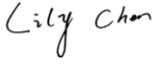




Test Report issued under the responsibility of:



TEST REPORT IEC TR 62778 Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires	
Report Number.....	4791427962_1
Date of issue	2024-08-20
Total number of pages	32 including attachments
Name of Testing Laboratory preparing the Report	UL-CCIC Company Limited
Applicant's name	Lumileds (Shanghai) Management Co., Ltd.
Address.....	Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China
Test specification:	
Standard	IEC TR 62778:2014 (Second Edition)
Test procedure.....	CB Scheme
Non-standard test method	N/A
Test Report Form No.	IEC62778A
Test Report Form(s) Originator	TÜV SÜD Product Service GmbH
Master TRF	Dated 2016-02
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General disclaimer:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.	

Test item description	Built-in LED Package	
Trade Mark		
Manufacturer	Same as Applicant	
Model/Type reference	L150-6570500600HH0, L150-4070500600HH0, L150-aabb5006xxHHy (see GPI for type designation)	
Ratings	Imax 1200 mA === Vmax 6,6 V (see GPI for further ratings)	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	CB Testing Laboratory:	UL-CCIC Company Limited
	Testing location/ address	No.2, Chengwan Road, Suzhou Industrial Park Suzhou 215122, China
<input type="checkbox"/>	Associated Testing Laboratory:	
	Testing location/ address	
	Tested by (name, function, signature)	Chris Yi Project handler 
	Approved by (name, function, signature) ...	Lily Chen Reviewer 
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
	Testing location/ address	
	Tested by (name, function, signature)	
	Approved by (name, function, signature) ...	
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
	Testing location/ address	
	Tested by (name + signature)	
	Witnessed by (name, function, signature) . :	
	Approved by (name, function, signature) ...	
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
	Testing location/ address	
	Tested by (name, function, signature)	
	Witnessed by (name, function, signature) . :	
	Approved by (name, function, signature) ...	
	Supervised by (name, function, signature) :	

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Note: Due to the limited amount of Built-in LED Package surface, the required markings and ratings may be provided on the smallest package.

Test item particulars: -	
Product evaluated:	<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire
Rated voltage (V)	see GPI for further ratings
Rated current (mA)	see GPI for further ratings
Rated CCT (K)	see GPI for further ratings
Rated Luminance (Mcd/m²)	-
Component report data used	<input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp Report number:
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing:	
Date of receipt of test item	2024-08-05
Date (s) of performance of tests	2024-08-13
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62778:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)	Lumileds (Shanghai) Management Co., Ltd. Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China

General product information:

The product under test is a Built-in LED package for lighting applications (indoor and outdoor use).

L150-6570500600HH0, with ANSI bin 6500K, is part of Lumileds LUXEON 5050 HE Plus product line. The tested sample of L150-6570500600HH0 is with the highest CCT in that product line. The present classification is thus valid (worst case) within the LUXEON 5050 HE Plus product line with part number L150-aabb5006xxHHy, where aa represents nominal ANSI CCT bins can be equal to 6500K or lower (see TR IEC62778), and bb represents CRI ranging from 70 and above, and xx and y represents Lumileds internal code. See the appendix below for an explanation of the type designation.

Type: L150-aabb5006xxHHy

where

aa - designates nominal ANSI CCT (18=1800K, 22=2200K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K)

bb - designates minimum CRI (70=70CRI, 80=80CRI, 90=90CRI)

xx - reserved for internal code, could be any alphanumeric characters from 0 to 9 and A to Z.

y - reserved for internal code, could be any alphanumeric characters from 0 to 9 and A to Z.

Model/ type	Drive current (mA)	CCT								
		1800K	2200K	2700K	3000K	3500K	4000K	5000K	5700K	6500K
L150- aabb5 006xx HHy	300	RG1								
	430	RG1	RG1	RG1	RG1	RG1	RG1	RG2	RG2	RG2
	1200	RG2								

Note: this table is provided by the manufacturer.

