Transmitted by IWG SLR

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agenda item 4)

Modifications to Annex 3 of the draft Resolution on the common specification of light source categories (ECE/TRANS/WP.29/GRE/2015/28)

Annex 3

Sheets for led light sources

List of sheets for LED light sources and their sequence in this annex:

Sheet number(s)
LR1/1 to 5
LW2/1 to 5
L~~R~~3/1 to ~~5~~6
LR4/1 to 5
L5/1 to 6

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

Figure 1
Main drawing

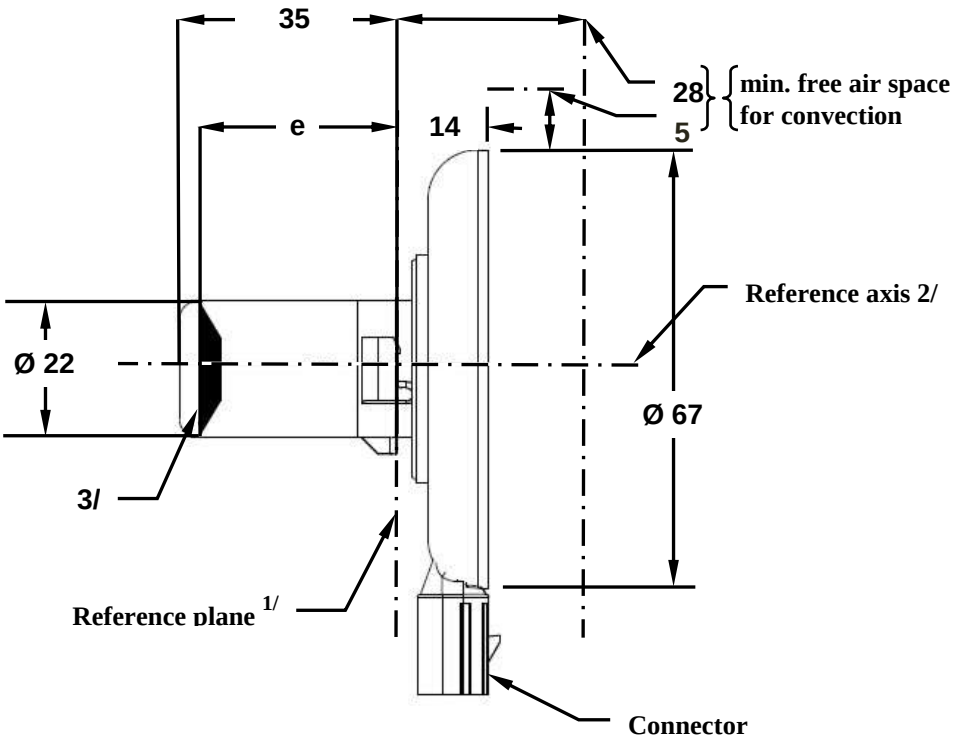
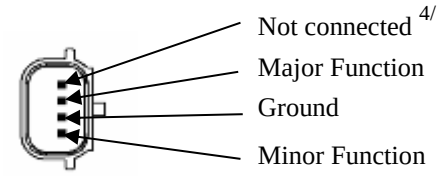


Figure 2
Connector detail



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 3.
4/ Optional pin.

Table 1

Essential dimensional, electrical and photometric characteristics

Dimensions in mm		*Tolerance*			
		LED light sources of normal production		*Standard LED light source*	
e [3/ 7/]	24.0	0.2		0.1	
Cap PGJ21t-1 in accordance with IEC Publication 60061 (sheet 7004-165-1)					
Electrical and photometric characteristics [5/]					
Rated values		*Minor function*	*Major function*	*Minor function*	*Major function*
	Volts	12		12	
Objective Values [6/]	Watts (at 13.5 V DC)	0.75 max.	3.5 max. 1.4 min.	0.75 max.	3.5 max. 1.4 min.
	Luminous flux (in lm at 13.5V DC)			3.5 ± 10%	47 ± 10%
	Luminous flux (in lm at 10-16 V DC)	3.5 ± 20%	47 ± 20%		

[5/] The emitted light shall be red.

[6/] Continuous on for 30 minutes at 23 ± 2.5° C.

[7/] Light centre length.

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 – operation 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 3, which shows the projections when viewing along direction $\gamma=90^{o}$ in the planes C_{90} and C_{180} (C, γ as defined in Figure 4). At least 95 per cent of the luminous flux emitted into the viewing direction has to come from the trapezoidal area defined by d1, d2 and c. Less than 70 per cent of the luminous flux shall be emitted from the rectangular area defined by d3 and c.

Figure 3
Box definition of the light emitting area

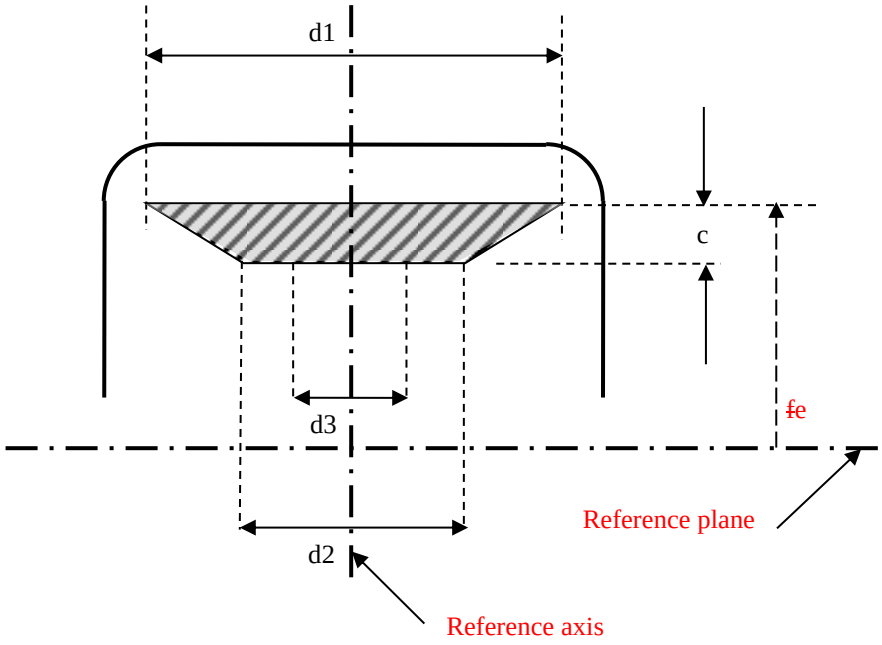


Table 2
Dimensions of the box system in Figure 3

Dimensions in mm	*~~f~~e*	*c*	*d1*	*d2*	*d3*
LED light sources of normal production	~~E~~ 24.0 + 0.2	3.6	21.0	15.0	7.0
Standard (etalon) LED light sources	~~E~~ 24.0 + 0.1	3.4	21.0	15.0	7.0

