GRE TF S/R – 17th meeting

Agenda item: 7.1 H11 category sheet changes

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15-June 2023

In a nutshell

- Starting from enforced H11 (LEDr) category sheet *(full photometric equivalence)*
- Keep all mechanical/geometrical, electrical and thermal specifications
- Keep specifications for luminous flux, colour and contrast
- Introduce alternative “embodiment” as modification of
  - “Screen projection requirements” (near-field characteristics), and
  - “Normalized luminous intensity distribution “ (far-field characteristics)

Note: “embodiment” or other suitable term

Existing H11 (LEDr) category sheet *(WP.29/2021/145)*

Category H11 — Sheet H11_LEDr/1

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

Figure 1
Main drawings

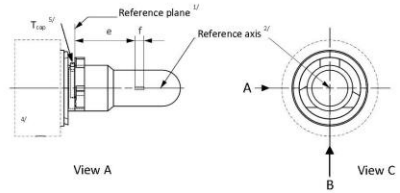
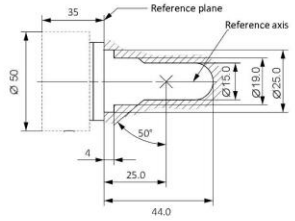


Figure 2
Maximum LED light source outline 3/



1/ The reference plane is the plane formed by the underside of the bevelled lead-in flange of the cap.
2/ The reference axis is perpendicular to the reference plane and passing through the centre of the 19 mm cap diameter.
3/ The LED light source shall not exceed the envelope as indicated in Figure 2.
4/ The light source shall function in either voltage polarity.
5/ Measurement point for cap temperature T_{cap}

Keep

Sheet H11_LEDr/2

ce

nal production
61 (sheet 7004-110-3)
24
27 11/
28.0
27 min. 10/ 62 max. 11/
120 max. 10/
1000 min. 10/ (at 24-28 V DC)
±10% (at 24V) ±10% (at 28V)

5% of the objective luminous

light source shall either still
n or stop emitting light
14 V, shall be less than 100

light source shall either still
n or stop emitting light
28 V, shall be less than 50

ee details in sheet H11

e measured flux at test
the specified voltage range.

outline dimensions in Figure

Keep

Sheet H11_LEDr/3

t emitting area of the LED
ned relative to the reference

gure 4 when operated at test
Dr/1, Figure 1) and from A
270 (as defined in Figure 6).
from the area(s) as defined

15%

t test voltage,
EDr/1, Figure

hese viewing
the contrast
finition of the

Modify

Sheet H11_LEDr/4

Keep

Sheet H11_LEDr/5

stribution of the light source
section of the reference axis
he coordinate system origin.

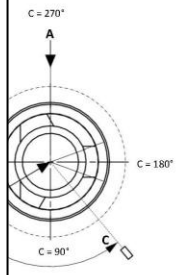
res. The plate is fixed to the
s up with one of the rotating
Figure 6.

easurement distance should
in the far field of the light

rsection coincides with the
es γ are specified in Table 3.

s flux of the individual light
of a 1000 lm light source.

C-Planes and angle γ



View from C

y distributions".

Keep

Sheet H11_LEDr/6

klm)
270

e. in between
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klm)

C_{90} and C_{270})
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Modify

Sheet H11_LEDr/7

of the

klm)

ween C_{150} and
s the relative
two adjacent
he grid points

H11 filament
) there is no

Modify

Category H11 **Sheet H11_LEDr/1**

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

Figure 1
Main drawings

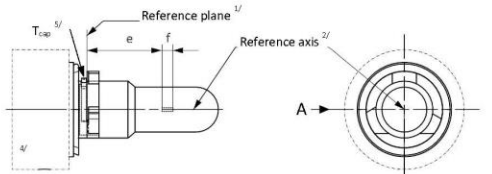
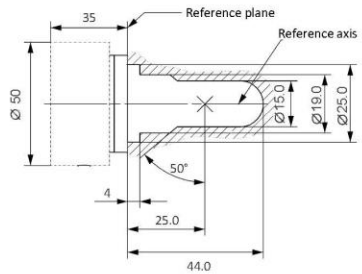


Figure 2
Maximum LED light source outline 3/



1/ The reference plane is the plane formed by the underside of the bevelled lead-in flange of the cap.
2/ The reference axis is perpendicular to the reference plane and passing through the centre of the 19 mm cap diameter.
3/ The LED light source shall not exceed the envelope as indicated in Figure 2.
4/ The light source shall function in either voltage polarity.
5/ Measurement point for cap temperature T_{cap}

