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Working Party on Lighting and Light-Signalling

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Item 5 of the provisional agenda
Regulations Nos. 37 (Filament lamps), 99 (Gas discharge light sources) and 128 (Light emitting diodes light sources)

Proposal for Supplement 5 to the original version of Regulation No. 128 (Light emitting diodes light sources)

Submitted by the expert from the International Automotive Lighting and Light Signalling Expert Group*

The text reproduced below was prepared by the expert from the International Automotive Lighting and Light Signalling Expert Group (GTB) to introduce new Light Emitting Dodes (LED) light source categories LW3, LY3, LR5, LW5 and LY5, and to align some drawings of category LR4 with drawings of these new categories. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94 and ECE/TRANS/2012/12, 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

Annex 1,

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
LR3A	**L3/1 to 6**
LR3B	**L3/1 to 6**
LW3A	**L3/1 to 6**
LW3B	**L3/1 to 6**
LY3A	**L3/1 to 6**
LY3B	**L3/1 to 6**
LR4A	LR4/1 to 5
LR4B	LR4/1 to 5
LR5A	**L5/1 to 6**
LR5B	**L5/1 to 6**
LW5A	**L5/1 to 6**
LW5B	**L5/1 to 6**
LY5A	**L5/1 to 6**
LY5B	**L5/1 to 6**

"

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

"

Sheet number(s)
LR1/1 to 5
LW2/1 to 5
L3/1 to 6
LR4/1 to 5
L5/1 to 6

"

Sheets LR3/1 to 5, replace by new sheets L3/1 to 6, to read (see following pages; one page per sheet):

Sheet LR4/1, replace by new sheet LR4/1, to read (see following pages):

Sheet LR4/4, replace by new sheet LR4/4, to read (see following pages):

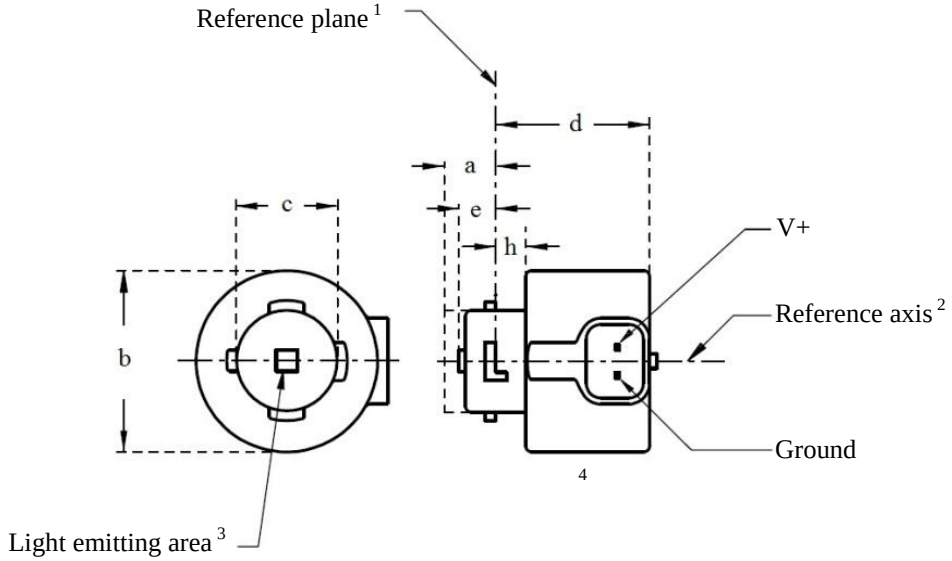
After sheet LR4/5, insert new sheets L5/1 to 6, to read (see following pages; one page per sheet):

CATEGORIES LR3A, LR3B, LW3A, LW3B, LY3A and LY3B **Sheet L3/1**

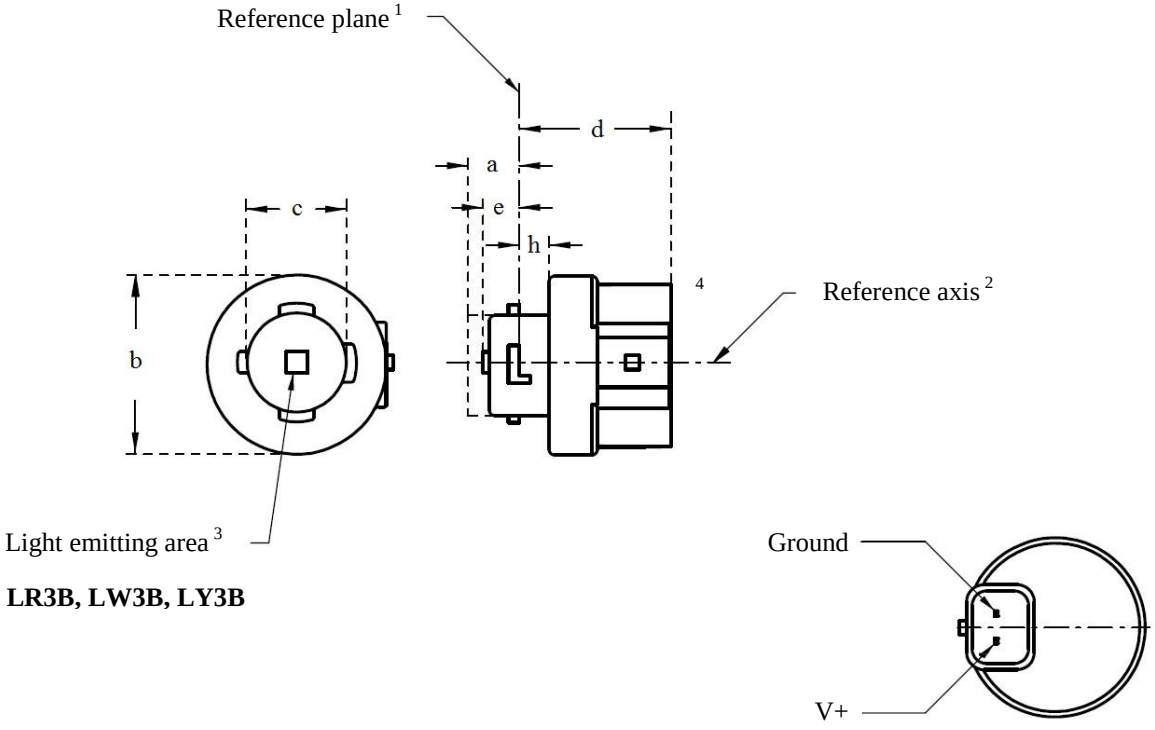
The drawings are intended only to illustrate the essential dimensions of the LED light source.