Models used for the tests:

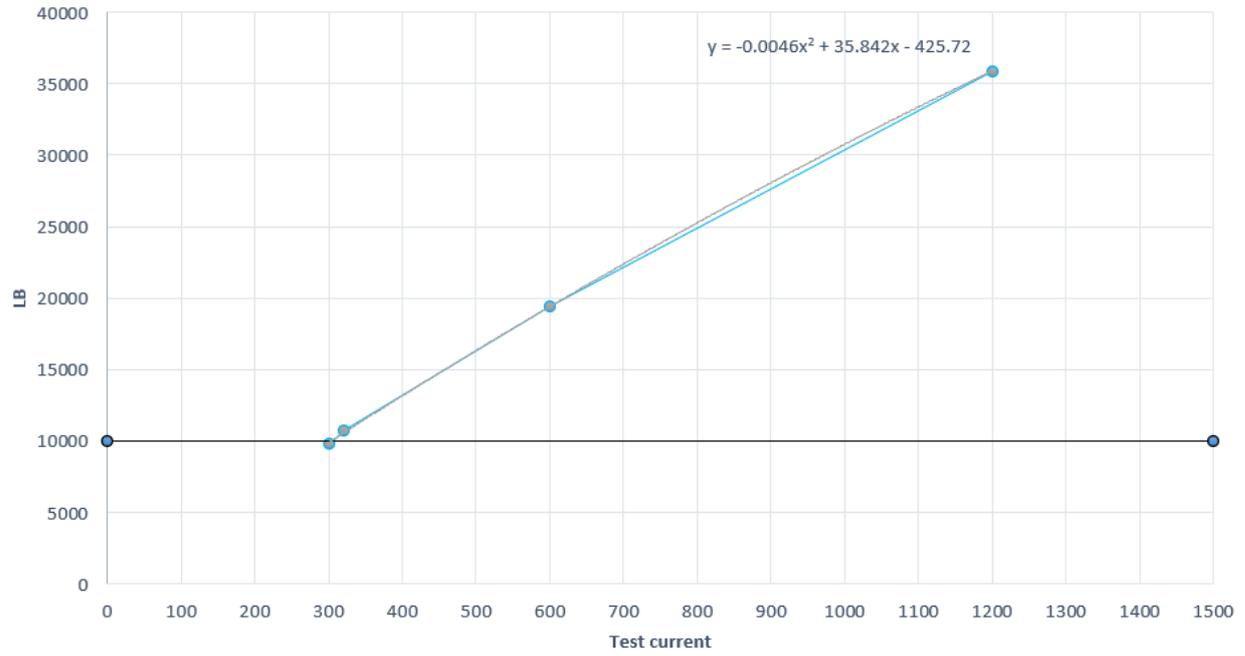
Model	Maximum ratings and characteristics	Risk Group Classification	
L150-6570500600HH0	Vmax 6,6V, Imax 1200mA CRI 70, CCT 6500K	For 1200mA	Risk Group 2 Ethr = 1007 lx
		For 300mA	Risk Group 1 Unlimited
L150-4070500600HH0	Vmax 6,6V, Imax 1200mA CRI 70, CCT 4000K	For 430mA	Risk Group 1 Unlimited

NOTE:

1. The Radiance measure was carried out at the distance of 200 mm from detector, in the direction of maximum light output, in place in order to determinate (according to IEC TR 62778) the highest LB value of the product.
2. The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.
3. Install the sample into the holder, with the back close to the heat sink for testing.

IEC TR 62778			
Clause	Requirement + Test	Result - Remark	Verdict
7	MEASUREMENT INFORMATION FLOW		P
7.1	Basic flow		P
	'Law of conservation of luminance' applied		P
	Use of only true luminance/radiance values		P
	In case of luminaire: The light source is operated in the luminaire under similar conditions as when tested as a component		N/A
	In case E_{thr} value for RG2 was established the peak value was derived from angular light distribution		P
7.2	Conditions for the radiance measurement		P
	Standard condition applied (200mm distance, 0,011rad field of view)	200mm	P
	Non-standard condition applied		N/A
7.3	Special cases (I): Replacement by a lamp or LED module of another type		N/A
	Light source is a white light source		N/A
	Evaluation done based on highest luminance		N/A
	Evaluation done based on CCT value		N/A
7.4	Special cases (II): Arrays and clusters of primary light sources		N/A
	LED package is evaluated as	<input type="checkbox"/> RG0 unlimited <input type="checkbox"/> RG1 unlimited	N/A
	E_{thr} of LED package applies to array		N/A
8	RISK GROUP CLASSIFICATION		P
	Risk group achieved:		P
	- ..Risk Group 0 unlimited		N/A
	- ..Risk Group 1 unlimited		N/A
	- E_{thr} (lx) : Distance to reach RG1 (m) :	See detail measurements in Table: Spectroradiometric measurement	P