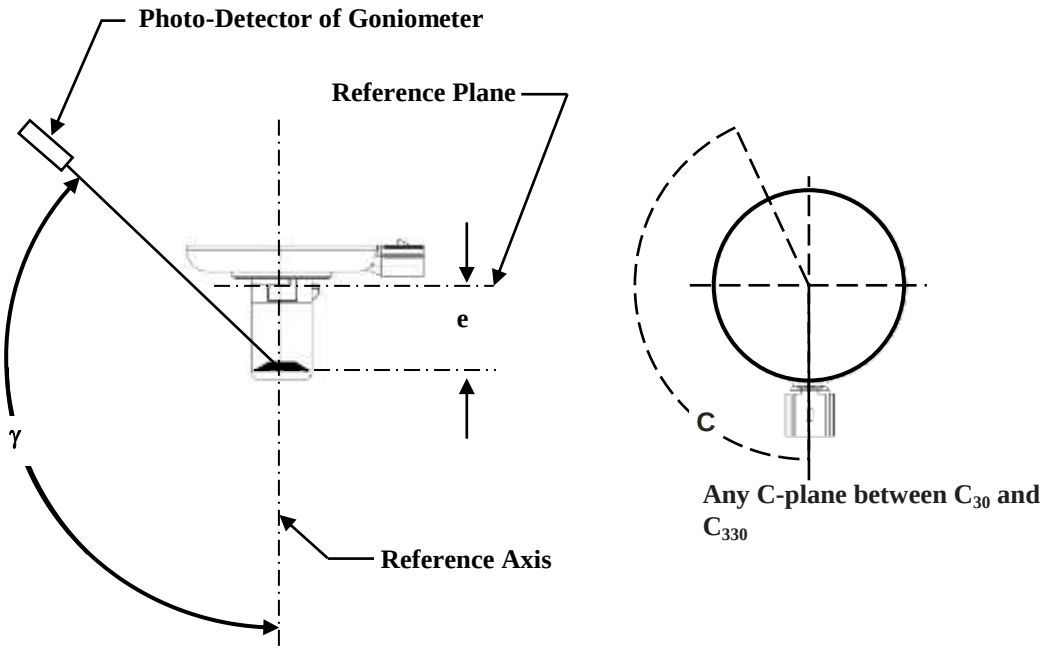
Normalized luminous intensity distribution

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

The LED 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 LED light source lines up with one of the rotating axis of the goniometer. The corresponding measurement set-up is described in Figure 4.

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

Figure 4
Set-up to measure the luminous intensity distribution



Luminous intensity data is recorded for the major function 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 3 C-planes, which contain the reference axis of the LED light source. The 3 C-planes shall be within C_{30} and C_{330} to avoid the connector shadows and they have to be at least 30° apart from each other. The test points for each plane for multiple polar angles γ are specified in Table 3.

The measured luminous intensity values, normalised to the measured luminous flux of the individual LED light source under test, shall be converted to normalised luminous intensity values of a 1000 lm LED light source. The data shall comply with the tolerance band as defined in Table 3.

C-planes: see CIE publication 70-1987, "The measurement of absolute intensity distributions".

Table 3

Test point values of normalized intensity for the major function of normal production and standard LED light sources, respectively.

	LED light source of normal production		*Standard LED light source*	
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*
0°	0	30	0	20
15°	0	30	0	20
30°	0	70	0	40
45°	20	100	20	60
60°	35	120	35	80
75°	50	140	50	100
90°	70	160	70	120
105°	90	180	90	140
120°	110	200	110	160
135°	110	200	110	160
150°	90	180	90	140

The luminous intensity distribution as described in Table 3 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.

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

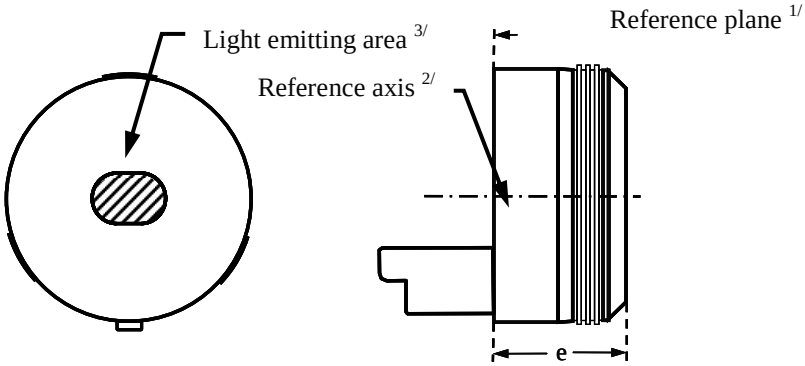


Figure 2 – Connector Detail

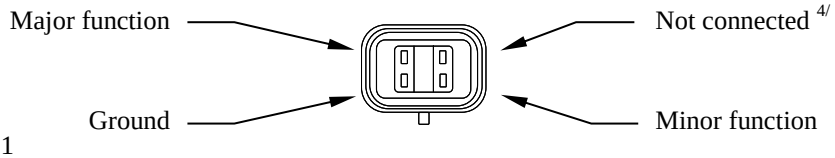


Table 1
Essential dimensional, electrical and photometric characteristics

Dimensions in mm		*Tolerances*			
		LED light sources of normal production		*Standard LED light sources*	
e 8/	26.4	0.2		0.1	
Cap PGJY50 in accordance with IEC Publication 60061 (sheet 7004-182-1)					
Electrical and photometric characteristics 5/					
Rated values		*Minor function*	*Major function*	*Minor function*	*Major function*
	Volts	12		12	
Objective Values 6/ 7/	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_b in °C		30 ± 2	55 ± 2	30 ± 0.5	55 ± 0.5

1/ The reference plane is given by the thermal transfer area on the backside of the LED light source.
2/ The reference axis is perpendicular to the reference plane and passing through the centre of the LED light source as defined by three notches on the outer perimeter.
3/ Light emitting area: to be checked by means of the box system in Figure 3.
4/ Optional pin.
5/ The emitted light shall be white.
6/ Continuous operation for 30 minutes with base temperature Tb stabilized as specified above.
7/ Luminous flux from the light emitting area shall be determined within a solid angle of - 40° < α < + 40° and - 40° < β < +40° using either integral methods or the procedure described on sheets LW2/3 and LW2/4.
8/ Light centre length.

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 ±40° 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

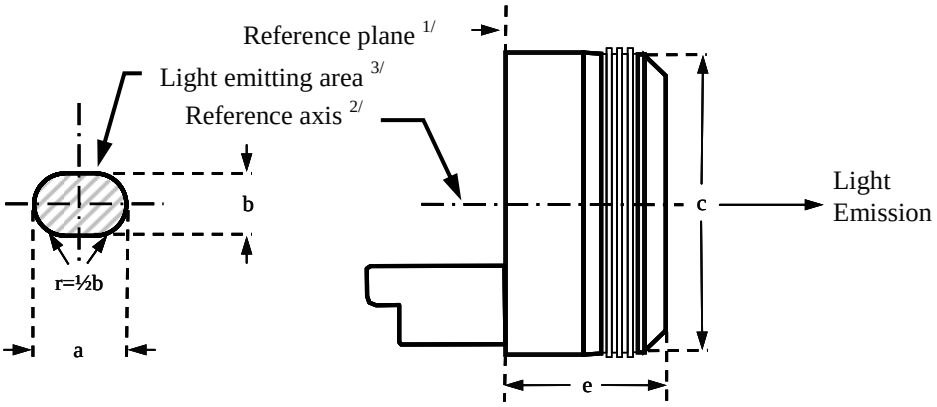


Table 2
Dimensions of the light emitting area in Figure 3

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

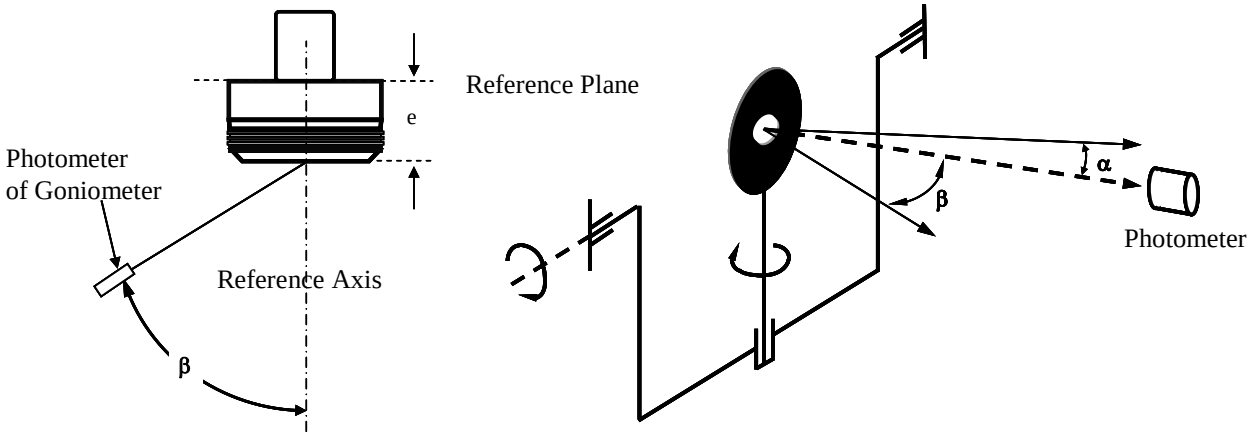
Cumulative luminous flux distribution

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 LED 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 LED 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 LED light source lines up with the measurement axis of the goniometer. The corresponding measurement set-up is described in Figure 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 $-40° < \alpha < +40°$ and $-40° < \beta < +40°$. 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° 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 $-40° < \alpha < +40°$ and $-40° < \beta < +40$. 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 LED light sources