Figure 1*

Main Drawing



LR3A, LW3A, LY3A



LR3B, LW3B, LY3B

For the notes see sheet L3/2.

* Projection method:

Table 1
Essential dimensional, electrical and photometric characteristics of the LED light source

Dimensions			*Production LED light sources*	*Standard LED light sources*
a		mm	6.0 max.	
b		mm	c + 10.0 min. 38.0 max.	
c		mm	18.5 ± 0.1	
d		mm	28.0 max.	
e		mm	3.0 ± 0.30	3.0 ± 0.15
h		mm	5.5 + 0.0/ – 0.1	
Cap	LR3A, LR3B PGJ18.5d-1 LW3A, LW3B PGJ18.5d-24 LY3A, LY3B PGJ18.5d-15		in accordance with IEC Publication 60061 (sheet 7004-185-1)	
Electrical and photometric characteristics				
Rated values	Volts		12	
	Watts	LR3A, LR3B	3	
		LW3A, LW3B LY3A, LY3B	4	
Objective Values[8]	Watts (at 13.5 V DC)	LR3A, LR3B	3.5 max.	
		LW3A, LW3B	5 max.	
		[12] LY3A, LY3B		
	Luminous flux (in lm at 13.5 V DC)	[5] LR3A, LR3B	80 ± 20%[9]	80 ± 10%[10]
		[6] LW3A, LW3B	250 ± 20%	250 ± 10%[11]
		[7, 12] LY3A, LY3B	150 ± 20%[9]	150 ± 10%[10]
	Luminous flux (in lm at 9 V DC)	[5] LR3A, LR3B	19 min	
		[6] LW3A, LW3B	50 min.	
		[7, 12] LY3A, LY3B	30 min	

1 The reference plane is the plane defined by the contact points of the cap-holder fit.
2 The reference axis is perpendicular to the reference plane and passing through the centre of the bayonet core.
3 Light emitting area: to be checked by means of the box system in Figure 2.
4 A minimum free air space of 5mm around the light source shall be respected for convection.
5 The emitted light shall be red.
6 The emitted light shall be white.
7 The emitted light shall be amber.
8 After continuous operation for 30 minutes at 23 ± 2.5° C.
9 The measured value shall be in between 100 per cent and 70 per cent of the value measured after 1 minute.
10 The measured value shall be in between 85 per cent and 75 per cent of the value measured after 1 minute.
11 The measured value shall be in between 100 per cent and 90 per cent of the value measured after 1 minute.
12 Operated in flashing mode for 30 minutes (frequency = 1.5 Hz, duty cycle 50 per cent ON, 50 per cent OFF). Measured in the ON-state of flashing mode after 30 minutes of operation.

Electrical characteristics

In case of LED light source failure (no light emitted) the max. electrical current draw, when operated between 12 V and 14 V, shall be less than 20 mA (open circuit condition).

Screen projection requirements

The following test is intended to define the requirements for the apparent light emitting area of the LED light source and to determine whether the light emitting area is correctly positioned relative to the reference axis and reference plane in order to check compliance with the requirements.

The position of the light emitting area is checked by the box system defined in Figure 2, which is aligned to the planes C90 and C180 and shows the projection when viewing along direction $\gamma=0^{o}$ (C, γ as defined in Figure 3).

The proportion of the total luminous flux emitted into the viewing direction shall be as described in table 3.