TABLE: Spectroradiometric measurement				P
Measurement performed on:		<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire		
Model number.....		L150-6570500600HH0		
Test voltage (V)		6,8231VDC		—
Test current (mA)		1200 mA		—
Test frequency (Hz).....		-		—
Ambient, t (°C)		24,5°C		—
Measurement distance.....		<input checked="" type="checkbox"/> 20 cm <input type="checkbox"/> ... cm		—
Source size		<input checked="" type="checkbox"/> Non-small <input type="checkbox"/> Small : mm		—
Field of view		<input type="checkbox"/> 100 mrad <input checked="" type="checkbox"/> 11 mrad <input type="checkbox"/> 1,7 mrad (for small sources)		—
Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	6500	Rated
x/y colour coordinates	-	-	x=0,3160, y=0,3373	For reference only
Blue light hazard radiance	L _B	W/(m ² •sr ¹)	3,590e+004	-
Blue light hazard irradiance	E _B	W/m ²	-	-
Luminance	L	cd/m ²	3,614e+007	-
Illuminance	E	lx	-	-
Distance	dmin	mm	635	-
Risk Group Classification: Risk Group 2 for 1200mA, E_{thr} = 1007 lx Risk Group 1 Unlimited for 300 mA				



Product ID	Rated CCT	Test currents (mA) / LB(W/m²)			
		300 mA	320 mA	600 mA	1200 mA
L150-6570500600HH0	6500	9743	10750	19390	35900

TABLE: Spectroradiometric measurement				P
Measurement performed on:		<input checked="" type="checkbox"/> LED package <input type="checkbox"/> LED module <input type="checkbox"/> Lamp <input type="checkbox"/> Luminaire		
Model number.....		L150-4070500600HH0		
Test voltage (V)		5,984VDC		—
Test current (mA)		430 mA		—
Test frequency (Hz).....		-		—
Ambient, t (°C)		24,5 °C		—
Measurement distance.....		<input checked="" type="checkbox"/> 20 cm <input type="checkbox"/> ... cm		—
Source size		<input checked="" type="checkbox"/> Non-small <input type="checkbox"/> Small : mm		—
Field of view		<input type="checkbox"/> 100 mrad <input checked="" type="checkbox"/> 11 mrad <input type="checkbox"/> 1,7 mrad (for small sources)		—
Item	Symbol	Units	Result	Remark
Correlated colour temperature	CCT	K	4000	Rated
x/y colour coordinates	-	-	x=0,3831, y=0,3821	For reference only
Blue light hazard radiance	L _B	W/(m ² •sr ¹)	9,982e+003	-
Blue light hazard irradiance	E _B	W/m ²	-	-
Luminance	L	cd/m ²	1,342e+007	-
Illuminance	E	lx	-	-
Risk Group Classification: Risk Group 1 Unlimited for 430 mA				

	TABLE: Angular light distribution	N/A
-		

	Attachment No. 1: Components List	
--	--	--

Object / part No.	Manufacturer/ trademark	Type / model	Technical data
LED Chip	Lumileds	L150-6570500600HH0	Vmax 6,6V, Imax 1200mA CRI 70, CCT 6500K
LED Chip	Lumileds	L150-4070500600HH0	Vmax 6,6V, Imax 1200mA CRI 70, CCT 4000K