Angle α, β	*Min. normalized flux in %*	*Max. normalized flux in %*
$-5° < \alpha, \beta < +5°$	8	14
$-10° < \alpha, \beta < +10°$	31	37
$-15° < \alpha, \beta < +15°$	54	59
$-20° < \alpha, \beta < +20°$	75	81
$-25° < \alpha, \beta < +25°$	91	95
$-30° < \alpha, \beta < +30°$	97	100
$-35° < \alpha, \beta < +35°$	98	100
$-40° < \alpha, \beta < +40°$	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.

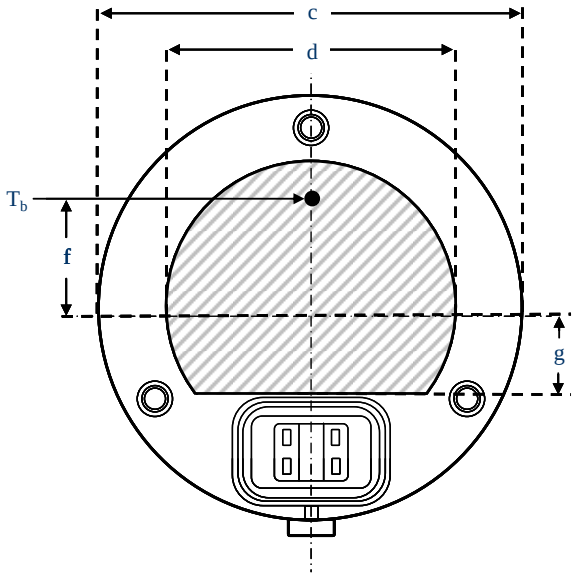
In case of doubt that cumulative luminous flux distributions of major and minor function differ, the procedure as described above for the major function shall be repeated for the minor function.

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

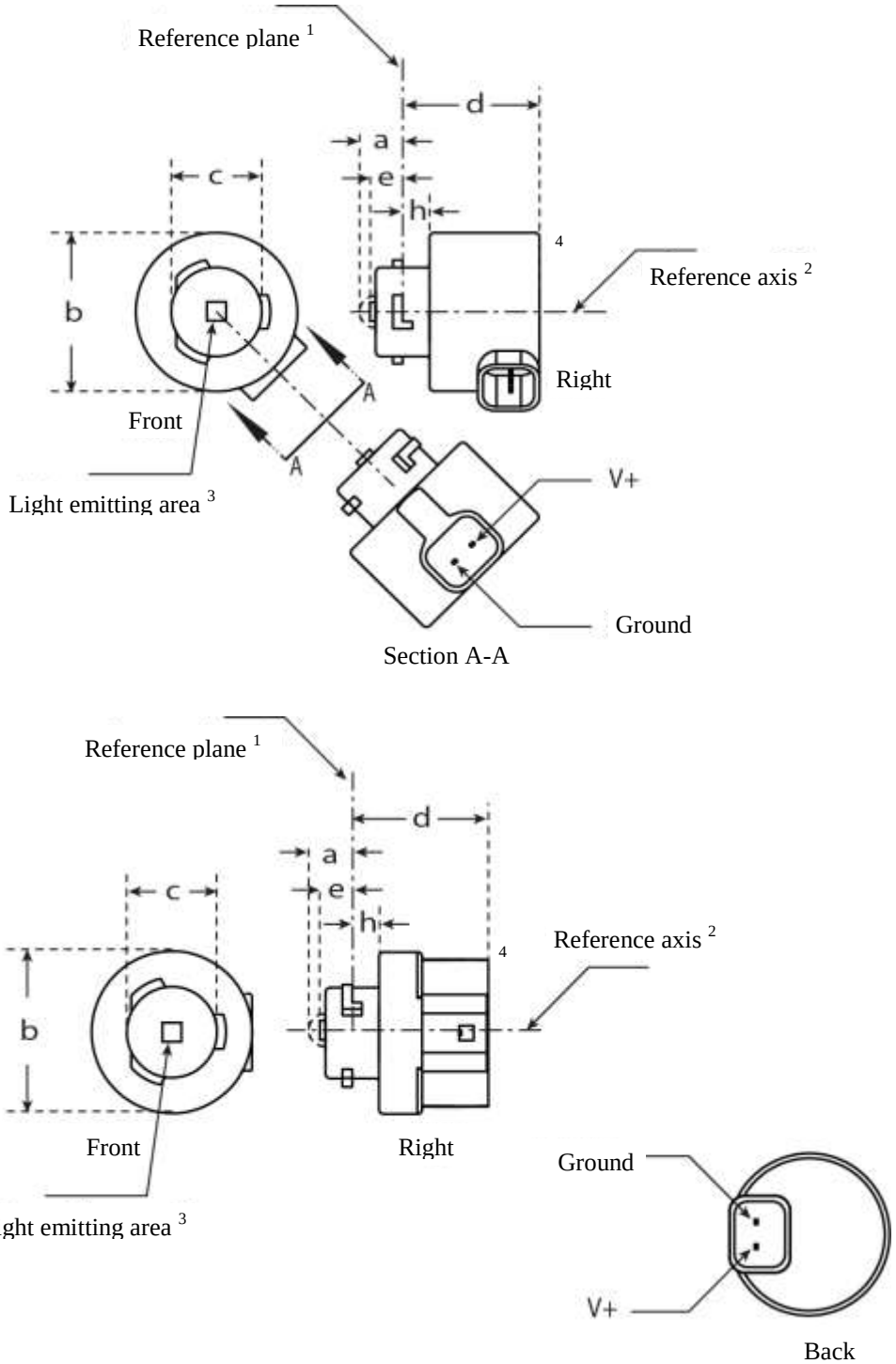


Dimensions in mm	
c	50.0
d	34.5
f	13.0
g	10.0

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).

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



~~Figure 1*~~

~~**Main Drawing, LR3A (top) and LR3B (bottom)**~~

~~For the notes see sheet LR3/2.~~

~~* 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 PGJ18.5d-1 in accordance with IEC Publication 60061 (sheet 7004-185-1)				
Electrical and photometric characteristics [5]				
Rated values	Volts		12	
	Watts		3	
Objective Values [6]	Watts (at 13.5 V DC)		3.5 max.	3.5 max.
	Luminous flux (in lm at 13.5 V DC)		80 ± 20% [7]	80 ± 10% [8]
	Luminous flux (in lm at 9 V DC)		19 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 LED light source shall be respected for convection.
[5] The emitted light shall be red.
[6] After continuous operation for 30 minutes at 23 ± 2.5° C.
[7] The measured value shall be in between 100 per cent and 70 per cent of the value measured after 1 minute.
[8] The measured value shall be in between 85 per cent and 75 per cent of the value measured after 1 minute.

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=0° (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.