Keep “Sheet H11_LEDr/1”

- Main drawing
- Maximum outline

Category H11 **Sheet H11_LEDr/2**

Table 1
Essential electrical and photometrical characteristics of the LED light source

Dimensions in mm			*LED light sources of normal production*	
e [2/]			25.0 nom.	
f [2/]			4.5 nom.	
Contrast [6/]			100 min.	
Elevated ambient air temperature [3/]			60°C	
Cap H11 PGJ19-2 [9/]			in accordance with IEC Publication 60061 (sheet 7004-110-3)	
Electrical and photometric characteristics			[4/]	[5/]
Rated values		Volts	12	24
		Watts	27 [11/]	27 [11/]
Test voltage (DC)		Volts (DC)	13.2	28.0
Objective values	Power [8/]	Watts	27 min. [10/] 62 max. [11/]	27 min. [10/] 62 max. [11/]
	Cap temperature T_{cap}	°C	120 max. [10/]	120 max. [10/]
	Electrical current [8/]	mA	2000 min. [10/] (at 12-14 V DC)	1000 min. [10/] (at 24-28 V DC)
	Luminous flux [1/] [3/]	lm	1,350 ± 10%	
	Luminous flux deviation [7/] (voltage range limits)	lm	±10% (at 12V) ±10% (at 14V)	±10% (at 24V) ±10% (at 28V)

[1/] The light emitted shall be white without a correlated colour temperature restriction.
[2/] To be checked by means of a "box system", sheet H11 LEDr/3
[3/] The luminous flux measured at the elevated ambient air temperature shall be at least 75% of the objective luminous flux (both measured at test voltage)
[4/] In case of a failure of any of the light emitting elements (open circuit failure), the LED light source shall either still comply to the requirements concerning luminous flux and luminous intensity distribution or stop emitting light whereby, in the latter case, the electrical current draw, when operated between 12 V and 14 V, shall be less than 100 mA
[5/] In case of a failure of any of the light emitting elements (open circuit failure), the LED light source shall either still comply to the requirements concerning luminous flux and luminous intensity distribution or stop emitting light whereby, in the latter case, the electrical current draw, when operated between 24 V and 28 V, shall be less than 50 mA
[6/] The contrast is the proportion of luminous flux originating from two different areas, see details in sheet H11 LEDr/3
[7/] The maximum luminous flux deviation at the tolerance limits is calculated by using the measured flux at test voltage as reference. The luminous flux behaviour shall be substantially uniform within the specified voltage range.
[8/] Including AE device, if any
[9/] The maximum specifications of parameters G and K are excluded, but the maximum outline dimensions in Figure 2 apply
[10/] Not applicable for high-efficiency type (if no AE device is specified)
[11/] For high-efficiency type 18W rated value and 21W max. objective value applies

Keep “Sheet H11_LEDr/2”

- Essential electrical and photometrical characteristics
  - Including luminous flux
  - Including contrast
  - Including power
  - Including failure behavior
- Including thermal requirements

Category H11 **Sheet H11_LEDr/3**

Screen projection requirements

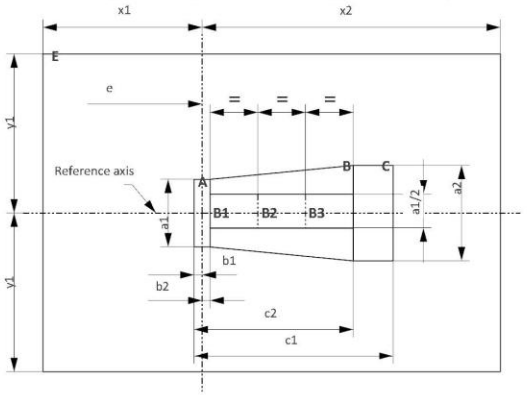
The following test is intended to define the requirements for the apparent light emitting area of the LED light source and to determine whether the light emitting area is correctly positioned relative to the reference axis and reference plane in order to check compliance with the requirements.

The position of the light emitting area is checked by a box system defined in Figure 4 when operated at test voltage, which shows the projections when viewing from B (see sheet H11 LEDr/1, Figure 1) and from A and –A (see sheet H11 LEDr/1, Figure 1), i.e. along the C-planes C_0, C_{90} and C_{270} (as defined in Figure 6).

