is introduced along with a correction to the sheets of category LR1.