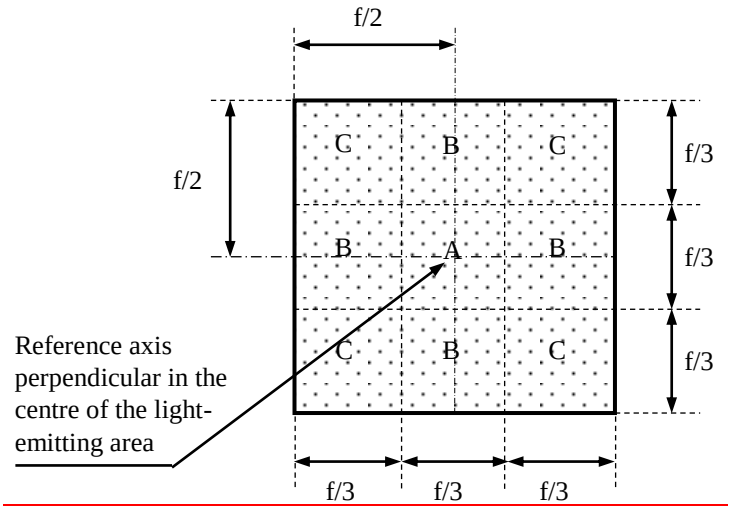


Figure 2
Box definition of the light emitting area with dimensions as specified in table 2

Table 2
Dimensions of the box system in Figure 2

Dimensions in mm	*f*
LED light sources of normal production	3.0
Standard LED light sources	3.0

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

Area(s)	*LED light sources of normal production*	*Standard LED light sources*
A	≤ 25%	≤ 10%
Each B individually	≥ 15%	≥ 20%
Each C individually	-	≤ 10%
A, all B and all C together	≥ 90%	≥ 90%

Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the LED 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 LED 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 LED 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 C0/180 and C90/270, which contain the reference axis of the LED 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 LED light source under test, shall be converted to normalised luminous intensity values of a 1000 lm LED 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.

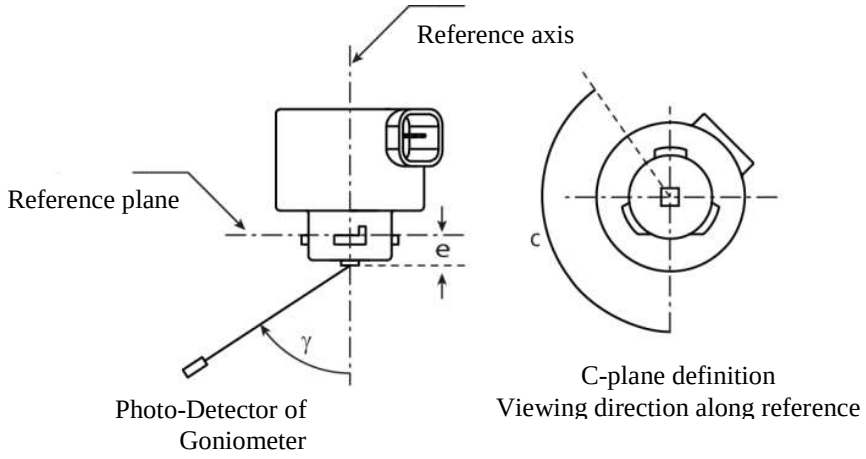


Figure 3
Set-up to measure the luminous intensity distribution, LR3A (top) and LR3B (bottom)

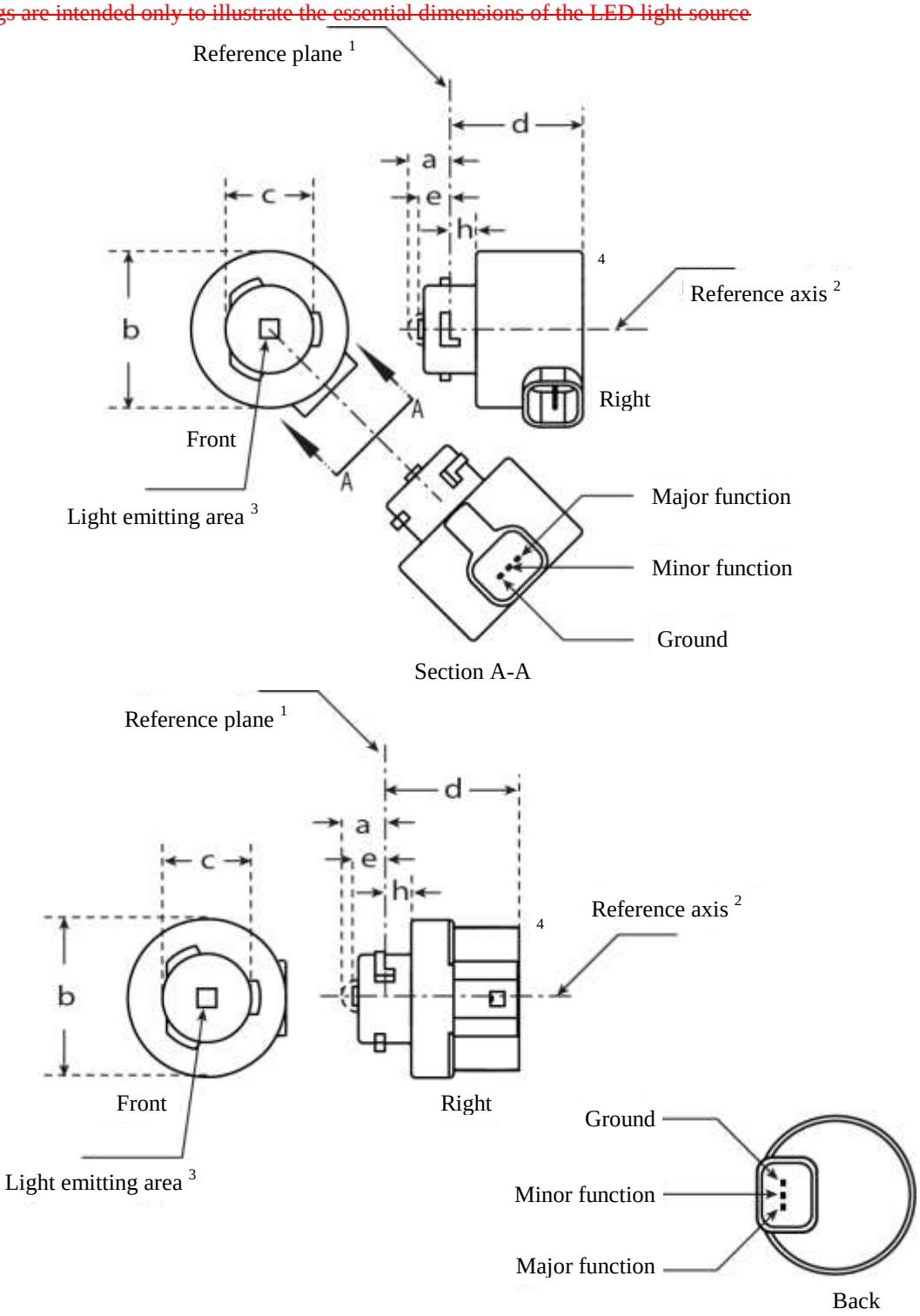
The light pattern as described in Table 4 shall be substantially uniform, i.e. in between two adjacent grid points the relative luminous intensity requirement is calculated by linear interpolation using the two adjacent grid points. In case of doubt this may be checked in addition to verification of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

Table 4

Test point values of normalized intensities of normal production and standard LED light sources, respectively.