The proportion of the total luminous flux emitted into these viewing directions from the area(s) as defined in Figure 4:

- Total box area: (A+B+C) / E shall be not less than 90%
- Area A: A / (A+B+C) shall be not more than 10%
- Areas B_1, B_2 and B_3: B_1/B, B_2/B, B_3/B shall each be not less than 15%
- Area B: B / (A+B+C) shall be not less than 72 %
- Area C: C / (A+B+C) shall be not more than 22%

Figure 4
Box definition of the light emitting area (dimensions given in Table 2)



The contrast is checked by a box system defined in Figure 5 when operated at test voltage, which shows the projections when viewing from A and –A (see sheet H11 LEDr/1, Figure 1), i.e. along the C-planes C_{90} and C_{270} (as defined in Figure 6).

The contrast is the proportion of the total luminous flux values emitted into these viewing directions from the corresponding areas (A+B+C) and D. The value of the contrast (A+B+C) / D shall be within the limits given in Table 1 (see Figure 5 for the definition of the area D).

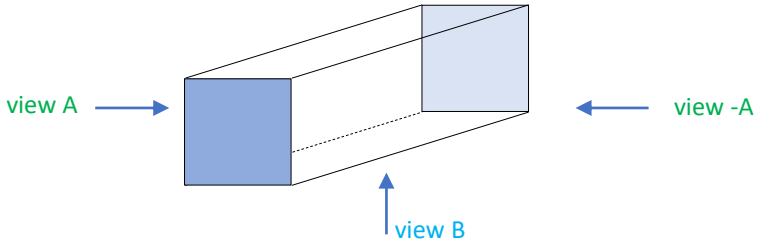
Modify “Sheet H11_LEDr/3”

- Keep box check from view A and –A (main emission directions)
- Keep the contrast requirement

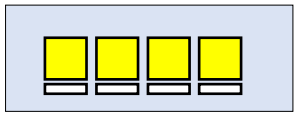
➢ This will ensure same glare level !

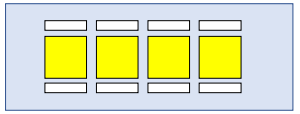
- Take out the box check from view B (secondary emission direction)
- … and replace it by a maximum extension (“thickness”)

➢ This will ensure beam control !

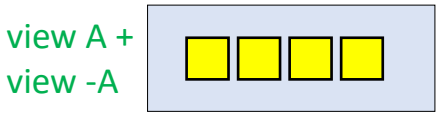


FULL PHOTOMETRIC EQUIVALENCE

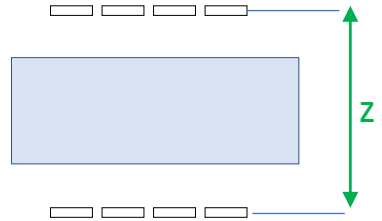




INTELLIGENT EQUIVALENCE



without check from view B there is no control of distance



→ **Need to limit the maximum extension “z”!**

How will the modified sheet _3 look like?

Category H11 **Sheet H11_LEDr/3**

Alternative embodiments

Two alternative specifications are allowed and the technical description given by the manufacturer contains the information which of them applies. The differences between both specifications affect only the "Screen projection requirements" and "Normalized luminous intensity distribution". For reference purposes in the relevant paragraphs, the alternatives are called Embodiment 1 (based on full photometric light source equivalence) and Embodiment 2 (based on "intelligent" equivalence).

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.

In case of Embodiment 1 the position of the light emitting area is checked by a box system defined in Figure 4 when operated at test voltage, which shows the projections when viewing from B (see sheet H11 LEDr/1, Figure 1) and from A and –A (see sheet H11 LEDr/1, Figure 1), i.e. along the C-planes C_0, C_{90} and C_{270} (as defined in Figure 6).

In case of Embodiment 2 the position of the light emitting area is checked by a box system defined in Figure 4 when operated at test voltage, which shows the projections when viewing from A and –A (see sheet H11 LEDr/1, Figure 1), i.e. along the C-planes C_{90} and C_{270} (as defined in Figure 6). The distance z between the surface of the two light emitting areas when viewing from B (see sheet H11 LEDr/1, Figure 1) shall not exceed [2.9 mm].