Figure 2
Box definition of the light emitting area with dimensions as specified in table 2

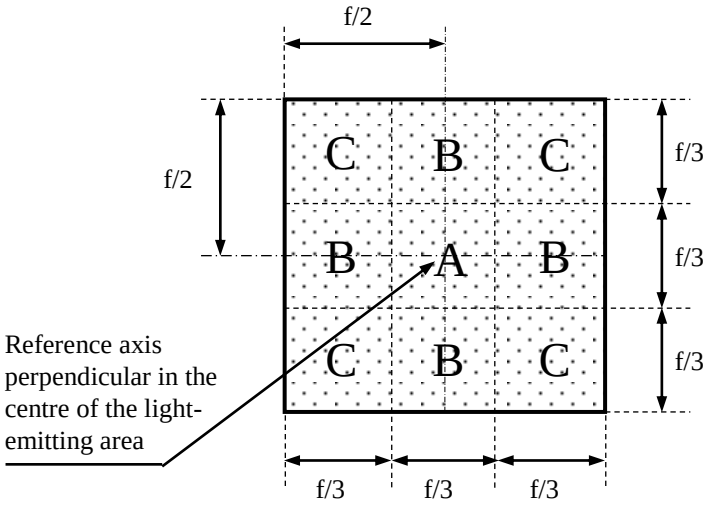


Table 2
Dimensions of the box system in Figure 2

Dimensions in mm	*f*	
	LR3A, LR3B	LW3A, LW3B LY3A, LY3B
LED light sources of normal production	3.0	4.5
Standard LED light sources	3.0	4.5

CATEGORIES LR3A, LR3B, LW3A, LW3B, LY3A and LY3B **Sheet L3/4**

Table 3
Proportion of the total luminous flux emitted into the viewing direction from the areas specified in figure 2

Category	*Area(s)*	*LED light sources of normal production*	*Standard LED light sources*
LR3A LR3B	A	≤ 25%	≤ 10%
	Each B individually	≥ 15%	≥ 20%
	Each C individually	-	≤ 10%
	A, all B and all C together	≥ 90%	≥ 90%
LW3A LW3B LY3A LY3B	Each A,B individually	≥ 6%	≥ 8%
	Each A, B individually	< 40%	< 30%
	All A, B together	≥ 55%	≥ 60%
	Each C individually	< 15%	< 10%
	All A, B and C together	≥ 90%	≥ 90%

Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the light source in an arbitrary plane containing the reference axis. The intersection of the reference axis and the parallel plane to the reference plane in distance e is used as the coordinate system origin.

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, so that the reference axis of the light source lines up with one of the rotating axis of the goniometer. The corresponding measurement set-up is described in Figure 3.

Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

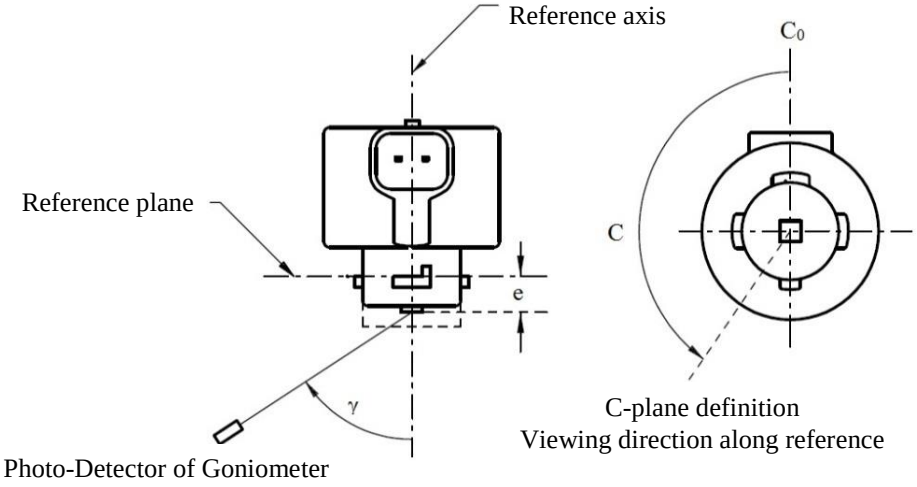
The measurements shall be performed in C-planes **C_0 (C_{180}) and C_{90} (C_{270}),** which contain the reference axis of the light source. The test points for each plane for multiple polar angles γ are specified in Table**s** 4a and 4b.

The measured luminous intensity values, normalised to the measured luminous flux of the individual light source under test, shall be converted to normalised luminous intensity values of a 1,000 lm light source. The data shall comply with the tolerance band as defined in Tables 4a and 4b.

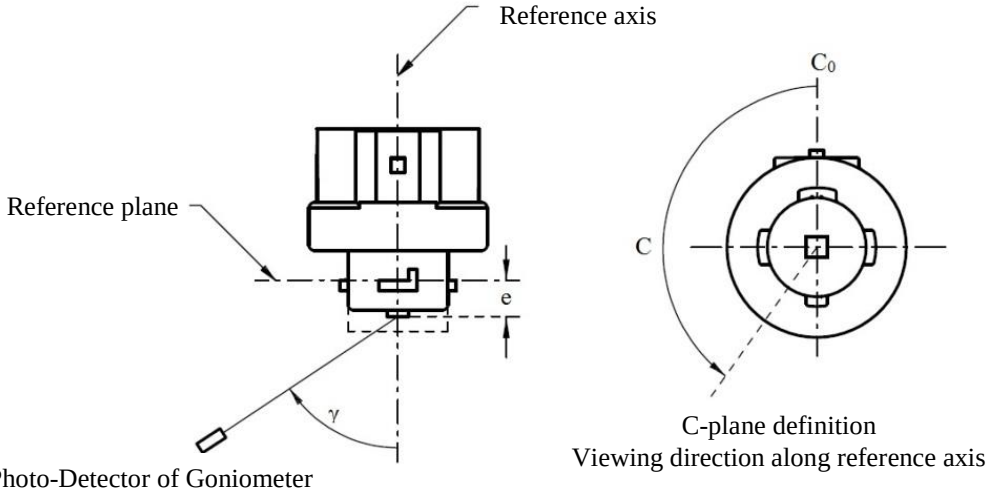
The drawings are intended only to illustrate the essential set-up for measurement of the LED light source.