	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

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



~~Figure 1*~~

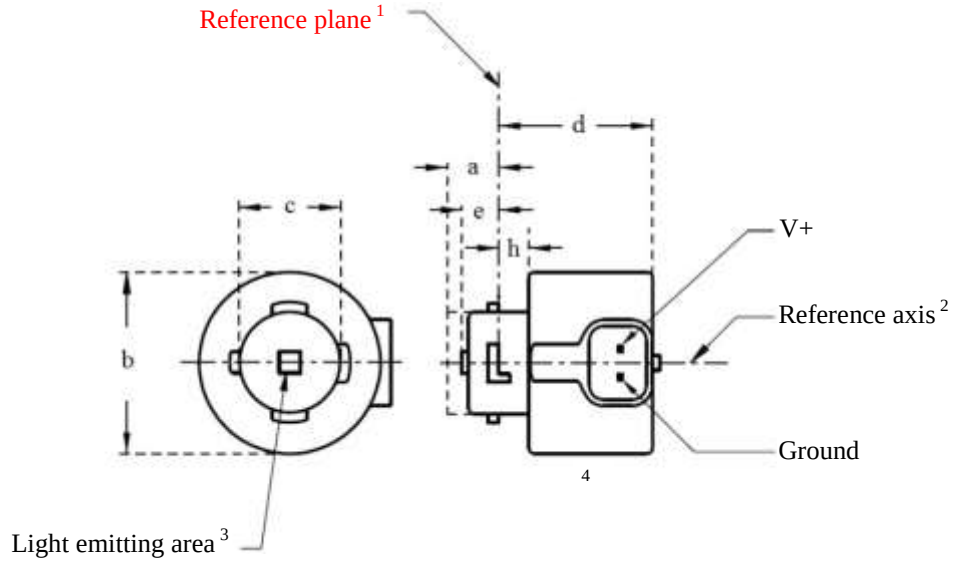
~~Main Drawing, LR4A (top) and LR4B (bottom)~~

~~For the notes see sheet LR4/2.~~

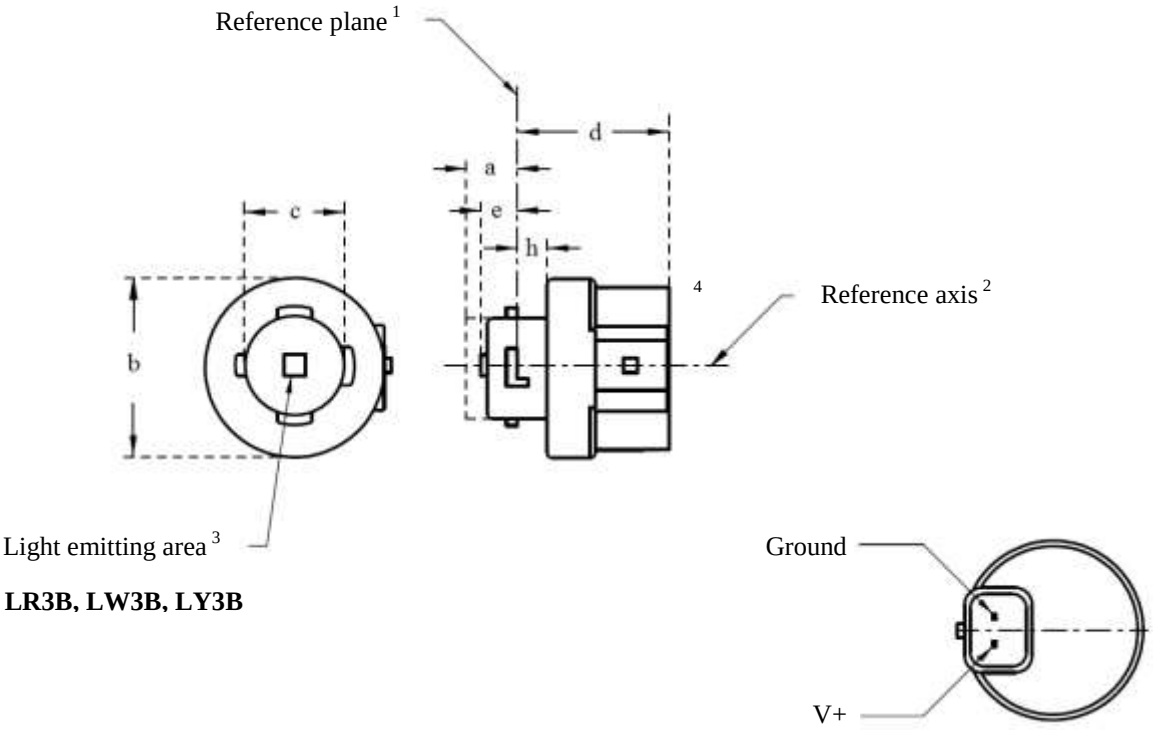
The drawings are intended only to illustrate the essential dimensions of the LED light source.

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 [13/]		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.
13/ Light centre length

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 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

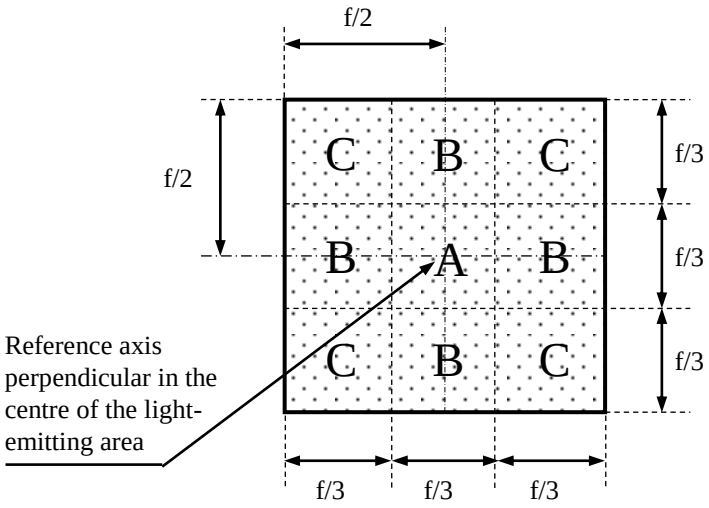


Table 2
Dimensions of the box system in Figure 2

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

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.

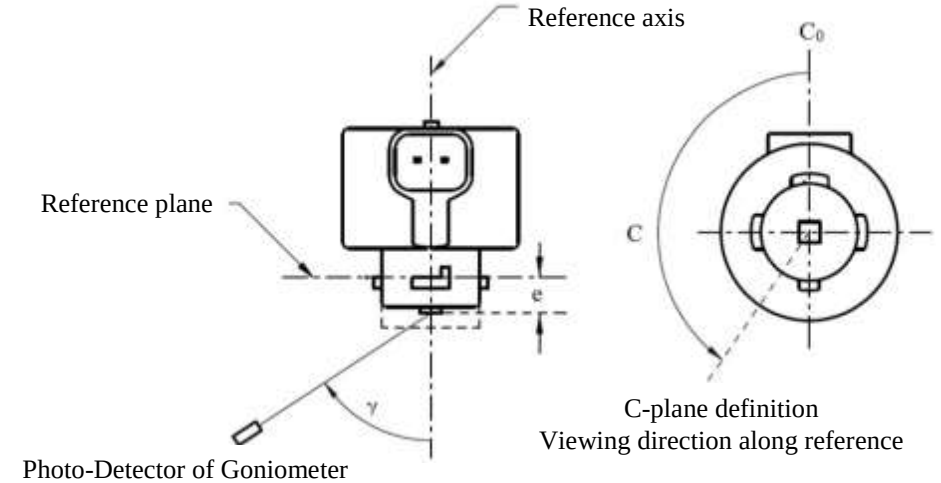
Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

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 Tables 4a and 4b.