In both configurations, the proportion of the total luminous flux emitted into these viewing directions from the area(s) as defined in Figure 4:

- Total box area: (A+B+C) / E shall be not less than 90%
- Area A: A / (A+B+C) shall be not more than 10%
- Areas B_1, B_2 and B_3: B_1/B, B_2/B, B_3/B shall each be not less than 15%
- Area B: B / (A+B+C) shall be not less than 72 %
- Area C: C / (A+B+C) shall be not more than 22%

Proposal:
To add text in highlight

Figure 5
Box definition of the area D (dimensions given in Table 2)

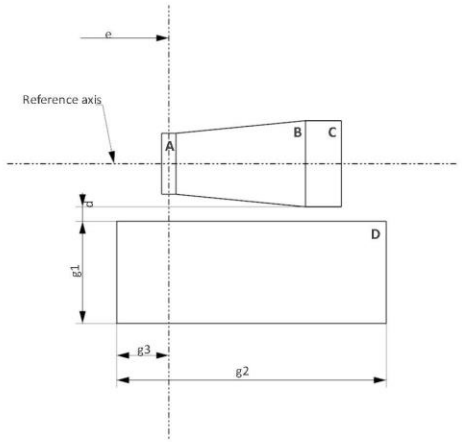


Table 2
Dimensions of the box definitions in Figure 4 and Figure 5

All views (as specified above)	*Dimensions in mm*	*All views (as specified above)*	*Dimensions in mm*
a1	1.7	x1	25
a2	1.9	x2	19
b1	0.2	y1	12.5
b2	0.2	g1	2.85
c1	5.0	g2	7.5
c2	4.0	g3	1.45
d	0.4		

Keep “Sheet H11_LEDr/4”

- Including box dimensions

Category H11 **Sheet H11_LEDr/5**

Normalized luminous intensity distribution

The following test is intended to determine the normalized luminous intensity distribution of the light source in the C-planes as described in Figure 6 when operated at test voltage. The intersection of the reference axis and the plane parallel to the reference plane at distance e = 25.0 mm is used as the coordinate system origin.

The light source is mounted on a flat plate with the corresponding holder features. The plate is fixed 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 6.

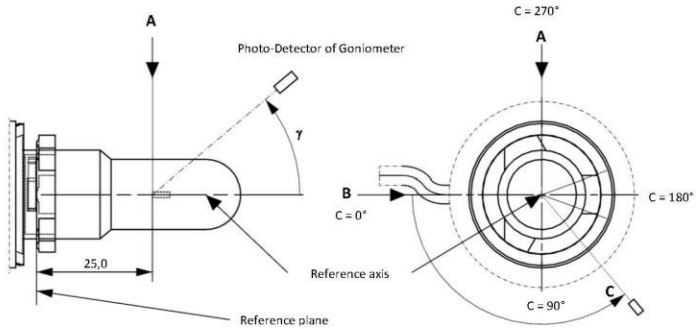
Luminous intensity data is recorded with a standard photo-goniometer. The measurement distance should be chosen appropriately in order to make sure that the detector is located in the far field of the light distribution.

The measurements shall be performed in C-planes for which the line of intersection coincides with the reference axis of the light source. The test points for each plane and polar angles γ are specified in Table 3.

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 1000 lm light source. These data shall comply with the limits as defined in Table 3.

Figure 6

Setup to measure the luminous intensity distribution and the definition of C-Planes and angle γ



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

Keep “Sheet H11_LEDr/5”

- Including test set-up

Table 3 – Part 1
Test point values of normalized intensity (Black top area)

LED light source of normal production		
	Minimum intensity (cd/klm)	*Maximum intensity (cd/klm)*
γ	C_0, C_{90}, C_{180}, C_{270}	C_0, C_{90}, C_{180}, C_{270}
0°	n/a	10
10°	n/a	10
20°	n/a	10
30°	n/a	10

The light pattern as described in Table 3 – part 1 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 3 – part 1.

Note: The angular range in Table 3 – Part 1 is equivalent to the black top of its counterpart H11 filament light source specified by γ_2 in sheet H11/3.

Table 3 – Part 2
Test point values of normalized intensity (Distortion free area)

	LED light source of normal production	
	Minimum intensity (cd/klm)	*Maximum intensity (cd/klm)*
γ	C_0, C_{90}, C_{270}	C_0, C_{90}, C_{270}
50°	80	130
60°	80	130
70°	80	130
80°	80	130
90°	80	130
100°	80	130
110°	80	130
120°	80	130
130°	80	130
140°	80	130

The light pattern as described in Table 3 – part 2 (excluding the section between C_{90} and C_{270}) 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 3 – part 2.