Figure 3

Set-up to measure the luminous intensity distribution



LR3A, LW3A, LY3A



LR3B, LW3B, LY3B

The light pattern as described in Tables 4a and 4b shall be substantially uniform, i.e. in between two adjacent grid points the relative luminous intensity requirement is calculated by linear interpolation using the two adjacent grid points. In case of doubt this may be checked in addition to verification of the grid points given in Tables 4a and 4b.

Table 4a
Test point values of normalized intensities for categories LR3A and LR3B

	LED light sources of normal production		*Standard LED light sources*	
Angle γ	*Minimum Intensity in cd /1000 lm*	*Maximum Intensity in cd/1000 lm*	*Minimum Intensity in cd /1000 lm*	*Maximum Intensity in cd /1000 lm*
-90°	0	38	0	25
-75°	0	160	0	140
-60°	98	246	127	220
-45°	142	305	181	275
-30°	169	352	213	315
-15°	192	389	239	340
0°	200	401	248	352
15°	192	389	239	340
30°	169	352	213	315
45°	142	305	181	275
60°	98	246	127	220
75°	0	160	0	140
90°	0	38	0	25

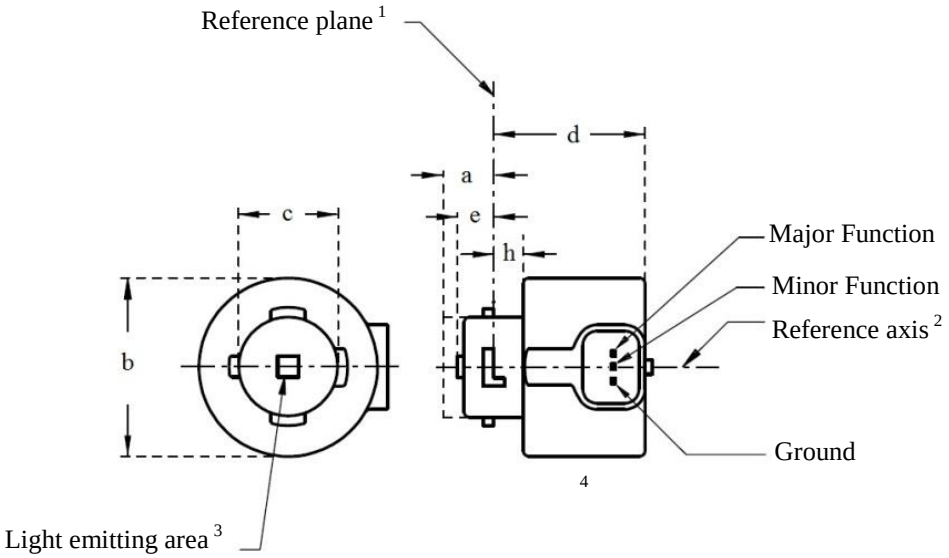
Table 4b
Test point values of normalized intensities for categories LW3A, LW3B, LY3A and LY3B

	LED light sources of normal production		*Standard LED light sources*	
Angle γ	*Minimum Intensity in cd /1000 lm*	*Maximum Intensity in cd/1000 lm*	*Minimum Intensity in cd /1000 lm*	*Maximum Intensity in cd /1000 lm*
-90°	0	70	0	65
-75°	0	160	0	150
-60°	85	245	105	220
-45°	145	310	180	275
-30°	170	380	220	335
-15°	190	415	240	370
0°	200	425	250	390
15°	190	415	240	370
30°	170	380	220	335
45°	145	310	180	275
60°	85	245	105	220
75°	0	160	0	150
90°	0	70	0	65

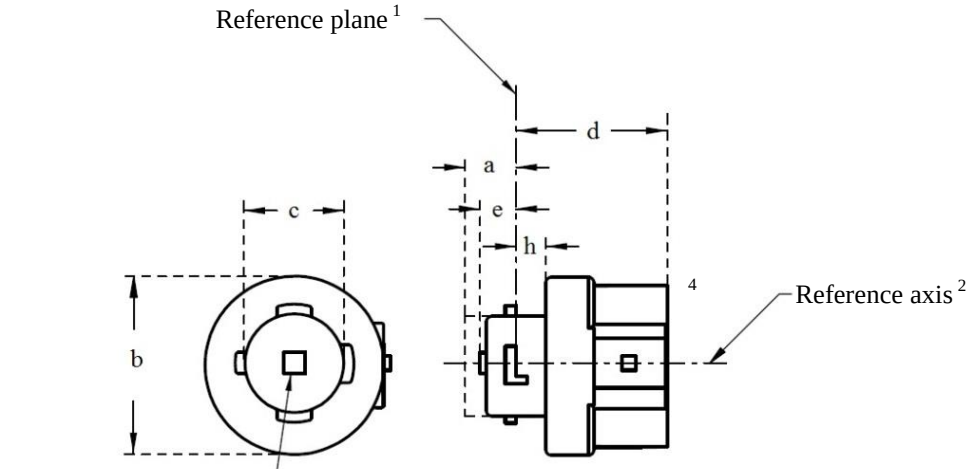
The drawings are intended only to illustrate the essential dimensions of the LED light source.