Attachment No. 2: Photographs

Photograph No. . – Front view of the model L150-6570500600HH0

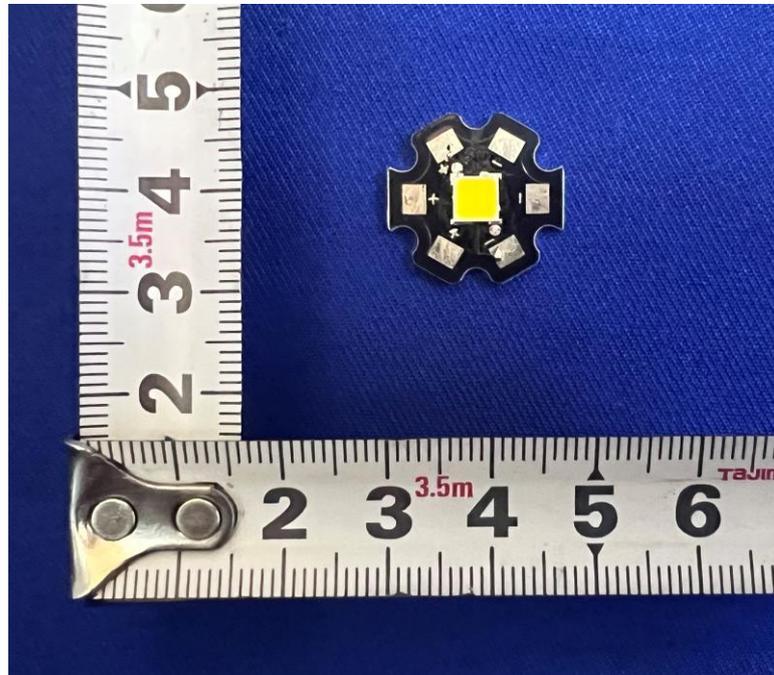


Photograph No. 2 – Rear view of the model L150-6570500600HH0

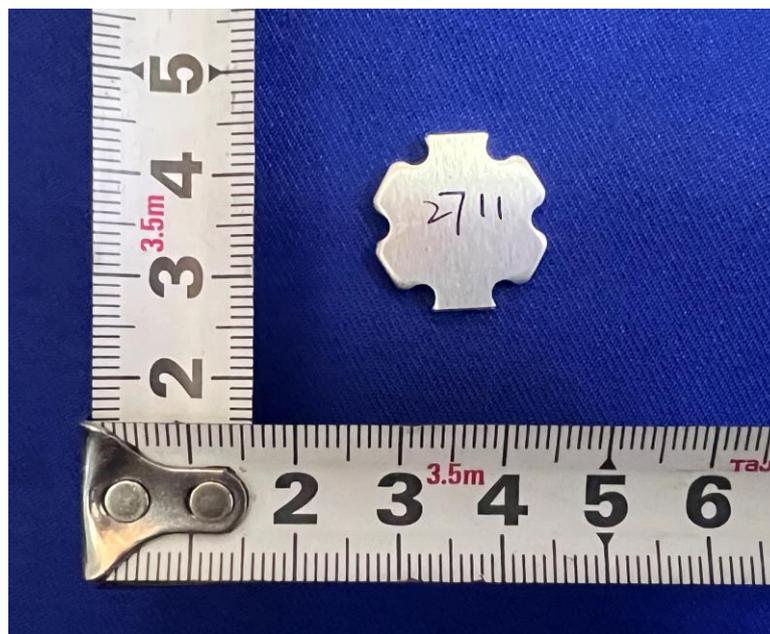


Attachment No. 2: Photographs

Photograph No. 3– Front view of the model L150-4070500600HH0



Photograph No. 4 – Rear view of the model L150-4070500600HH0



Attachment No. 3

Attachment No.3

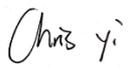
Technical reference for IEC 62471:2006
(Total 18 pages including this cover page)

Attachment No. 3

Test Report issued under the responsibility of:



TEST REPORT IEC 62471 Photobiological safety of lamps and lamp systems	
Report Reference No.	4791427962_1
Date of issue	2024-08-20
Total number of pages	17
Name of Testing Laboratory preparing the Report	UL-CCIC Company Limited
Applicant's name	Lumileds (Shanghai) Management Co., Ltd.
Address	Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China
Test specification:	
Standard	IEC 62471:2006
Test procedure	Informative Report
Non-standard test method	N/A
Test Report Form No.	IEC62471B
TRF Originator	VDE Testing and Certification Institute
Master TRF	Dated 2018-08-16
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This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.	
General disclaimer:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.	