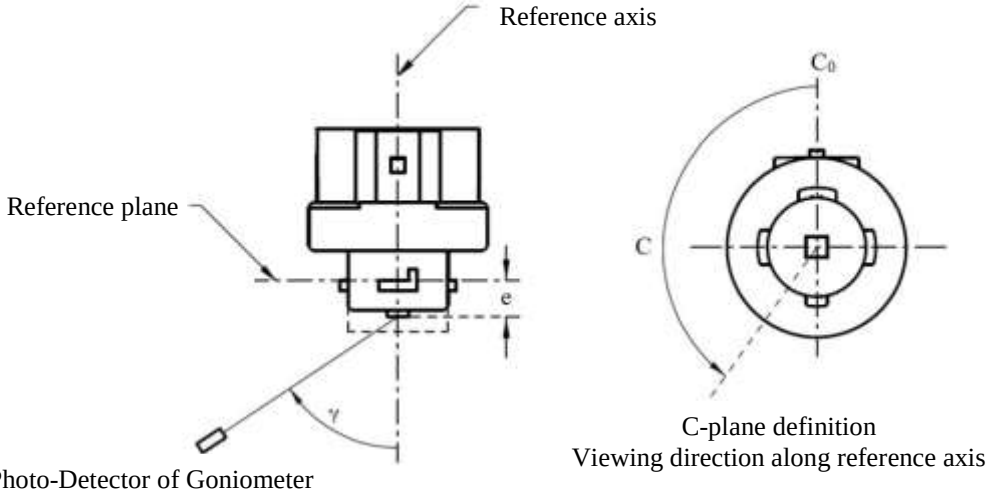
The measured luminous intensity values, normalised to the measured luminous flux of the individual light source under test, shall be converted to normalised luminous intensity values of a 1,000 lm light source. The data shall comply with the tolerance band as defined in Tables 4a and 4b.

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

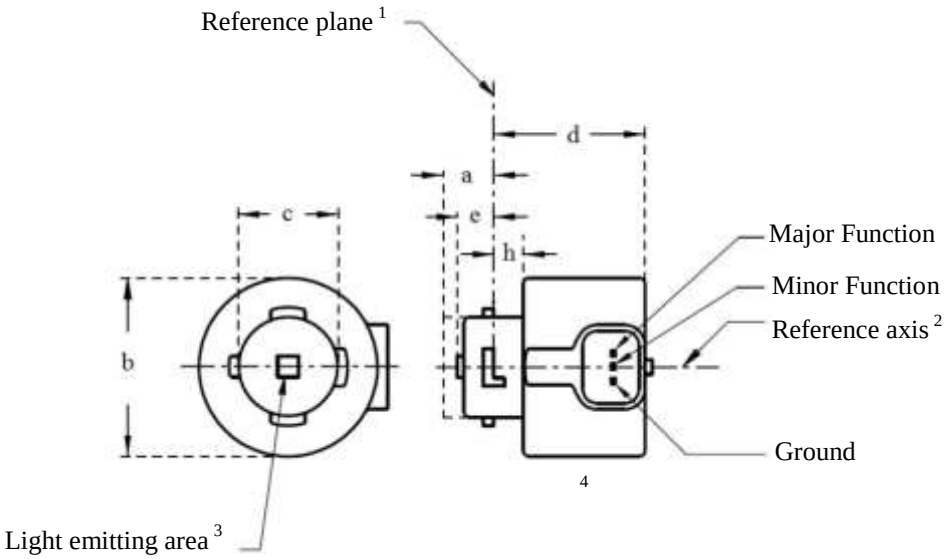
Test point values of normalized intensities for categories LW3A, LW3B, LY3A and LY3B

	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

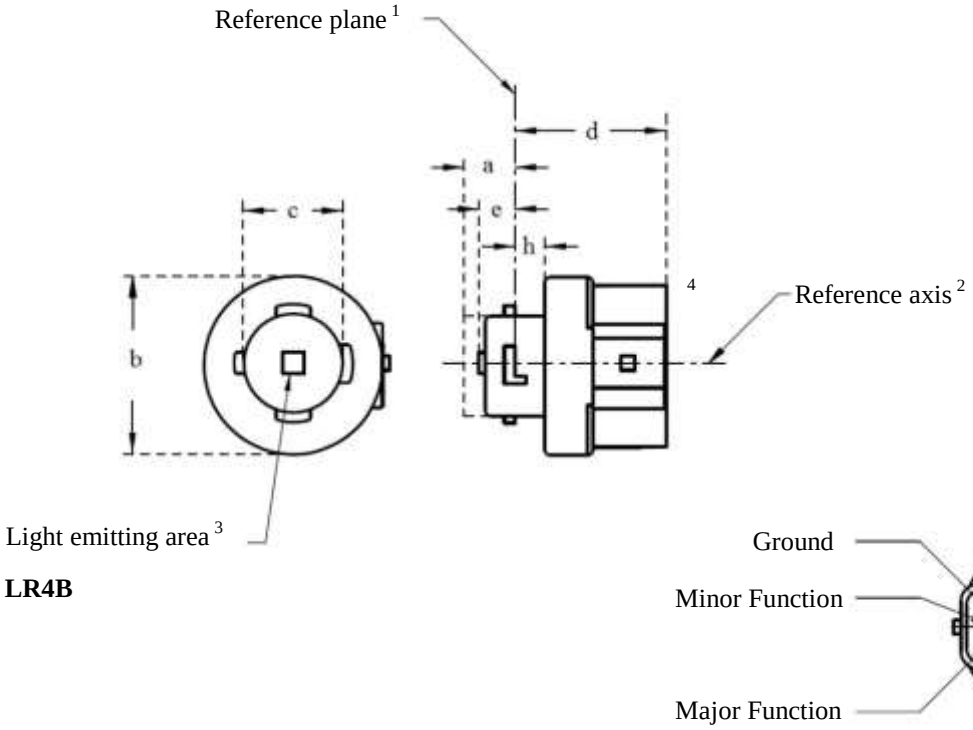
The drawings are intended only to illustrate the essential dimensions of the LED light source.

Figure 1*

Main Drawing



LR4A



LR4B

For the notes see sheet LR4/2.

* Projection method:

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 [9/]	mm	3.0 ± 0.30		3.0 ± 0.15	
h	mm	5.5 + 0.0/ – 0.1			
Cap PGJ18.5t-5 in accordance with IEC Publication 60061 (sheet 7004-185-1)					
Electrical and photometric characteristics [5]					
Rated values		*Minor function*	*Major function*	*Minor function*	*Major function*
	Volts	12		12	
	Watts	0.75	3	0.75	3
Objective Values [6]	Watts (at 13.5 V DC)	1.0 max.	3.5 max.	1.0 max.	3.5 max.
	Luminous flux (in lm at 13.5 V DC)	6 ± 20%	80 ± 20% [7]	6 ± 10%	80 ± 10% [8]
	Luminous flux (in lm at 9 V DC)	1.5 min.	19 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 LED light source shall be respected for convection.
5/ The emitted light shall be red.
6/ After continuous operation for 30 minutes at 23 ± 2.5° C.
7/ The measured value shall be in between 100 per cent and 70 per cent of the value measured after 1 minute.
8/ The measured value shall be in between 85 per cent and 75 per cent of the value measured after 1 minute.
9/ Light centre length

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).
The major and the minor function shall be operated by separate electrical circuits.

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.

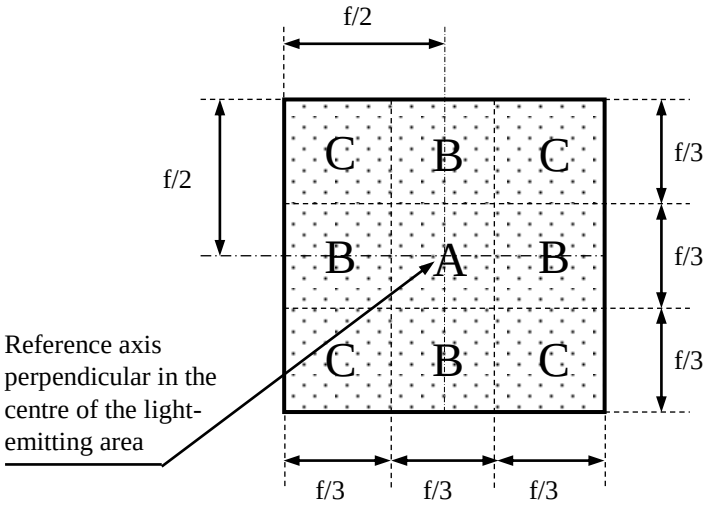


Figure 2

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
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