Figure 1*

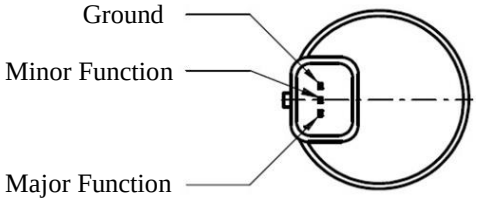
Main Drawing



LR4A



LR4B



For the notes see sheet LR4/2.

* Projection method:

CATEGORIES LR4A and LR4B **Sheet LR4/4**

Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the light source in an arbitrary plane containing the reference axis. The intersection of the reference axis and the parallel plane to the reference plane in distance e is used as the coordinate system origin.

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, so that the reference axis of the light source lines up with one of the rotating axis of the goniometer. The corresponding measurement set-up is described in Figure 3.

Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

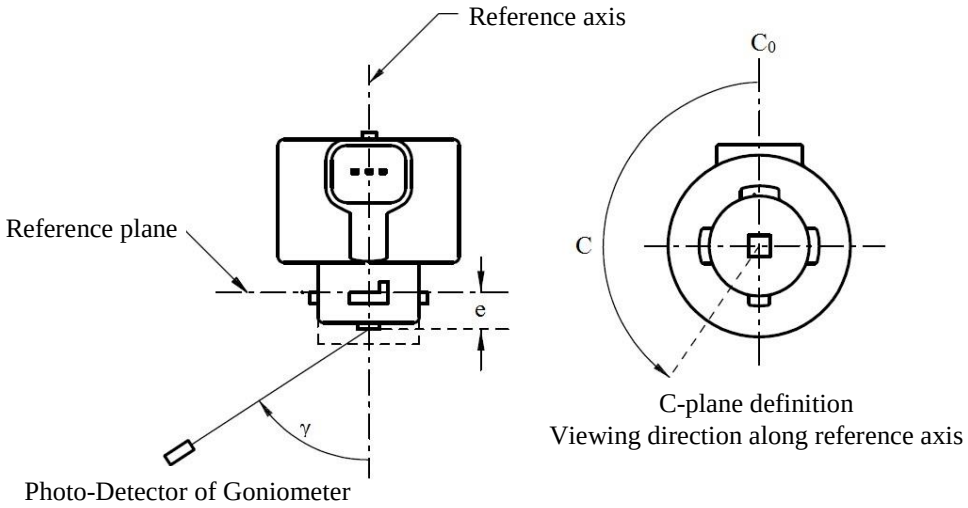
The measurements shall be performed in C-planes **C_0 (C_{180}) and C_{90} (C_{270}),** which contain the reference axis of the light source. The test points for each plane for multiple polar angles γ are specified in Table 4.

After measurement the data shall be normalized to 1,000 lm according to paragraph 3.1.11 using the luminous flux of the individual light source under test. The data shall comply with the tolerance band as defined in Table 4.

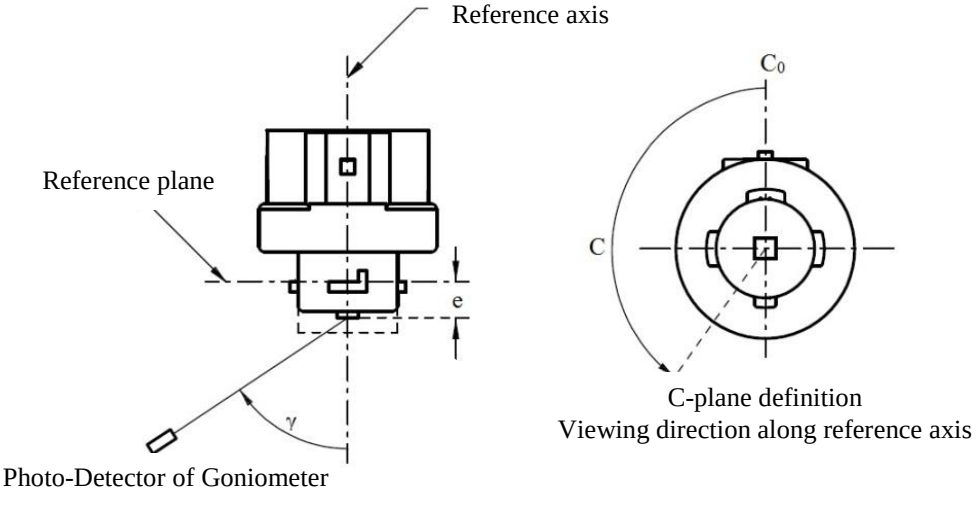
The drawings are intended only to illustrate the essential set-up for measurement of the LED light source.