Test item description	Built-in LED Package	
Trade Mark		
Manufacturer	Same as Applicant	
Model/Type reference	L150-6570500600HH0, L150-4070500600HH0, L150-aabb5006xxHHy (see GPI for type designation)	
Ratings	I _{max} 1200 mA \equiv V _{max} 6,6 V (see GPI for further ratings)	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	Testing Laboratory:	UL-CCIC Company Limited
	Testing location/ address	No.2, Chengwan Road, Suzhou Industrial Park Suzhou 215122, China
	Tested by (name, function, signature)	Chris Yi Project handler 
	Approved by (name, function, signature) ..	Lily Chen Reviewer 
<input type="checkbox"/>	Testing procedure: CTF Stage 1:	
	Testing location/ address	
	Tested by (name, function, signature)	
	Approved by (name, function, signature) ..	
<input type="checkbox"/>	Testing procedure: CTF Stage 2:	
	Testing location/ address	
	Tested by (name + signature)	
	Witnessed by (name, function, signature) ..	
	Approved by (name, function, signature) ..	
<input type="checkbox"/>	Testing procedure: CTF Stage 3:	
<input type="checkbox"/>	Testing procedure: CTF Stage 4:	
	Testing location/ address	
	Tested by (name, function, signature)	
	Witnessed by (name, function, signature) ..	
	Approved by (name, function, signature) ..	
	Supervised by (name, function, signature) :	

Attachment No. 3

<p>List of Attachments (including a total number of pages in each attachment):</p> <ul style="list-style-type: none"> • Photographs – See Attachment No.2 in test report No. 4791427962_1 of IEC62778A 	
<p>Summary of testing:</p>	
<p>Tests performed (name of test and test clause):</p> <p>Clause 5.2.1 and Clause 5.2.2 in IEC 62471:2006 (First Edition)</p> <p>The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.</p>	<p>Testing location:</p> <p>UL-CCIC Company Limited No.2 Chengwan Road, Suzhou Industrial Park Suzhou 215122, China</p>
<p>Summary of compliance with National Differences (List of countries addressed):</p> <p>N/A</p>	

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Note: Due to the limited amount of Built-in LED Package surface, the required markings and ratings may be provided on the smallest package

Attachment No. 3

Test item particulars	
Tested lamp	<input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps
Tested lamp system	N/A
Lamp classification group	<input type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input checked="" type="checkbox"/> risk 2 <input type="checkbox"/> risk 3
Lamp cap	N/A
Bulb	N/A
Rated of the lamp	see GPI for further ratings
Furthermore marking on the lamp	N/A
Seasoning of lamps according IEC standard	N/A
Used measurement instrument	OST-500
Temperature by measurement	24,5 °C
Information for safety use	N/A
Possible test case verdicts:	
– test case does not apply to the test object	N/A
– test object does meet the requirement	P (Pass)
– test object does not meet the requirement	F (Fail)
Testing:	
Date of receipt of test item	2024-08-05
Date (s) of performance of tests	2024-08-13
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC60730-2:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)..... : Lumileds (Shanghai) Management Co., Ltd. Building 1-A, No. 19 & 20, Lane 299, Wenshui Road, Jingan District, Shanghai, 200072, China	

General product information:

The product under test is a Built-in LED package for lighting applications (indoor and outdoor use).

L150-6570500600HH0, with ANSI bin 6500K, is part of Lumileds LUXEON 5050 HE Plus product line. The tested sample of L150-6570500600HH0 is with the highest CCT in that product line. The present classification is thus valid (worst case) within the LUXEON 5050 HE Plus product line with part number L150-6570500600HH0, where aa represents nominal ANSI CCT bins can be equal to 6500K or lower (see TR IEC62778), and bb represents CRI ranging from 70 and above, and xx and y represents Lumileds internal code. See the appendix below for an explanation of the type designation.

Type: L150-aabb5006xxHHy

where

aa - designates nominal ANSI CCT (18=1800K, 22=2200K, 27=2700K, 30=3000K, 35=3500K, 40=4000K, 50=5000K, 57=5700K, 65=6500K)

bb - designates minimum CRI (70=70CRI, 80=80CRI, 90=90CRI)

xx - reserved for internal code, could be any alphanumeric characters from 0 to 9 and A to Z.

y - reserved for internal code, could be any alphanumeric characters from 0 to 9 and A to Z.

Model/ type	Drive current (mA)	CCT								
		1800K	2200K	2700K	3000K	3500K	4000K	5000K	5700K	6500K
L150- aabb5 006xx HHy	300	RG1								
	430	RG1	RG1	RG1	RG1	RG1	RG1	RG2	RG2	RG2
	1200	RG2								

Note: this table is provided by the manufacturer.