Function	*Area(s)*	*LED light sources of normal production*	*Standard LED light sources*
Minor	A	≥ 75%	≥ 80%
Major	A	≤ 25%	≤ 10%
	Each B individually	≥ 15%	≥ 20%
	Each C individually	-	≤ 10%
	A, all B and all C together	≥ 90%	≥ 90%

Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the LED 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 LED 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 LED 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 C0/180 and C90/270, which contain the reference axis of the LED 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 LED light source under test, shall be converted to normalised luminous intensity values of a 1000 lm LED 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

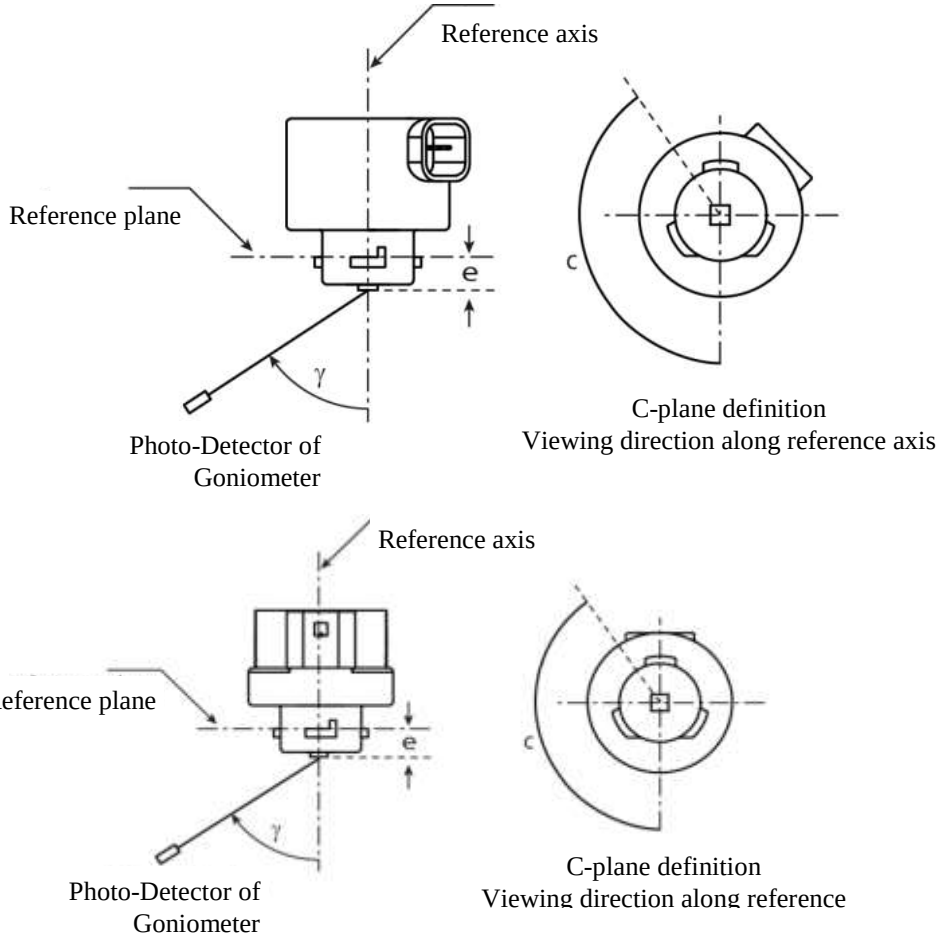


Figure 3
Set-up to measure the luminous intensity distribution, LR4A (top) and LR4B (bottom)

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.

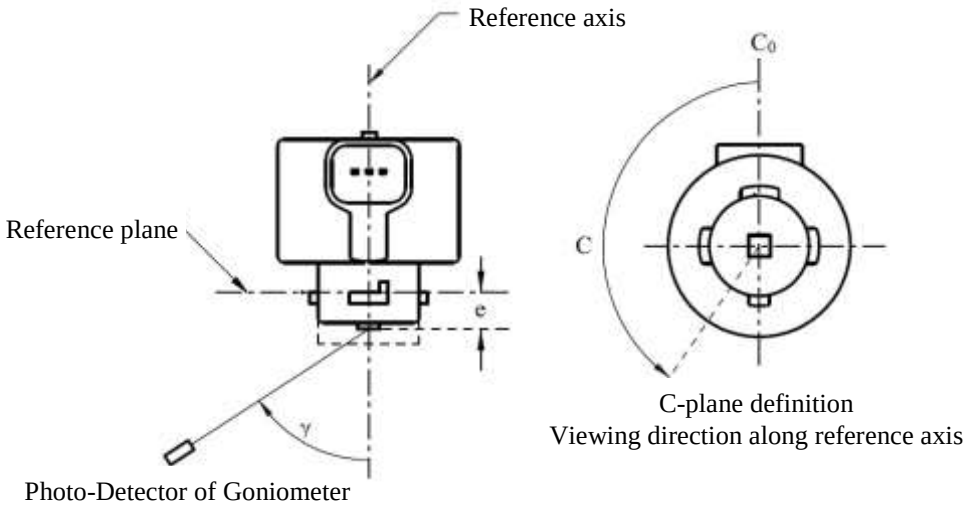
Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

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.

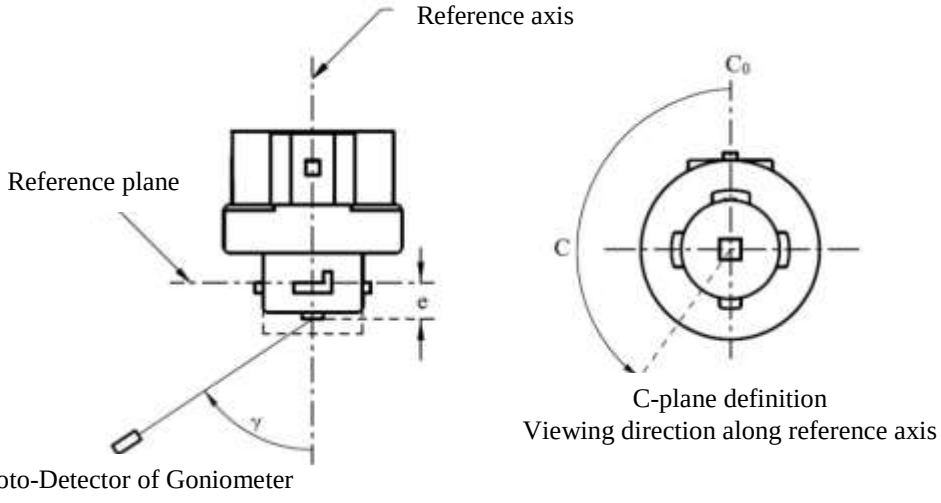
After measurement the data shall be normalized to 1,000 lm according to paragraph 3.1.11 using the luminous flux of the individual light source under test. The data shall comply with the tolerance band as defined in Table 4.

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

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

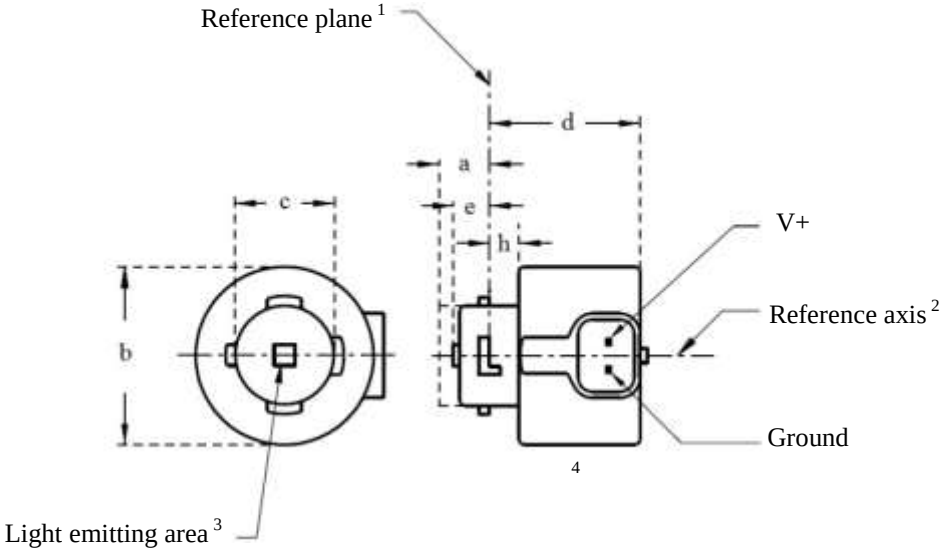
Test point values of normalized intensities of normal production and standard LED light sources, respectively. Requirements apply to both, major and minor function.