Figure 3*

Set-up to measure the luminous intensity distribution



LR4A

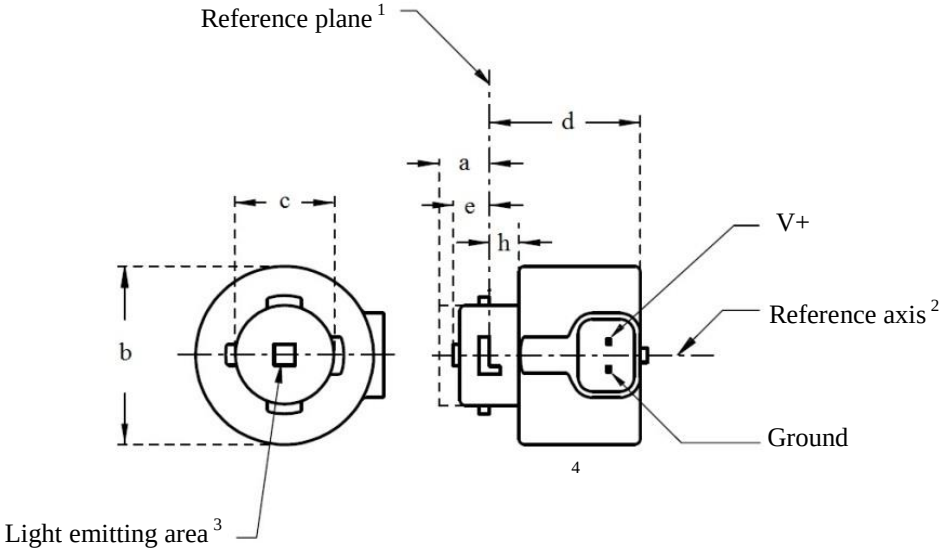


LR4B

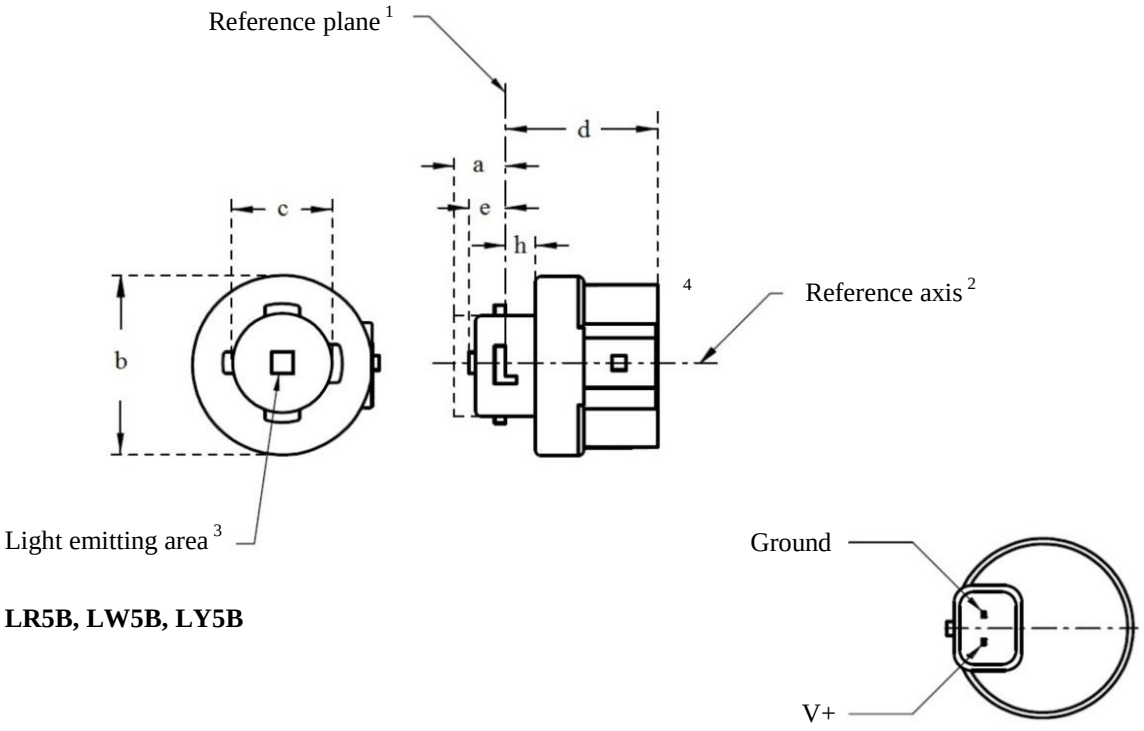
CATEGORIES LR5A, LR5B, LW5A, LW5B, LY5A, LY5B **Sheet L5/1**

The drawings are intended only to illustrate the essential dimensions of the LED light source.

Figure 1*
Main Drawing



LR5A, LW5A, LY5A



LR5B, LW5B, LY5B

For the notes see sheet L5/2

* Projection method:

CATEGORIES LR5A, LR5B, LW5A, LW5B, LY5A, LY5B **Sheet L5/2**

Table 1
Essential dimensional, electrical and photometric characteristics of the LED light source