Models used for the tests:

Model	Maximum ratings and characteristics	Risk Group Classification	
L150-6570500600HH0	Vmax 6,6V, Imax 1200mA CRI 70, CCT 6500K	For 1200mA	Risk Group 2
		For 300mA	Risk Group 1
L150-4070500600HH0	Vmax 6,6V, Imax 1200mA CRI 70, CCT 4000K	For 430mA	Risk Group 1

NOTE:

1. The measure was carried out at the distance of 200mm, in the direction of maximum light output according to IEC 62471.
2. When the optical characteristic of the LED or any optical components are changed, re-measurement or further consideration should be necessary.
3. The accuracy method decision rule is applied when the compliance or verdict is made to the results of this report.
4. Install the sample into the holder, with the back close to the heat sink for testing.

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4	EXPOSURE LIMITS		P
4.1	General		P
	The exposure limits in this standard is not less than 0,01 ms and not more than any 8-hour period and should be used as guides in the control of exposure		P
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds $10^4 \text{ cd}\cdot\text{m}^{-2}$	see clause 4.3	P
4.3	Hazard exposure limits		P
4.3.1	Actinic UV hazard exposure limit for the skin and eye		P
	The exposure limit for effective radiant exposure is $30 \text{ J}\cdot\text{m}^{-2}$ within any 8-hour period		P
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broadband source, the effective integrated spectral irradiance, E_s , of the light source shall not exceed the levels defined by:		P
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		P
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$		P
4.3.2	Near-UV hazard exposure limit for eye		P
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed $10000 \text{ J}\cdot\text{m}^{-2}$ for exposure times less than 1000 s. For exposure times greater than 1000 s (approximately 16 minutes) the UV-A irradiance for the unprotected eye, E_{UVA} , shall not exceed $10 \text{ W}\cdot\text{m}^{-2}$.		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by:		N/A
	$t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$		N/A
4.3.3	Retinal blue light hazard exposure limit		P
	To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, $B(\lambda)$, i.e., the blue-light weighted radiance, L_B , shall not exceed the levels defined by:		P
	$L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$	$t_{\max} = \frac{10^6}{L_B}$
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta \lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4 \text{ s}$	N/A
4.3.4	Retinal blue light hazard exposure limit - small source		N/A
	Thus the spectral irradiance at the eye E_λ , weighted against the blue-light hazard function $B(\lambda)$ shall not exceed the levels defined by:	see table 4.2	N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$	for $t \leq 100$ s	N/A
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100$ s	N/A
4.3.5	Retinal thermal hazard exposure limit		P
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_λ , weighted by the burn hazard weighting function $R(\lambda)$ (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		P
	$L_{IR} = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0.25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	($10 \mu\text{s} \leq t \leq 10$ s)	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		N/A
	For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, L_{IR} , as viewed by the eye for exposure times greater than 10 s shall be limited to:		N/A
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10$ s	N/A
4.3.7	Infrared radiation hazard exposure limits for the eye		P
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, E_{IR} , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0.75} \quad \text{W} \cdot \text{m}^{-2}$	$t \leq 1000$ s	N/A
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2}$	$t > 1000$ s	P
4.3.8	Thermal hazard exposure limit for the skin		N/A
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		N/A
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_\lambda(\lambda, t) \cdot \Delta\lambda \leq 20\,000 \cdot t^{0.25} \quad \text{J} \cdot \text{m}^{-2}$		N/A
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		P
5.1	Measurement conditions		P
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		P
5.1.1	Lamp ageing (seasoning)	LED source	N/A
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		N/A
5.1.2	Test environment		P
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		P
5.1.3	Extraneous radiation		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		P
5.1.4	Lamp operation		P
	Operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer' s recommendation		P
5.1.5	Lamp system operation		N/A
	The power source for operation of the test lamp shall be provided in accordance with:		N/A
	– the appropriate IEC standard, or		N/A
	– the manufacturer' s recommendation		N/A
5.2	Measurement procedure		P
5.2.1	Irradiance measurements		P
	Minimum aperture diameter 7mm.		P
	Maximum aperture diameter 50 mm.		P
	The measurement shall be made in that position of the beam giving the maximum reading.		P
	The measurement instrument is adequate calibrated.		P
5.2.2	Radiance measurements		P
5.2.2.1	Standard method		P
	The measurements made with an optical system.		P
	The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument.		P
5.2.2.2	Alternative method		N/A
	Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements.		N/A
5.2.3	Measurement of source size		P
	The determination of α , the angle subtended by a source, requires the determination of the 50% emission points of the source.	For model: L150-6570500600HH0 Angular subtense = 0,011rad For model: L150-4070500600HH0 Angular subtense = 0,011rad	P
5.2.4	Pulse width measurement for pulsed sources		N/A
	The determination of Δt , the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.		N/A
5.3	Analysis methods		P
5.3.1	Weighting curve interpolations		P
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.	see table 4.1	P
5.3.2	Calculations		P
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	weighted energy.		
5.3.3	Measurement uncertainty		P
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	The measurement uncertainties stated in this Test Report are estimated according to the Quality Procedure 00-LC-S0278.	P
6	LAMP CLASSIFICATION		P
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	P
	– for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm		N/A
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm	200 mm	P
6.1	Continuous wave lamps		P
6.1.1	Except Group		N/A
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		N/A
	– an actinic ultraviolet hazard (E_S) within 8-hours exposure (30000 s), nor		N/A
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor		N/A
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor		N/A
	– a retinal thermal hazard (L_R) within 10 s, nor		N/A
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s		N/A
6.1.2	Risk Group 1 (Low-Risk)		P
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		P
	– an actinic ultraviolet hazard (E_S) within 10000 s, nor		N/A
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor		N/A
	– a retinal blue-light hazard (L_B) within 100 s, nor	For model L150-4070500600HH0	P
	– a retinal thermal hazard (L_R) within 10 s, nor		N/A
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 100 s are in Risk Group 1.		N/A
6.1.3	Risk Group 2 (Moderate-Risk)		P
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		P
	– an actinic ultraviolet hazard (E_S) within 1000 s		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	exposure, nor		
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		N/A
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		P
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		N/A
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 10 s are in Risk Group 2.		N/A
6.1.4	Risk Group 3 (High-Risk)		N/A
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N/A
6.2	Pulsed lamps		N/A
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.		N/A
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		N/A
	The risk group determination of the lamp being tested shall be made as follows:		N/A
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		N/A
	– for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group		N/A
	– for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.1 Spectral weighting function for assessing ultraviolet hazards for skin and eye			P
Wavelength ¹ λ , nm	UV hazard function $S_{uv}(\lambda)$	Wavelength λ , nm	UV hazard function $S_{uv}(\lambda)$
200	0,030	313*	0,006
205	0,051	315	0,003
210	0,075	316	0,0024
215	0,095	317	0,0020
220	0,120	318	0,0016
225	0,150	319	0,0012
230	0,190	320	0,0010
235	0,240	322	0,00067
240	0,300	323	0,00054
245	0,360	325	0,00050
250	0,430	328	0,00044
254*	0,500	330	0,00041
255	0,520	333*	0,00037
260	0,650	335	0,00034
265	0,810	340	0,00028
270	1,000	345	0,00024
275	0,960	350	0,00020
280*	0,880	355	0,00016
285	0,770	360	0,00013
290	0,640	365*	0,00011
295	0,540	370	0,000093
297*	0,460	375	0,000077
300	0,300	380	0,000064
303*	0,120	385	0,000053
305	0,060	390	0,000044
308	0,026	395	0,000036
310	0,015	400	0,000030