Note: The angular range in Table 3 – Part 2 is equivalent to the distortion free area of its counterpart H11 filament light source specified by γ_2 and γ_1 in sheet H11/3.

Modify “Sheet H11_LEDr/6”

- Keep Part 1 of Table 3 unchanged (“black top area”)
- For Part 2 of Table 3 (“distortion free area”)
  - Take out evaluation in C0 plane (= view B)
  - Increase maximum intensity from 130 to [190] cd/klm

Note:

- Derived from filament variations the limits had been set to 80 – 130 cd/klm
- Perfect 2-sided LED arrangements correspond to 159 cd/klm (= 130 + 22.4%);
  → including production tolerances, a limit of 190 cd/klm is appropriate

Table 3 – Part 3
Test point values of normalized intensity (Shading area of the lead-in wire of the counterpart filament light source)

	LED light source of normal production	
	Minimum intensity (cd/klm)	*Maximum intensity (cd/klm)*
C-plane	$\gamma = 90°$	$\gamma = 90°$
C_0	80	130
C_{30}	80	130
C_{60}	80	130
C_{90}	80	130
C_{120}	80	130
C_{150}	80	130
C_{180}	n/a	n/a
C_{210}	80	130
C_{240}	80	130
C_{270}	80	130
C_{300}	80	130
C_{330}	80	130
C_{360} (= C_0)	80	130

The light pattern as described in Table 3 – part 3 (excluding the section between C_{150} and C_{210}) 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 3 – part 3.

Note: Due to the shading area created by the lead-in wire of its counterpart H11 filament light source (opposite to the metal-free zone; see Figure 4 on sheet H11/2) there is no requirement in the C_{180}-plane."

Modify “Sheet H11_LEDr/7”

- For Part 3 of Table 3
  - Take out evaluation in C0 plane (= view B)
  - Modify minimum and maximum intensity limits

Note:

- Derived from filament variations the limits had been set to 80 – 130 cd/klm
- Perfect 2-sided LED arrangements correspond to 159 cd/klm * cos α,
  → production tolerances need to be added appropriately

How will the modified sheets _6/_7 look like?

Table 3 – Part 2
Test point values of normalized intensity (Distortion free area)

	LED light source of normal production			
	Minimum intensity (cd/klm)		*Maximum intensity (cd/klm)*	
	Embodiment 1	Embodiment 2	Embodiment 1	Embodiment 2
γ	C_0, C_{90}, C_{270}	C_{90}, C_{270}	C_0, C_{90}, C_{270}	C_{90}, C_{270}
50°	80	[95]	130	[150]
60°	80	[110]	130	[165]
70°	80	[120]	130	[180]
80°	80	[125]	130	[190]
90°	80	[125]	130	[190]
100°	80	[125]	130	[190]
110°	80	[120]	130	[180]
120°	80	[110]	130	[165]
130°	80	[95]	130	[150]
140°	80	[80]	130	[125]

Proposal:
To add specification in highlight

Table 3 – Part 3
Test point values of normalized intensity (Shading area of the lead-in wire of the counterpart filament light source)

	LED light source of normal production			
	Minimum intensity (cd/klm)		*Maximum intensity (cd/klm)*	
	γ = 90°			γ = 90°
C-plane	Embodiment 1	Embodiment 2	Embodiment 1	Embodiment 2
C_0	80	n.a.	130	n.a.
C_{30}	80	[60]	130	[100]
C_{60}	80	[110]	130	[165]
C_{90}	80	[125]	130	[190]
C_{120}	80	[110]	130	[165]
C_{150}	80	[60]	130	[100]
C_{180}	n/a	n.a.	n/a	n.a.
C_{210}	80	[60]	130	[100]
C_{240}	80	[110]	130	[165]
C_{270}	80	[125]	130	[190]
C_{300}	80	[110]	130	[165]
C_{330}	80	[60]	130	[100]
C_{360} (= C_0)	80	n.a.	130	n.a.

The light pattern as described in Table 3 – part 3 (excluding the section between C_{150} and C_{210} and for Embodiment 2 also the section between C_{330} and C_{30}) 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 3 – part 3.