Dimensions			*Production LED light sources*	*Standard LED light sources*
a		mm	6.0 max.	
b		mm	c + 10.0 min. 38.0 max.	
c		mm	18.5 ± 0.1	
d		mm	28.0 max.	
e		mm	3.0 ± 0.30	3.0 ± 0.15
h		mm	5.5 + 0.0/ – 0.1	
Cap	LR5A, LR5B PGJ18.5d-10 LW5A, LW5B PGJ18.5d-28 LY5A, LY5B PGJ18.5d-19		in accordance with IEC Publication 60061 (sheet 7004-185-1)	
Electrical and photometric characteristics				
Rated values	Volts		12	
	Watts	LR5A, LR5B	3	
		LW5A, LW5B LY5A, LY5B	6	
Objective Values[8]	Watts (at 13.5 V DC)	LR5A, LR5B	3.5 max.	
		LW5A, LW5B	8 max.	
		[10] LY5A, LY5B		
	Luminous flux (in lm at 13.5 V DC)	[5] LR5A, LR5B	120 ± 15%	120 ± 5% [9]
		[6] LW5A, LW5B	350 ± 20%	350 ± 10% [9]
		[7, 10] LY5A, LY5B	280 ± 20%	280 ± 10% [9]
	Luminous flux (in lm at 9 V DC)	[5] LR5A, LR5B	28 min.	
		[6] LW5A, LW5B	65 min.	
		[7, 10] LY5A, LY5B	55 min.	

[1] The reference plane is the plane defined by the contact points of the cap-holder fit.
[2] The reference axis is perpendicular to the reference plane and passing through the centre of the bayonet core.
[3] Light emitting area: to be checked by means of the box system in Figure 2
[4] A minimum free air space of 5mm around the light source shall be respected for convection.
[5] The emitted light shall be red.
[6] The emitted light shall be white.
[7] The emitted light shall be amber.
[8] After continuous operation for 30 minutes at 23 ± 2.5° C.
[9] The measured value shall be in between 100 per cent and 90 per cent of the value measured after 1 minute.
[10] Operated in flashing mode for 30 minutes (frequency = 1.5 Hz, duty cycle 50 per cent ON, 50 per cent OFF). Measured in the ON-state of flashing mode after 30 minutes of operation.

Electrical characteristics

In case of LED light source failure (no light emitted) the max. electrical current draw, when operated between 12 V and 14 V, shall be less than 20 mA (open circuit condition).

Screen projection requirements

The following test is intended to define the requirements for the apparent light emitting area of the LED light source and to determine whether the light emitting area is correctly positioned relative to the reference axis and reference plane in order to check compliance with the requirements.

The position of the light emitting area is checked by the box system defined in Figure 2, which is aligned to the planes C90 and C180 and shows the projection when viewing along direction γ=0º (C, γ as defined in Figure 3).

The proportion of the total luminous flux emitted into the viewing direction shall be as described in table 3.

Figure 2
Box definition of the light emitting area with dimensions as specified in table 2

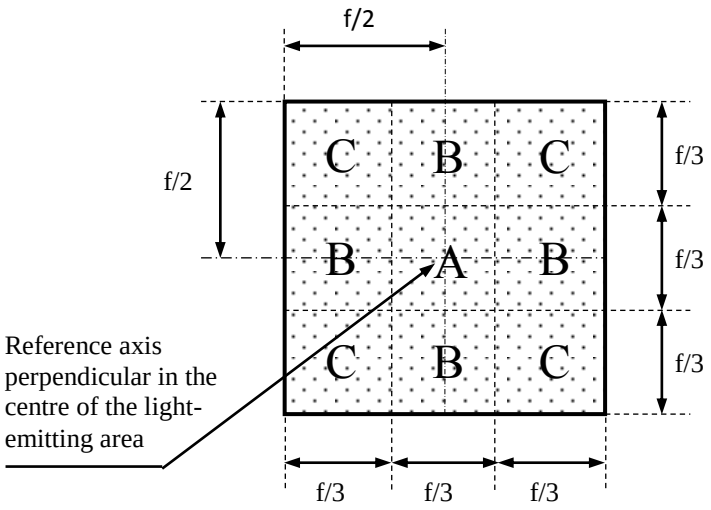


Table 2
Dimensions of the box system in Figure 2

Dimensions in mm	*f*
LED light sources of normal production	4.5
Standard LED light sources	4.5

Table 3
Proportion of the total luminous flux emitted into the viewing direction from the areas specified in figure 2

Category	*Area(s)*	*LED light sources of normal production*	*Standard LED light sources*
LR5A LR5B	Each B individually	≥ 10%	≥ 15%
	Each A, B individually	< 40%	< 30%
	All B together	≥ 60%	≥ 65%
	Each C individually	-	< 10%
	All A, B and C together	≥ 90%	≥ 90%
LW5A LW5B LY5A LY5B	Each A,B individually	≥ 6%	≥ 8%
	Each A, B individually	< 40%	< 30%
	All A, B together	≥ 55%	≥ 60%
	Each C individually	< 15%	< 10%
	All A, B and C together	≥ 90%	≥ 90%

Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the light source in an arbitrary plane containing the reference axis. The intersection of the reference axis and the parallel plane to the reference plane in distance e is used as the coordinate system origin.

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, so that the reference axis of the light source lines up with one of the rotating axis of the goniometer. The corresponding measurement set-up is described in Figure 3.