¹ Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.
* Emission lines of a mercury discharge spectrum.

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources		P
Wavelength nm	Blue-light hazard function B (λ)	Burn hazard function R (λ)	
300	0,01		
305	0,01		
310	0,01		
315	0,01		
320	0,01		
325	0,01		
330	0,01		
335	0,01		
340	0,01		
345	0,01		
350	0,01		
355	0,01		
360	0,01		
365	0,01		
370	0,01		
375	0,01		
380	0,01	0,1	
385	0,013	0,13	
390	0,025	0,25	
395	0,05	0,5	
400	0,10	1,0	
405	0,20	2,0	
410	0,40	4,0	
415	0,80	8,0	
420	0,90	9,0	
425	0,95	9,5	
430	0,98	9,8	
435	1,00	10,0	
440	1,00	10,0	
445	0,97	9,7	
450	0,94	9,4	
455	0,90	9,0	
460	0,80	8,0	
465	0,70	7,0	
470	0,62	6,2	
475	0,55	5,5	
480	0,45	4,5	
485	0,40	4,0	
490	0,22	2,2	
495	0,16	1,6	
500-600	$10^{[(450-\lambda)/50]}$	1,0	
600-700	0,001	1,0	
700-1050		$10^{[(700-\lambda)/500]}$	
1050-1150		0,2	
1150-1200		$0,2 \cdot 10^{0,02(1150-\lambda)}$	
1200-1400		0,02	