	LED light sources of normal production		*Standard LED light sources*	
Angle γ	*Minimum Intensity in cd /1000lm*	*Maximum Intensity in cd/1000lm*	*Minimum Intensity in cd /1000lm*	*Maximum Intensity in cd/1000lm*
-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

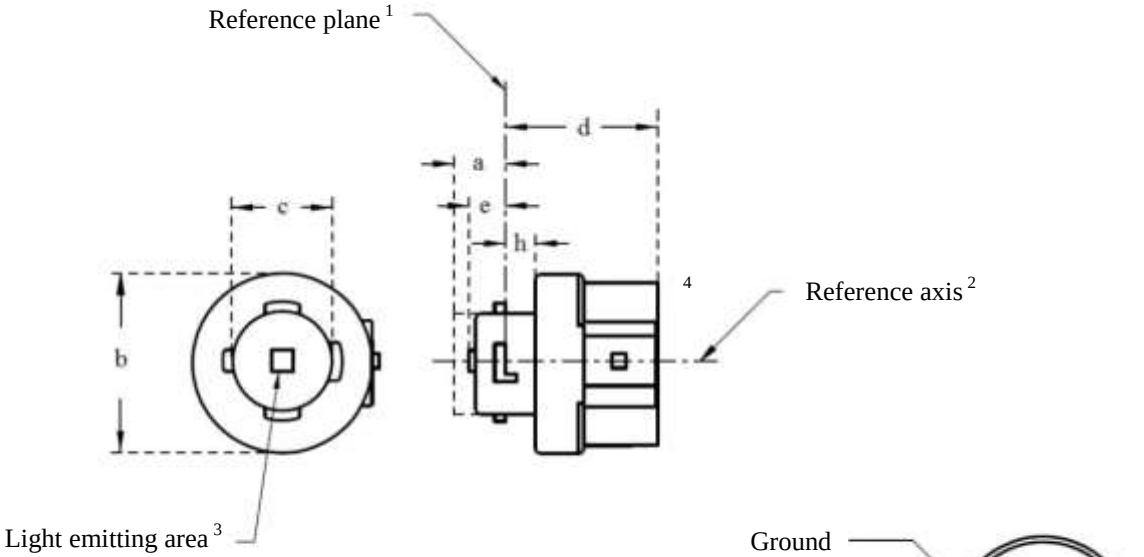
The drawings are intended only to illustrate the essential dimensions of the LED light source.

Figure 1*

Main Drawing



LR5A, LW5A, LY5A



LR5B, LW5B, LY5B

For the notes see sheet L5/2

* Projection method:

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 [11/]		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.
[11/] Light centre length

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 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

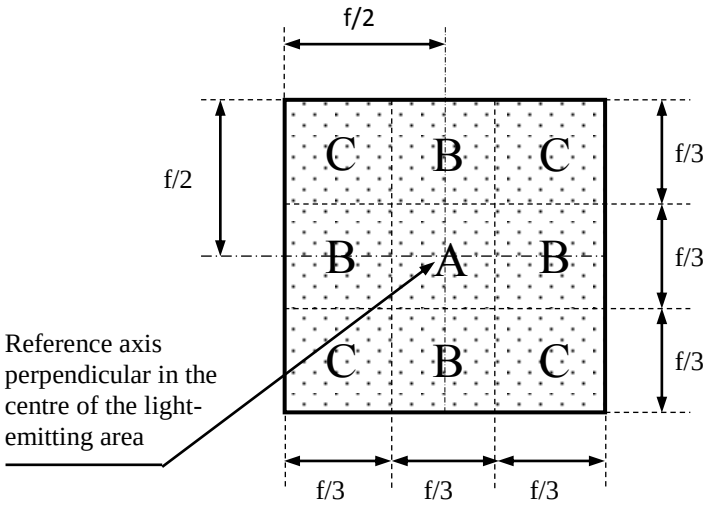


Table 2
Dimensions of the box system in Figure 2

Dimensions in mm	*f*
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.

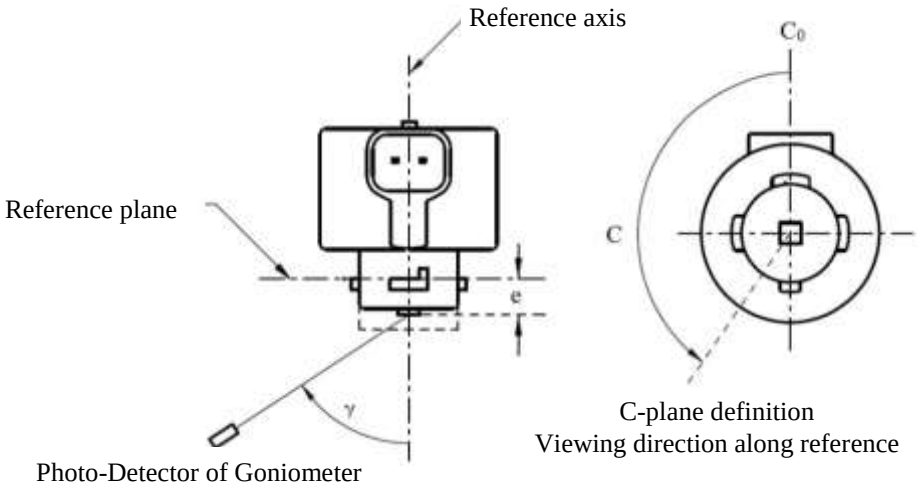
Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately, to make sure that the detector is located in the far field of the light distribution.

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.

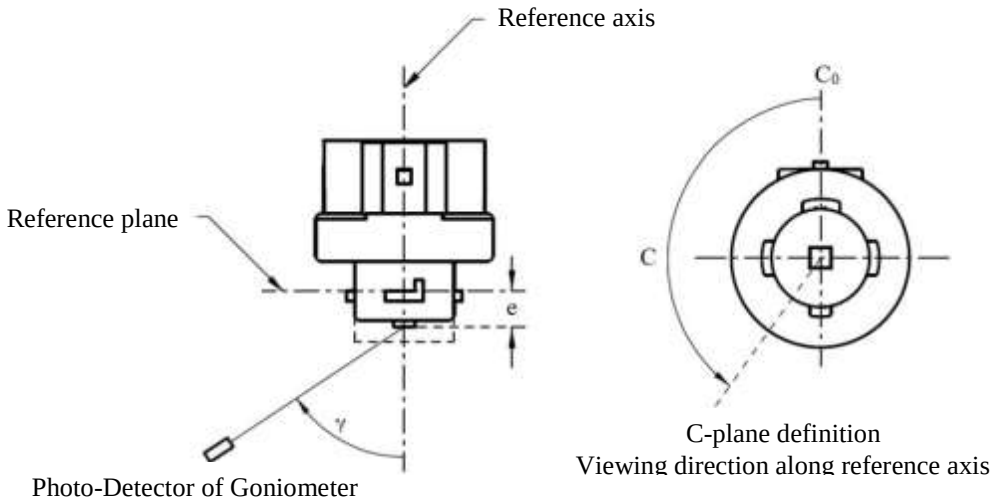
The measured luminous intensity values, normalised to the measured luminous flux of the individual light source under test, shall be converted to normalised luminous intensity values of a 1,000 lm light source. The data shall comply with the tolerance band as defined in Table 4.

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

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