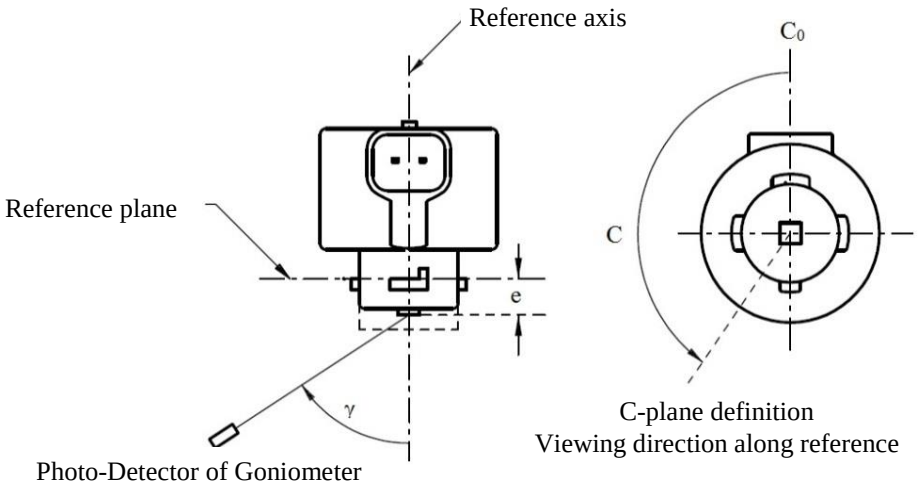
Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

The measurements shall be performed in C-planes **C_0 (C_{180}) and C_{90} (C_{270}),** which contain the reference axis of the light source. The test points for each plane for multiple polar angles γ are specified in Table 4.

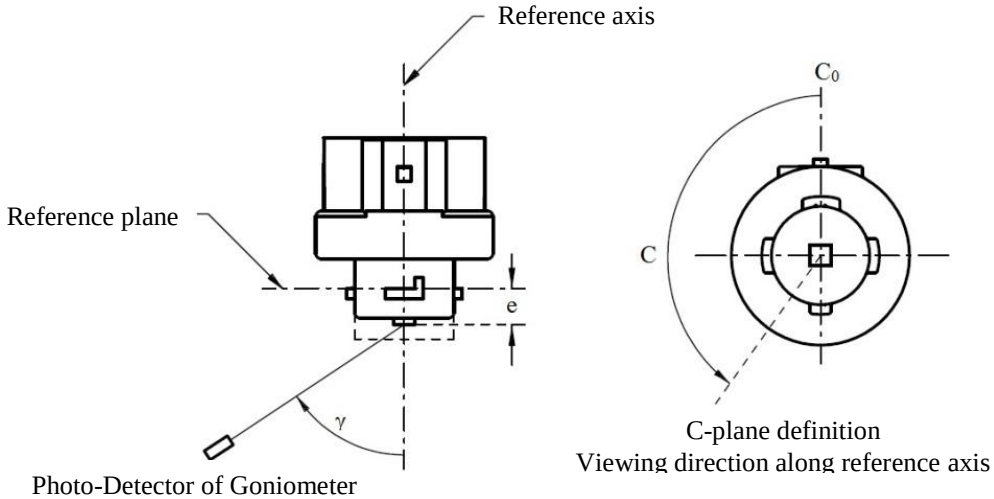
The measured luminous intensity values, normalised to the measured luminous flux of the individual light source under test, shall be converted to normalised luminous intensity values of a 1,000 lm light source. The data shall comply with the tolerance band as defined in Table 4.

The drawings are intended only to illustrate the essential set-up for measurement of the LED light source.

Figure 3
Set-up to measure the luminous intensity distribution



LR5A. LW5A. LY5A



LR5B, LW5B, LY5B

CATEGORIES LR5A, LR5B, LW5A, LW5B, LY5A, LY5B **Sheet L5/6**

The light pattern as described in Table 4 shall be substantially uniform, i.e. in between two adjacent grid points the relative luminous intensity requirement is calculated by linear interpolation using the two adjacent grid points. In case of doubt this may be checked in addition to verification of the grid points given in Table 4.

Table 4
Test point values of normalized intensities for categories LR5A, LR5B, LW5A, LW5B, LY5A and LY5B

	LED light sources of normal production		*Standard LED light sources*	
Angle γ	*Minimum Intensity in cd /1000 lm*	*Maximum Intensity in cd/1000 lm*	*Minimum Intensity in cd /1000 lm*	*Maximum Intensity in cd /1000 lm*
-90°	0	70	0	65
-75°	0	160	0	150
-60°	85	245	105	220
-45°	145	310	180	275
-30°	170	380	220	335
-15°	190	415	240	370
0°	200	425	250	390
15°	190	415	240	370
30°	170	380	220	335
45°	145	310	180	275
60°	85	245	105	220
75°	0	160	0	150
90°	0	70	0	65

II. Justification

1. This proposal introduces new LED light source categories for signalling to accommodate an increasing market demand for LED light sources according to Regulation No. 128.

2. Light source categories emitting white and amber light, both with an elbow connector at the side – the A version – and with a straight connector at the bottom – the B version – are proposed to complete the red light emitting categories LR3A and LR3B.

3. The L5 light source categories are more or less identical to the L3 categories. The main difference is a higher luminous flux and consequently mostly a higher power consumption. The L5 categories are intended for use in lamps for which higher luminous intensity values are required.

4. The cap/holder system for LR3A and LR3B allows many other keys. For the newly proposed LED light source categories no new system needs to be developed and keys not in use so far have been assigned to the newly proposed categories.

5. For consistency, the sheets LR4/1 and LR4/4 were replaced by new sheets to align the main figures with the main figures of L3 and L5, which in turn were aligned with the drawings in standard IEC60061.

6. This proposal can easily be merged with the proposals for simplification of light source regulations.