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 5.4 Summary of the ELs for the surface of the skin or cornea (irradiance based values)					P
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Limiting aperture rad (deg)	EL in terms of constant irradiance $W \cdot m^{-2}$
Actinic UV skin & eye	$E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200 – 400	< 30000	1,4 (80)	30/t
Eye UV-A	$E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$	315 – 400	≤ 1000 > 1000	1,4 (80)	10000/t 10
Blue-light small source	$E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	≤ 100 > 100	< 0,011	100/t 1,0
Eye IR	$E_{IR} = \sum E_\lambda \cdot \Delta\lambda$	780 – 3000	≤ 1000 > 1000	1,4 (80)	18000/t ^{0,75} 100
Skin thermal	$E_H = \sum E_\lambda \cdot \Delta\lambda$	380 – 3000	< 10	2π sr	20000/t ^{0,75}

Table 5.5 Summary of the ELs for the retina (radiance based values)					P
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Field of view radians	EL in terms of constant radiance $W \cdot m^{-2} \cdot sr^{-1}$
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	0,25 – 10 10-100 100-10000 ≥ 10000	$0,011 \cdot \sqrt{(t/10)}$ 0,011 $0,0011 \cdot \sqrt{t}$ 0,1	$10^6/t$ $10^6/t$ $10^6/t$ 100
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25 0,25 – 10	0,0017 $0,011 \cdot \sqrt{(t/10)}$	$50000/(\alpha \cdot t^{0,25})$ $50000/(\alpha \cdot t^{0,25})$
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	6000/α

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1 Emission limits for risk groups of continuous wave lamps(model: L150-6570500600HH0)									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	3,57e-03	0.003	-	0.03	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	2,69e-03	33	-	100	-
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	-	10000	3,590e+04	4000000	-
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	-	1,0	-	400	-
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	2,40e+05	28000/ α	-	28000/ α	-
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	6000/ α	-	6000/ α	-	6000/ α	-
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	3,21e-01	570	-	3200	-

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

Risk Group 2 for 1200 mA
Input Voltage: 6,8231VDC, Input Current: 1200mA, Power: 8,1911W, Alpha = 0,011rad

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1 Emission limits for risk groups of continuous wave lamps(model: L150-6570500600HH0)									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	1,91e-04	0.003	-	0.03	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	3,08e-04	33	-	100	-
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	-	10000	9,84e+03	4000000	-
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	-	1,0	-	400	-
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	1,20e+05	28000/ α	-	28000/ α	-
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	6000/ α	-	6000/ α	-	6000/ α	-
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	2,98e-01	570	-	3200	-

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

Risk Group 1 for 300mA
Input Voltage: 5,6152VDC, Input Current: 300mA, Power: 1,6856W, Alpha = 0,011rad

IEC 62471

Clause	Requirement + Test	Result – Remark	Verdict
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Table 6.1 Emission limits for risk groups of continuous wave lamps(model: L150-4070500600HH0)									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_s	$W \cdot m^{-2}$	0,001	4,30e-03	0.003	-	0.03	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	1,67e-03	33	-	100	-
Blue light	$B(\lambda)$	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	-	10000	9,982e+03	4000000	-
Blue light, small source	$B(\lambda)$	E_B	$W \cdot m^{-2}$	1,0*	-	1,0	-	400	-
Retinal thermal	$R(\lambda)$	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/ α	1,39e+05	28000/ α	-	28000/ α	-
Retinal thermal, weak visual stimulus**	$R(\lambda)$	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	6000/ α	-	6000/ α	-	6000/ α	-
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	3,09e-01	570	-	3200	-

* Small source defined as one with $\alpha < 0,011$ radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

Risk Group 1 for 430 mA
Input Voltage: 5,984VDC, Input Current: 430mA, Power: 2,5743W, Alpha = 0,011rad